

CSIR-NEIST

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North East Institute of Science & Technology, Jorhat



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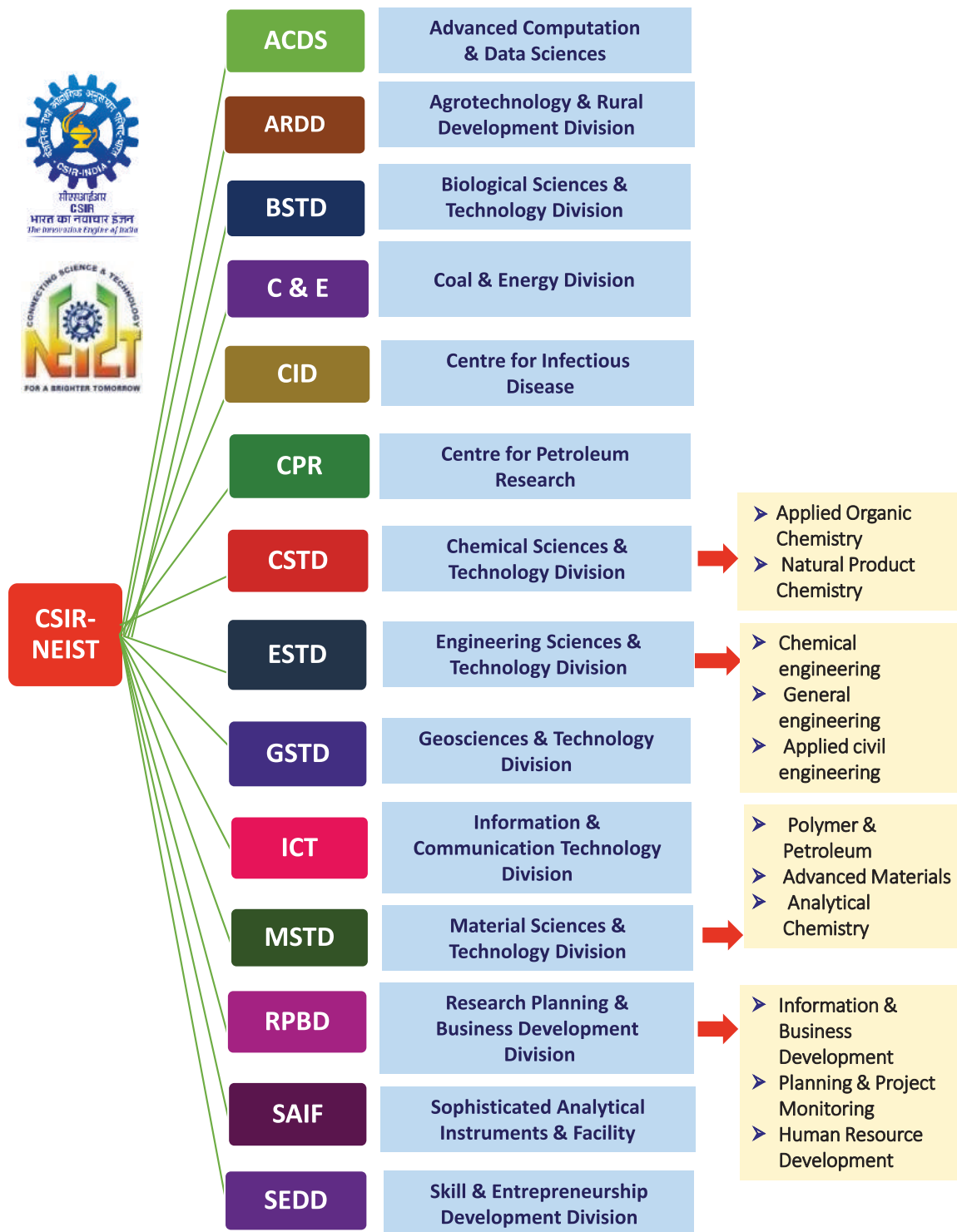
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CSIR-NEIST Divisions and Groups



CSIR-NORTH EAST INSTITUTE OF SCIENCE & TECHNOLOGY, JORHAT

VISION

Knowledge for empowering, particularly North East region, through science and technology interventions.

MISSION

To nurture excellence in basic and applied research for developing technologies with sustainable development goals to improve the quality of life in the North East India.

MANDATE

To put to effective use the immense material resources of North Eastern region and to provide R&D inputs for developing the economy of the NE region in particular and the country in general.

MOTTO

Revitalizing CSIR-NEIST for strengthening North East

CSIR-NEIST AT A GLANCE

The CSIR-North East Institute of Science & Technology at Jorhat, Assam was established on 18 March, 1961 under the aegis of Council of Scientific & Industrial Research (CSIR), as a multidisciplinary institute. Being the only R&D Institute of its kind in the North East India, its major thrust of activities has been to develop indigenous technologies by utilizing the immense natural wealth of India in general and NE region in particular and thus contributing to the region's as well as country's industrial growth and economic prosperity. The Institute has two branch laboratories at Itanagar, Arunachal Pradesh and Imphal, Manipur which are mainly involved in extension activities.

Over the years of its existence, the Institute has developed expertise in the areas like Agro-technologies, Drugs and Drug Intermediates, Herbal Formulations, Oil Field Chemicals, Ecology and Environment Studies, Advanced carbon materials, Aerosol chemistry, Artificial intelligence and Machine learning, Big data science, Geotechnical Investigations, Foundation Design Engineering, Membrane Technologies, Cement Plant Technologies and Earthquake Seismology. CSIR-NEIST generated technologies have not only contributed towards productivity, but also ensured better use of local resources, employment generation, upgradation of artisan skills and improvement in the quality of life. The Institute focuses on set policies, setting up new R&D standards, Lab to Land transfer of technologies, scientific and technical manpower development, entrepreneurship development, alliance and networking with academic institutes as well as laboratories across the country. Besides attending to the national priorities, the Institute has been significantly contributing towards socio-economic development of the rural people through S&T intervention. Its efforts for 'Lab to Land' activities has brought several hectares of fallow and waste lands in the NE states under the cultivation of various medicinal, economic and aromatic plants such as Citronella, Lemongrass, Patchouli, etc., and also has been making impact with other small/cottage scale technologies like Mushroom cultivation, Vermi-compost production etc. STINER is a major R&D project in this institute for the development of north east India.

Since inception, the Institute has bagged a number of prestigious awards for its contributions in various fields of activities. To name a few, the institute received the FICCI (Federation of Indian Chambers of Commerce & Industry) Award twice in the year 1982 & 1985 for development of technologies and rural development activities; NRDC Awards for development of process technologies in the year 1972, 1984 & 1985; SIDC Award in 1987 and Industrial Promotion Board Award in 1988 to name a few and CSIR Technology Awards for consecutive four years from 2010 to 2013 in various categories like Innovation, Life Sciences and Business Development & Technology Marketing. Besides, a large number of scientists have been awarded by various organizations for their outstanding contributions in different fields of S&T.

Foreword



The CSIR-North-East Institute of Science & Technology (CSIR-NEIST), Jorhat, the sole multidisciplinary CSIR laboratory in NE region, representing the eight states, has forged ahead a long way since it was established in 18 March 1961 as Regional Research Laboratory. The North-East region is very special due to its cultural richness, ethnic diversity, and strategic location. By collaborating closely with society and industry, the aim of CSIR-NEIST is to develop indigenous technologies by utilising the natural wealth of the region and to develop the economy, industry and society as a link between state organisation and national laboratories. Presently, the institute has given more importance in two areas, “Environmental Care” and “Herbal Formulations”. At the same time, the institute is emphasizing on “Knowledge for Empowerment” of the region and the country through our S&T interventions. In the era of Industry 4.0 and 5.0, combining our traditional wisdom with modern science appear to be indispensable in the sectors such as Education, Health, Agriculture, Industrial and Societal development at large.

Over the years, CSIR-NEIST has generated more than 130 technologies in Agrotechnology, Biological, Oil, Field Chemicals, of which about 60% were of commercial success, promoting in setting up of various entrepreneurship and small-scale industries throughout the country. The laboratory has accomplished a leadership role in the areas like Natural Products Chemistry, Drug and drug intermediates, VSK cement, Plant Technology, Agro-technologies, Coal technology, Petroleum and Petrochemical technology, Herbal Chemical Technology, Ecology and Environmental Technology, Geotechnical investigations, Design and Structural Mechanical Engineering and most recently Advance Computation and Biomedical Science. The most recent estimate of an annual turnover of the products originating from CSIR-NEIST technologies is around Rs. 350 crores which highlight the strength of technological innovation of this institute. Beyond these, this laboratory has constantly been working to disseminate the direct benefit of science & technology to society through wide ranges of social awareness, field-centric technology translational and implementation programmes.

Another most accountable achievement is reviving the R&D capabilities of the institute in the area of petroleum technology with new vigour in the form of the Centre of Excellence in Petroleum Research for mitigating issues faced by the petroleum industry, generating novel solutions for environmental

care and devising newer strategies for economic empowerment with commercialized petroleum industry derived products. Centre of Excellence for Advanced Computing and Data Science, is another most indispensable modern area of R&D for futuristic application of computation power for enabling all others from fundamental understanding to taxonomic data science and herbal formulation development, biomedical research to future-ready diverse industrial applications. CSIR-BioNest support is another worth mentioning capacity building by the institute to provide analytical services, technology development platform, and mentorship accessibility to prospective young entrepreneurs of North East India, particularly in agrotechnology, nutrition, health, and biomedical solutions for commercialization and self-sustainability. CSIR-NEIST traditionally emphasized in the broad social responsibility outlook and is touching new heights in many areas of CSIR Skill and Entrepreneurship Development Programs such as Promoting Innovations in Individuals, Start-ups and MSMEs (PRISM), Science & Technological Intervention for North East India (STINER), Floriculture Mission, Immunity Wellness Mission, CSIR-NEIST Rural Women Technology Park. In addition to this, the institute is also a frontrunner in indigenous development, technology transfer, and promotion of commercially successful advanced biofertilizer for improving agricultural productivity with environmentally-safer farming practices in both draught and flood affected conditions. CSIR-NEIST opened up new frontiers for combating the Covid-19 pandemic by establishing RT-PCR diagnostic testing facility in war footed pace, providing solutions and support to the nation. CSIR-NEIST has been accredited by NABL for coal testing facility.

In its constant pursuit to develop high-quality human resources for the Nation, CSIR-NEIST has achieved several new landmarks through a series of successful programs like Gyantarang-2020, CSIR-NEIST Summer Research Training Program (SRTP), CSIR Jigyasa Student-Scientist Connect Program, CSIR Drug Discovery Hackathon (DDH), CSIR-NEIST Child Scientist Program, and CSIR-NEIST Kids World of Science.

This compendium is a brief of active technologies, process and products of CSIR-NEIST in terms of S&T which would spread the wings to the expectations of current younger generations' scientific and technological ambitions and to bring new glory to the institute. I am confident that this compendium of technologies will certainly help to disseminate the S&T information of this institute for entrepreneurship and socio-economic development including further collaboration with industries.

It gives me great pleasure to have a bird-eye view of the technologies developed by CSIR-NEIST with a reasonable sense of pride and satisfaction. I am delighted that this compendium will depict as a memorabilia of the achievements of this premier institute marching ahead strongly towards a brighter future.

(G. Narahari Sastry)
Director, CSIR-NEIST

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Improved variety of Java Citronella (*Cymbopogon winterianus*) Jor Lab C-5

Brief Description

Citronella or Java Citronella (*Cymbopogon winterianus*, Jowitt) is a perennial grass belonging to the family Poaceae. The plants are 2-2.5 m in height, perennial herbs with fibrous root system. The Citronella oil is used extensively as a source of perfumery chemicals such as citronellal, citronellol and geraniol. These chemicals find extensive use in soap, candles and incense, perfumery, cosmetic and flavouring industries throughout the world.



Citronella plantation at CSIR-NEIST experimental farm

In 1964, CSIR-NEIST Jorhat acquired fifty slips of Citronella grass from its sister laboratory CIMAP for acclimatization and trial cultivation. Through systematic repeated selection and multiplication, an improved variety designated Jor Lab C-2 was developed in 1979. Further work on the aromatic plant was continued to develop an improved strain and in 2016, an improved variety named, Jor Lab C-5 has been developed through EMS (Ethyl Methane Sulfonate) mutant progeny which has high essential oil content. This variety contains more than 1% essential oil with more than 35% citronellal content.

Technology Validation

Since 1970s CSIR-NEIST has been promoting Citronella cultivation in the NE region with the involvement of state government departments and NGOs. Citronella cultivation finds a special mention in rural development activities of the Institute. Till date, around 5500 ha of land has been brought under the cultivation in NE benefitting more than 25,000 people. The beneficiaries were able to augment their income resources by its commercial cultivation. CSIR-NEIST also procured and installed more than 125 Citronella oil distillation units ranging between 200-600 kg/batch capacity in different areas to further boost the industry and benefit the farmers.

Importance of the Technology

India is a major exporter of essential oil in the world and the third largest producer with a share of 16-17% in global production. In recent years, there has been a tremendous growth of interest in plant based drugs, pharmaceuticals, perfumery products, cosmetics and aroma compounds used in food flavors and fragrances and natural colors in the world. Citronella oil has good market value and the oil finds varied uses in the industry for its aromatic and medicinal properties.

Applications/Uses: Citronella oil finds extensive use in soap, candles and incense, perfumery, cosmetic and fragrant industries throughout the world.

Level/Scale of Development: Agro-technology for cultivation and processing.

Potential Customers: Fragrance & Flavor industry, small enterprises, farmers, women entrepreneurs, NGOs and SHGs.

Techno-Economics (Tentative)

- Cost of cultivation: Rs.25,000/ha/year
- Gross return: Rs.50,000-Rs.60,000/ha/year
- Net profit: Rs.25,000-Rs.35,000/ha/year

Technology Package: Technical & scientific consultancy, TEFR on cultivation & processing of the agro-technology and planting material.

Technology Transfer: The Citronella Jor Lab C-5 technology has been transferred to 15 parties/entrepreneurs for commercial cultivation.

1. M/s Lukwah Tea Estate, Sivasagar
2. M/s Nahorjan Tea Company Pvt.Ltd., Golaghat
3. M/s S S Enterprise, Bokajan, Assam
4. Aroma India Pvt.Ltd., Kamrup, Assam
5. M/s Flower Valley Agrotech Pvt.Ltd., Hojai, Assam
6. M/s Ashri Menthol Pvt.Ltd., Barabanki, Uttar Pradesh
7. Institute of Horticulture Technology, Kamrup, Assam
8. M/s Arunachal Agro Industries, Roing, Arunachal
9. M/s Agroscent Pvt Ltd, Faridabad, Haryana
10. Shri Takum Miza (Farmer), East Siang, Arunachal
11. Shri Amitava Dhar (Farmer), Agartala, Tripura
12. M/s Krishi Shakti Food & Beverages, Ahmadnagar, Maharashtra
13. M/s Vigor Healthcare Services Private Limited Ranga Reddy, Telangana
14. M/s Rising Sun Enterprise Indore, Madhya Pradesh
15. M/s Bengal Medicinal and Aromatic Processing Plant, West Bengal

Improved variety of Lemongrass (*Cymbopogon flexuosus*) Jor Lab L-8

Brief Description

Lemongrass (*Cymbopogon flexuosus*) is one of the traditional essential oil bearing plant belonging to the family poaceae. The oil is obtained from certain species of grasses of the genus *Cymbopogon*. The genus consists of about 80 species, 10 to 12 of which are known to occur in India. The value of Lemongrass oil depends entirely upon its citral content. Lemongrass is a plant of the humid tropics. It grows best in warm moist climate. An annual rainfall of 250 cm is ideal for its cultivation.



Lemongrass plantation at CSIR-NEIST experimental farm

It can also be cultivated in areas raining a slightly lower rate of rainfall, provided it is well distributed throughout the year. It can tolerate temperature range of 10°C to 38°C and grows well from the sea level to 1200m altitude in hill slopes. It can tolerate drought to some extent. The agro practice of Lemongrass has been standardized. In 2016, CSIR-NEIST developed an improved variety named, Jor Lab L-8 with high herbage yield, high essential oil as well as high Citral content. It contains more than 1% essential oil content with more than 70% citral content.

Technology Validation

Through CSIR-NEIST's efforts, more than 1000 ha of land have been brought under Lemongrass cultivation in NE benefitting more than 5,000 people. To boost the cultivation and for the benefit of the farmers, several distillation units ranging between 200 to 600 kg capacity were installed at different places.

Importance of the Technology

In recent years, there has been a tremendous growth of interest in plant based drugs, pharmaceuticals, perfumery products, cosmetics and aroma compounds used in food flavors and fragrances and natural colors in the world. Lemongrass oil is one of the important essential oils used in fragrance and flavour industries. The oil has high market demand in India and abroad.

Applications/Uses

Lemongrass oil is used in wide range of skin care and cosmetic products, such as soaps, deodorants, shampoos, lotions, and tonics. It also works as an air freshener and deodorizer, especially when blended with other essential oils. Lemongrass oil is also known for its ability to repel insects, such as mosquitoes and ants, due to its high citral and geraniol content.

Level/Scale of Development: Agro-technology for cultivation and processing.

Potential Customers: Fragrance & Flavor industry, small enterprises, farmers, women entrepreneurs, NGOs and SHGs.

Techno-Economics (Tentative)

- Cost of cultivation: Rs.25,000/ha/year
- Gross return: Rs.50,000-Rs.70,000/ha/year
- Net profit: Rs.25,000-Rs.45,000/ha/year

Technology Package: Technical & scientific consultancy, TEFR on cultivation & processing of the agro-technology and planting material.

Technology Transfer: The Lemongrass Jor Lab L-8 technology has been transferred to 13 parties/entrepreneurs for commercial cultivation.

1. M/s Radhabari Tea Company Pvt.Ltd., Golaghat, Assam
2. M/s Mphinite Solutions Pvt.Ltd., Bangalore
3. M/s Sukrit Ayurveda Pvt.Ltd., Ghaziabad, Uttar Pradesh
4. M/s Eco Factory Foundation, Pune
5. Aroma India Pvt.Ltd., Kamrup, Assam
6. M/s Flower Valley Agrotech Pvt.Ltd., Hojai, Assam
7. M/s Ashri Menthol Pvt.Ltd., Barabanki, Uttar Pradesh
8. M/s Pitambari Products Pvt Ltd, Mumbai
9. M/s Agroscent Pvt Ltd, Faridabad, Haryana
10. Shri Arindam Reang, West Tripura, Tripura
11. M/s S S Enterprise, Karbi Anglong, Assam
12. M/s Rising Sun Enterprise, Madhya Pradesh
13. M/s Bengal Medicinal and Aromatic Processing Plant, West Bengal

Lemongrass methyl eugenol rich Jor Lab L-9 (*Cymbopogon khasianus* (Hack.) Stapf ex Bor)

Brief Description

Cymbopogon khasianus is an important aromatic crop under the family of Poaceae. It is a vegetatively (also, seed) propagated perennial, multicut crop in the tropics. Methyl eugenol is used commercially for various purposes like insect trapping, perfumery, flavour, condiments, non-alcoholic beverages, hard and soft candy. Presently pharmaceutical industries were depended on the synthetic methyl eugenol. This new methyl eugenol rich variety of lemongrass will open more scope of commercial cultivation of this lemon grass variety and provide the raw material to the pharmaceutical industries.



Lemongrass Jor Lab L-9 plantations at CSIR-NEIST

Salient Technical Features

- A methyleugenol rich variety of *Cymbopogon khasianus* (Jor Lab L-9).
- This variety contains more than 0.5 percent essential oil with more than 60% methyl eugenol content.

Technology Validation

Lemongrass Jor Lab L-9 variety is very new, unique and registered at ICAR-NBPGR, New Delhi with registration No. INGR-18037. Through CSIR-NEIST's efforts, some land have been brought under Lemongrass cultivation in NE Region. To boost the cultivation and for the benefit of the farmers, several distillation units ranging between 200 to 600 kg capacity were installed at different places.

Importance of the Technology

Till date none of the methyl eugenol rich variety of lemon grass is available in the public domain. So a methyl eugenol rich variety of lemongrass was developed. The price of methyl eugenol rich essential oil is five times higher than the normal citral rich lemon grass essential oil. In recent years, there has been a tremendous growth of interest in plant based drugs, pharmaceuticals, perfumery products, cosmetics and aroma compounds used in food flavors and fragrances and natural colors in the world. Lemongrass oil is one of the important essential oils used in fragrance and flavour industries. The oil has high market demand in India and abroad.

Applications/Uses

Lemongrass oil is used in wide range of skin care and cosmetic products, such as soaps, deodorants,

shampoos, lotions, and tonics. It also works as an air freshener and deodorizer, especially when blended with other essential oils. Lemongrass oil is also known for its ability to repel insects, such as mosquitoes and ants, due to its high citral and geraniol content.

Level/Scale of Development: Agro-technology for cultivation and processing.

Potential Customers: Fragrance & Flavor industry, small enterprises, farmers, women entrepreneurs, NGOs and SHGs.

Techno-Economics (Tentative)

- Cost of cultivation: Rs.45,000/ha/year + processing cost Rs. 1,50,000/ha/year
- Gross return: Rs.4,38,000-Rs.4,80,000/ha/year
- Net profit: Rs.1,89,000-Rs.2,85,000/ha/year

Technology Package: Technical & scientific consultancy, TEFR on cultivation & processing of the agro-technology and planting material.

Technology Transfer: The Lemongrass Jor Lab L-9 technology has been transferred to two parties/entrepreneurs for commercial cultivation.

1. M/s Agroscent Pvt Ltd, Faridabad, Haryana
2. M/s Krishi Shakti Food & Beverages, Ahmadnagar, Maharastra



Dr G Narahari Sastry, Director, CSIR-NEIST handing over the Technology Transfer Agreement and technology package on Citronella (Jor Lab C-5), Lemongrass (Jor Lab L-9, Jor Lab L-10) & Patchouli (Jor Lab P-1) to M/s Krishi Shakti Food & Beverages, Maharastra in presence of the Technology and Business Development team members on 09 September 2019.

Elemicin rich Lemongrass Jor Lab L-10 (*Cymbopogon khasianus* (Hack.) Stapf ex Bor)

Brief Description

Cymbopogon khasianus is a genus belonging to family Poaceae. It is a vegetatively propagated perennial crop basically found in Khasi and Naga Hills and some lower part of Assam of North East India. Elemicin is a natural organic compound which is known as pheypropene, also a constituent of oleoresin. It was named as elemicin after discovery of this compound in the essential oil of *Canarium luzonicum*, which is known as elemi plant. It is used to synthesize the alkaloid, mescaline.



Lemongrass Jor Lab -10 plantations at CSIR-NEIST

Elemicin has some anti proliferative effects and tumoricidal effects against several human cell lines. It also has antibacterial activity against human enteropathogen *Campylobacter jejuni* also. Elemicin has anti allergic properties on 5-lipoxygenase from RBL-1 cells.

Salient Technical Features

- An elemicin rich variety of *Cymbopogon khasianus* (Jor Lab L-10).
- This variety contains more than 0.40 percent essential oil with more than 60% elemicin content.

Technology Validation

Lemongrass Jor Lab L-10 variety is very new, unique and registered at ICAR-NBPGR, New Delhi with registration No. INGR-18039. Through CSIR-NEIST's efforts, some land have been brought under Lemongrass cultivation in NE Region. To boost the cultivation and for the benefit of the farmers, several distillation units ranging between 200 to 600 kg capacity were installed at different places.

Importance of the Technology

Till date none of the elemicin rich variety of lemon grass is available in the public domain. So, CSIR-NEIST made efforts to identify high elemicin rich variety of lemon grass from the collected germplasm. The price of elemicin rich essential oil is ten times higher than the normal lemon grass essential oil. In recent years, there has been a tremendous growth of interest in plant based drugs, pharmaceuticals, perfumery products, cosmetics and aroma compounds used in food flavors and fragrances and natural colors in the world. Lemongrass oil is one of the important essential oils used in fragrance and flavour industries. The oil has high market demand in India and abroad.

Applications/Uses

Elemicin rich lemongrass oil has wide range of applications. It is used to synthesize the alkaloid,

mescaline. Elemicin mainly has wide application in the pharmaceutical industry. The variety is a cheap source of elemicin.

Level/Scale of Development: Agro-technology for cultivation and processing.

Potential Customers: Fragrance & Flavor industry, small enterprises, farmers, women entrepreneurs, NGOs and SHGs.

Techno-Economics (Tentative)

- Cost of cultivation: Rs.60,000/ha/year + processing cost Rs. 1,50,000/ha/year
- Gross return: Rs.6,00,000-Rs.6,72,000/ha/year
- Net profit: Rs.3,90,000-Rs.4,62,000/ha/year

Technology Package: Technical & scientific consultancy, TEFR on cultivation & processing of the agro-technology and planting material.

Technology Transfer: The Lemongrass Jor Lab L-10 technology has been transferred to two parties/entrepreneurs for commercial cultivation.

1. M/s Agroscent Pvt Ltd, Faridabad, Haryana
2. M/s Krishi Shakti Food & Beverages, Ahmadnagar, Maharashtra

Lemongrass Jor Lab L-11 (*Cymbopogon khasianus* (Hack.) Stapf ex Bor)

Brief Description

Cymbopogon flexuosus of the family Poaceae is a highly valued grass known throughout the world for its aromatic properties. Jor Lab L-11 is myrcene and methyl iso-eugenol rich essential oil variety of lemongrass. Myrcene is an earthy, spicy, clove fragrance commonly used in the culinary and perfume industry while methyl iso-eugenol has a typical sweet-warm, spicy-clove, woody, floral odour mostly used in perfume industries.



Lemongrass Jor Lab L-11 plantations
at CSIR-NEIST experimental farm

Salient Technical Features

- Myrcene and methyl iso-eugenol rich variety of *Cymbopogon flexuosus* (Jor Lab L-11).
- This variety contains more than 0.58 percent essential oil with more than 45 % myrcene and 35% methyl-isoeugenol content.

Technology Validation

Lemongrass Jor Lab L-11 variety is very new, unique and registered at ICAR-NBPGR, New Delhi with registration No. INGR-20053. Through CSIR-NEIST's efforts, some land have been brought under Lemongrass cultivation in NE Region. To boost the cultivation and for the benefit of the farmers, several distillation units ranging between 200 to 600 kg capacity were installed at different places.

Importance of the Technology

Till date none of the myrcene and methyl isoeugenol rich lines of lemongrass variety of lemon grass is available in the public domain. So, CSIR-NEIST made efforts to identify high elemicin rich variety of lemon grass from the collected germplasm. The price of this compound rich essential oil is much higher than the normal lemon grass essential oil. In recent years, there has been a tremendous growth of interest in plant based drugs, pharmaceuticals, perfumery products, cosmetics and aroma compounds used in food flavors and fragrances and natural colors in the world. Lemongrass oil is one of the important essential oils used in fragrance and flavour industries. The oil has high market demand in India and abroad.

Applications/Uses

The compound rich lemongrass essential oil is has major applications in the flavour and fragrance industry. Myrcene is an earthy, spicy, clove fragrance commonly used in the culinary and perfume

industry while methyl iso-eugenol has a typical sweet-warm, spicy- clove, woody, floral odour mostly used in perfume industries.

Level/Scale of Development : Agro-technology for cultivation and processing.

Potential Customers : Fragrance & Flavor industry, small enterprises, farmers, women entrepreneurs, NGOs and SHGs.

Techno-Economics (Tentative)

- Cost of cultivation: Rs.60,000/ha/year
- Gross return: Rs.2,00,000-Rs.2,50,000/ha/year
- Net profit: Rs.1,40,000-Rs.1,90,000/ha/year

Technology Package : Technical & scientific consultancy, TEFR on cultivation & processing of the agro-technology and planting material.

Edible Mushroom

Brief Description

Mushroom is a nutritious food rich in protein, amino-acids, minerals, vitamin B12, vitamin D, folic acid, minerals and fibre. Also called as 'White vegetable', Mushroom is the fruiting body of fungus. It is considered ideal food for patients with hypertension, obesity and diabetics. Mushroom growing is relatively simple and can be taken up as individual home based activity or on small and large scale. Propagated through spawns, it can be cultivated in cool and humid climate. The cultivation is done on specially prepared compost made out of paddy straw and other agricultural wastes. There are two seasonal varieties. Winter varieties grow during the month of November to April and summer varieties can be cultivated in the month of June to August.

CSIR-NEIST started R&D work on introduction and cultivation of edible mushroom during early 1980s. Scientific investigation regarding utility of paddy straw, turmeric plant waste, de-oiled java citronella grass, sugarcane bagasse, tea waste and aquatic weed like hyacinth as bedding material for a number of edible mushroom species were carried out. The Institute has developed cultivation processes and technologies for edible mushroom cultivation as well as spawn production technology. Mushroom varieties maintained at CSIR-NEIST germplasm bank include Oyster Mushroom, European White Button Mushroom, Paddy Straw Mushroom and Medicinal Mushroom.



Oyster mushroom cultivation

Technology Validation

Mushroom cultivation created lot of enthusiasm among the rural population to grow Mushroom on commercial scale. The Institute along with its Branch Laboratory at Itanagar is aggressively promoting the cultivation in NE region. So far, 30,000 beneficiaries have been trained and generated employment to over 5000 people. To further promote mushroom cultivation, the Institute works along with NGOs and has tie-ups with about 15 NGOs.

Importance of the Technology

Till date, mushroom cultivation has been adopted by large number of farmers in NE India. This rural technology still generates high interest from the masses because of its low investment and high income generation avenues.

At present, several NGOs, entrepreneurs and rural women are engaged in commercial cultivation with CSIR-NEIST's efforts. To promote mushroom cultivation, the institute also works along with NGOs, SHGs, etc. in order to reach out to large sections of people. Under societal activities, the Institute organizes training and awareness programs to encourage mushroom cultivation among marginal farmers, unemployed youth and rural women.

Applications/Uses : For fresh production and making various value added products.

Level/Scale of Development : Cultivation process and production of Mushroom spawn.

Potential Customers : Small enterprises, farmers, women entrepreneurs, NGOs and SHGs

Techno-Economics (Tentative)

Mushroom can be harvested 3-4 times/season on an average depending upon the type and variety of the mushroom.

Yield: 1000 kg/year

- Cost of production: Rs.25,000.00
- Gross annual income: Rs.90,000.00
- Net income per month: Rs.5,500.00

Technology Package : Technical consultancy and demonstration.

Production of Bamboo (*Bambusa balcooa*) Plantlets by Plant Tissue Culture Technique

Brief Description

Bambusa balcooa's position is recorded at the top for commercial utilization, out of 20 selected Bamboo taxa. Among the priority species of national and regional importance, *B. balcooa* holds high position for development of various rural industries such as food industry (Pickle preparation), household works and related small-scale cottage industry etc. Moreover, it is recorded as the best and strongest species of bamboo for building purposes apart from the uses of paper industry.

CSIR-NEIST has developed a reproducible multiplication protocol, which is environmental friendly and can be used for germplasm conservation as well as for large scale multiplication for commercial use.

Salient Technical Features

- Highly reproducible technique for in vitro mass multiplication with no toxic chemicals.
- Micropropagated plantlets genetically true to type. Hence technology can be adopted to multiply any elite variety of the species.
- Easy to handle process.



In vitro multiplication of
Bambusa balcooa and its rooted plantlets

Technology Validation

The technology has been validated for production of one lakh plantlets/year.

Importance of the Technology

Bambusa balcooa Roxb. species is valued for its edible tender shoots, mainly for food and pickle industry. It is utilized mostly for structural use and in cottage/paper/small scale/food industry. Standardized tissue culture technique of CSIR-NEIST aims to provide sufficient stock of planting material in less time and investment as compared to the alternative vegetative propagation. By using this protocol, 3-4 times plantlets regeneration is possible from nursery transferred plants (macroproliferation).

Applications/Uses : Large scale multiplication for commercial purpose.

Level/Scale of Development : 1 lakh plantlets per annum.

Potential Customers : Biotech companies, bamboo based industries and other interested companies.

Techno-Economics (Tentative)

- Capital investment (plant & machinery) for one lakh plantlets/year: ~Rs.15.00 lakhs.
- The project-economics can be worked out as per location and client requirement.

Technology Package: Process know-how, demonstration and technical assistance in implementation.

Patchouli Jor Lab P-1 (*Pogostemon cablin*)

Brief Description

Patchouli (*Pogostemon cablin*) is an aromatic grass belonging to Lamiaceae family which gives essential oil upon steam distillation. This oil is used extensively as a source of important perfumery chemicals like patchouli alcohol, which finds its extensive use in soap, perfumery, cosmetic and flavoring industries throughout the world.



Patchouli P-1

Salient Technical Features

- A high oil yielding variety of Patchouli (Jor Lab P-1).
- Unique variety where the essential oil yield is more than 2.5% on dry weight basis and yield is around 50-70 kg/hectare which is far superior to the other available varieties.

Technology Validation

Through CSIR-NEIST's efforts, Patchouli Jor Lab P-1 has been propagated to fields through technology transfer and also through CSIR-AROMA mission to boost the cultivation and for the benefit of the farmers.

Importance of the Technology

The use of active secondary chemical compounds such as alkaloids and terpenoids in the medicinal plants holds a great promise in the field of medicine in ancient as well as modern era. Further, since no synthetic substitute is available for the patchouli essential oil, the plant has high market demand and the only alternative to meet the increasing demand is the large scale commercial cultivation of this high quality varieties. Due to the limited improved varieties for high oil yield and herbage yield, its cultivation was not popular among farmers. Therefore, a high oil and herbage yielding variety of Patchouli Jor Lab P-1 genotype was developed by CSIR-NEIST to combat its necessity.

Applications/Uses

Patchouli oil is an essential oil derived from the leaves of the Patchouli plant, which is an aromatic herb. This potent oil is a storehouse of anti-bacterial, anti-inflammatory, anti-fungal and antiseptic properties.

Level/Scale of Development : Agro-technology for cultivation and processing.

Potential Customers : Fragrance & Flavor industry, small enterprises, farmers, women entrepreneurs, NGOs and SHGs.

Techno-Economics (Tentative)

- Cost of cultivation: Rs.95,000/ha/year
- Gross return: Rs.2,50,000-Rs.3,50,000/ha/year
- Net profit: Rs.1,55,000-Rs.2,55,000/ha/year

Technology Package : Technical & scientific consultancy, TEFR on cultivation & processing of the agro-technology and planting material.

Technology Transfer : The Patchouli Jor Lab P-1 technology has been transferred to 5 parties/entrepreneurs for commercial cultivation.

1. M/s Institute Horticulture Mandira, Kamrup, Assam
2. M/s Krishi Shakti Food & Beverages, Ahmadnagar, Maharashtra
3. M/s Agroscent Pvt Ltd, Faridabad, Haryana
4. M/s Seuj Jatra, Golaghat, Assam
5. M/s Vista Naturals Guwahati, Assam

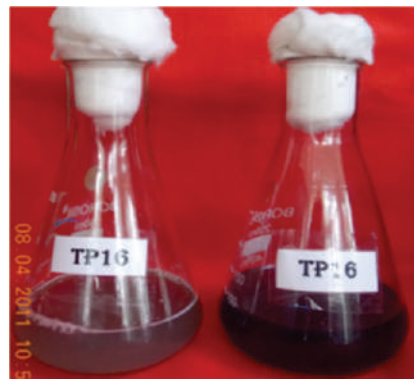


Dr G Narahari Sastry, Director, CSIR-NEIST handing over agro-technology package of improved variety of Patchouli (Jor Lab P-1) to M/s Sansys Enterprise, Dibrugarh, Assam in presence of technology team members and business development team on 24 August 2021.

TP-16 Bio-fertilizer

Brief Description

The continuous use of chemical fertilizers and manures for enhanced soil fertility and crop productivity causes unexpected environmental degradation, including leaching of nitrate into ground water, surface runoff of phosphorus and nitrogen, and *eutrophication* of aquatic ecosystems. Integrated Nutrient Management (INM) systems are needed to maintain sustainable agricultural productivity and also to reduce possible environmental effect from fertilization. Microbial inoculants which flourish as beneficial free living soil bacteria and as rhizosphere bacteria in plants; which grow in and around plant tissues improve soil quality and stimulate plant growth and also help in nutrient use efficiency by plants. Based on beneficial characters of bacteria, a free living soil microbe designated as TP-16 was evaluated to be used as bio-fertilizer. The application of bio-fertilizer based on TP-16 also fortifies the soil quality. The present technology know-how describes the use of TP-16 in sustainable crop production and soil fertility improvement.



Liquid and solid carrier based TP-16 Bio-fertilizer

CSIR-NEIST has developed both liquid and carrier based formulations from a plant growth promoting TP-16 microbial strain. The bio-fertilizer is suitable for recovery of degraded soil; improves soil biological properties; promotes yield in plantation crops (tea) and agriculture crops as desired.

Salient Technical Features

- Reduces the amount of use of synthetic nitrogen urea by half the amount.
- The microbial strain bears multiple plant growth promoting characters.
- Improves nutrient uptake by the plants.
- Suitable for recovery of degraded soil.
- Environment friendly product.

Technology Validation

The technology has been successfully commercialized in the market benefiting agriculturists and

farmers largely. CSIR-NEIST has extensively worked on bio-prospection of microbial diversity of the North East Region and developed similar liquid bio-fertilizers for soil fertility and plant growth.

Importance of the Technology

Transformation to organic farming and the increasing awareness on benefits of bio-fertilizers among the agriculturists and farmers has led to the increase of bio-fertilizer production and its manufacturers. Consequently, a significant increase in the use of bio-fertilizers by the farmers and cultivators was evident. Over the last decade, there has been a significant surge in the production of bio-fertilizers in India even as the Government is promoting the use/production of bio-fertilizers through various programmes under different missions. Bio-fertilizers not only improve soil quality but also enhance plant growth and crop yield.

Applications/Uses : The product is suitable for promoting yield in plantation crops (Tea) and agricultural crops.

Level/Scale of Development : 560 L/ Day and one Ton/day as solid base.

Potential Customers : Bio-fertilizer industries, small & medium enterprises and other interested companies.

Techno-Economics (Tentative)

- Project capital cost for production unit of capacity, 560 L/day (liquid bio-fertilizer) and 830 Kg/day (solid bio-fertilizer): ~Rs. 30.00 lakhs.
- The project-economics can be worked out as per location and client requirement.

Technology Package : Process know-how, demonstration and technical assistance in implementation.

Technology Transfer : The TP-16 Biofertilizer technology has been transferred to 2 parties/entrepreneurs for commercial production.

1. M/s Amrit Organic Fertilizer Plant, Duliajan, Assam
2. Arunachal Pradesh State Council for Science and Technology (APSCST), Govt. of Arunachal Pradesh, Itanagar, Arunachal Pradesh

OP-12 Biofertilizer Mediated Plant Health Improvement in Normal and Water Deficit Conditions

Brief Description

Water deficit is one of the main limiting factors in crop production in many parts of India. The excess production of the plant hormone, ethylene is responsible for inducing various deleterious effects like reduced root growth, premature senescence (wilting/drooping etc.), chlorosis, consequently leading to crop loss. Ethylene synthesis is accelerated in response to various environmental stresses including desiccation/drought. ACC-deaminase (1-aminocyclopropane-1-carboxylate deaminase) catalyzes degradation of ACC, which is the immediate precursor of ethylene, into -ketobutyrate and ammonia. However, some plant growth-promoting rhizobacteria (PGPR), *e.g.*, OP-12 produce ACC-deaminase which cleaves ACC, thus preventing the effects of high levels of ethylene on plants. The OP-12 biofertilizer acts as sink for ACC produced as a consequence of plant stress. This also possesses other plant growth promoting traits like nitrogen fixation, phosphate solubilization, synthesis of plant growth hormone, *etc.* which directly help promote plant growth. Therefore, it can promote plant growth in normal and under water deficit condition in multiple crops in different agro- climatic conditions and regions. CSIR-NEIST has developed carrier based formulations from a plant growth-promoting rhizobacterial strain. This bio-fertilizer is not only suitable for plant growth and development in normal and water deficit conditions, but also improves soil properties/fertility; increase yield of different crops in diverse agro- climatic conditions/ regions.



Commercialised OP-12 Biofertilizer

Salient Technical Features

- Improves plant growth and development in normal as well as water deficit conditions.
- Effective in multiple crops in different agro-climatic conditions/regions.
- Low capital investment, simple production technique, needs cheaper raw materials and easily available.
- Environment friendly, non-toxic to human and animals.

Technology Validation

The technology has been successfully commercialized in the market benefiting agriculturists and

farmers largely. CSIR-NEIST has extensively worked on bio-prospection of microbial diversity of the North East Region and developed similar liquid bio-fertilizers for soil fertility and plant growth.

Importance of the Technology

Owing to over dependence and excess use of chemical fertilizers, diminution of useful soil microbes is increasing day by day. Cost of chemical fertilizers is increasing and in many cases, has become unaffordable to the cultivators. It is also associated with hazards and other environmental issues. Bio-fertilizers, in contrary have proven themselves to be an effective and alternative to such problems and there has been consistent increase in their applications in various fields of agriculture in modern time. Thus, a significant increase in the use of bio-fertilizers by the farmers and cultivators is obvious.

Applications/Uses : The product is suitable for promoting yield in plantation crops and various agricultural crops.

Level/Scale of Development : One tone/day as solid base.

Potential Customers : Bio-fertilizer industries, small & medium enterprises and other interested companies.

Techno-Economics (Tentative)

- Cost of production (number of working days = 300), Plant capacity=1000 Kg/day (solid bio-fertilizer): ~Rs. 32.00 lakhs, Project Capital Cost = Rs. 16.53 Lakhs.
- The project-economics can be worked out as per location and client requirement.

Technology Package: Process know-how, demonstration and technical assistance in implementation

Technology Transfer : The OP-12 Biofertilizer technology has been transferred to 4 parties/entrepreneurs for commercial production.

1. M/s Amrit Organic Fertilizer Plant, Duliajan, Assam
2. M/s Yespie & Lyeon Agro Herbo, Mumbai, Maharashtra
3. M/s Sansys Enterprise, Dibrugarh, Assam
4. M/s Axom Agro Chemicals, Moranhat, Dibrugarh, Assam
5. Directorate of Agriculture, Govt. of Mizoram, Aizawl (Turnkey basis)

Bacterial Formulation for Crop Enhancement and Yield Improvement

Brief Description

Application of various synthetic compounds has become an integral part of present day agricultural practices to improve crop health and productivity. Continuous application of these compounds has resulted in deterioration of the quality of produce and soil fertility. These compounds also have a negative effect on the microbial biodiversity of the soil dwellers, rhizosphere and phyllosphere, particularly the beneficial microorganisms associated with the crop plants. Therefore, there is a need to look for a viable alternative to minimize the use of these compounds in agriculture for a better tomorrow. Use of free living organisms, generally called Plant Growth Promoting Beneficial Bacteria (PGPB) and Plant Growth Promoting Rhizobacteria (PGPR) are regarded as an eco-friendly and cost effective choice.



Commercial product based on CSIR-NEIST technology

Strains belonging to bacterial genera have shown potential to enhance growth and yield in crop plants besides control of many diseases. North eastern part of India comes under one of the hot spot for microbial biodiversity. CSIR-NEIST developed the present technology from the rich microbial diversity for improved biomass, yield and control of fungal & bacterial diseases of agriculturally important crop plants besides improving soil fertility improvement.

Salient Technical Features

- Formulation based on Plant Growth Promoting Rhizobacteria and free living beneficial soil bacteria.
- Control of fungal diseases and improving the crop yield.
- Environment friendly product.

Technology Validation

The technology has been successfully commercialized by various parties in NE India benefiting farmers and cultivators. The formulation has also created impact in Tea industry wherein it has been used extensively in tea plantations.

Importance of the Technology

Eco-friendly formulations for better crop yield are slowly gaining importance in the field of Agriculture due to many advantages and this has attracted large no. of enterprises and production units. Use of bio-formulations also contributes towards organic farming encouraged by agriculturists and farmers.

Applications/Uses : The product can be used in cultivation of all crops.

Environmental Considerations : Eco-friendly process.

Level/Scale of Development : 400 L/Day.

Potential Customers: Bio-fertilizer industries, small & medium enterprises, Tea planters and other interested companies.

Techno-Economics (Tentative)

Plant capacity: 10000 L/Month

- Capital investment (plant & machinery): Rs.10.00 lakhs (approx)
- The project-economics can be worked out as per location and client requirement.

Technology Package : Process know-how, demonstration and technical assistance in implementation.

Technology Transfer : The Bacterial Formulation for Crop Enhancement and Yield Improvement technology has been transferred to 9 parties/entrepreneurs for commercial production.

1. M/s Carnation Flora, IID Centre, AIDC Ltd., Kundargaon, Titabor, Assam
2. Shri Rajib Bora, Dhruba Nagar Station Road, Golaghat, Assam
3. M/s Lakily Tea Estate, Sivasagar, Assam
4. M/s Karma Pharma Biotech Resources, Thane, Maharashtra
5. Praneswar Basumatary, Ex – MLA, Sootea Assembly Constituency, Sonitpur, Assam
6. M/s Axom Agro Chemicals, Dibrugarh, Assam
7. M/s Tarajan Tea Co. (Pvt.) Ltd., Jorhat, Assam
8. M/s Lukwah Tea Estate, Sivasagar
9. Arunachal Pradesh State Council for Science and Technology (APSCST), Govt. of Arunachal Pradesh, Itanagar, Arunachal Pradesh

SUFAL- Organic Fertilizer

Brief Description

The bio-based fertilizer “SUFAL”, contain a mixer of different bio components along with a suitable bio-insecticide at appropriate ratio which increase the soil fertility and enhances the growth and crop yield significantly.

It also protects the seeds/ seedlings from insect/fungus attack in the field at tender age. Hence, the product has twofold affect on the crop field. The ingredients of “SUFAL” have capacity to mix with the soil immediately and make the nutrients available for the plants to get absorb from the soil.

Salient Technical Features

- SUFAL is a formulation of organic fertilizer consists of five different agro/bio waste materials.
- The product is rich in essential elements/ micro nutrients and helps in rapid growth & development of crop plants.
- It doesn't affect on soil quality and texture.
- It reduces the flowering time and increased the crop productivity in a short duration.
- In addition to N-P-K, it can provides other important micronutrients and micronutrients to the plants.
- The product is free from animal excreta/ municipal wastes, there is no possibility of health hazard effect on handling.
- The technology can be adopted both in small scale as well as medium scale level.



SUFAL Organic Fertilizer

Technology Validation

The technology has been successfully commercialized in the market benefiting agriculturists and farmers largely.

Importance of the Technology

Owing to over dependence and excess use of chemical fertilizers, diminution of useful soil microbes is increasing day by day. Cost of chemical fertilizers is increasing and in many cases, has become unaffordable to the cultivators. It is also associated with hazards and other environmental issues. The

organic fertilizer SUFAL developed by CSIR-NEIST is a bio based organic fertilizer made from the mixer of 5 different bio materials which may play an important role in near future in enhancement of crop productivity, protecting the ecology & environment, maintaining soil texture and quality with higher economic impact to the society.

Applications/Uses: The product is suitable for all types of vegetable crops, tea plantations and agronomically important crops.

Level/Scale of Development : One tone/day as solid base.

Potential Customers : Organic-fertilizer industries, small & medium enterprises and other interested companies.

Techno-Economics (Tentative)

- The investment cost for production of 1 ton per day/ 300 ton per annum capacity plan will be approximately Rs. 57.23 Lakhs.
- The project-economics can be worked out as per location and client requirement.

Technology Package : Process know-how, demonstration and technical assistance in implementation.

Technology Transfer : The Organic Fertilizer-SUFAL technology has been transferred to 1 party for commercial production.

1. M/s Rishika Interior & Developer Pvt.Ltd., Guwahati



Dr D Ramaiah, Director, CSIR-NEIST along with Mr Naveen Verma, Secretary, MDoNER handing over the technology package of Bio-Organic Fertilizer to Mr Dibyajit Barooah, Managing Director, M/s Rishika Interior and Developer Pvt. Ltd, Guwahati on 18 March, 2018 during 57th NEIST Foundation Day celebration.

Vermi-compost Production

Brief Description

Vermi-compost is well recognized as important organic manure for plant growth and development. The intention has been based on the adverse effects of the inorganic fertilizers and other chemicals used to enhance the quality and fertility of soils for more production. Vermi-compost helps in biodegradation of organic compounds and improves the soil fertility and stimulates plant growth. The soil nutrient management for agro ecosystems with poor nutrient storage and rapid loss of fertility can be improved by vermi-compost.



Vermi-compost production at Naharlagun, Itanagar with technical guidance of CSIR-NEIST Branch Lab (Itanagar)

Salient Technical Features

- It helps in biodegradation of organic compounds and improves soil fertility and stimulates plant growth.
- Environment friendly product.

Technology Validation

CSIR-NEIST through its branch laboratory at Itanagar (Arunachal Pradesh) has been engaged in popularizing vermi-compost production among the rural masses for socio-economic development. Through technical guidance and training programmes, a large number of people including farmers, unemployed men/women from Assam and Arunachal Pradesh adopted vermi-compost production as a source of livelihood and income generation.

Importance of the Technology

In recent times, a lot of emphasis has been given on organic farming across the globe with increased awareness in the use of manures (FYM) and/ or biofertilizers in farming system. The soil nutrient management for agro ecosystems with poor nutrient storage and rapid loss of fertility can be improved by vermi-compost. Vermi-compost production can be easily adopted by local entrepreneurs and farmers for income generation and employment generation. Production of vermi-compost requires negligible capital investment with high return/profitability.

Applications/Uses : The product can be used in cultivation of all crops.

Level/Scale of Development : Cottage scale

Potential Customers : Small & medium enterprises, farmers, women entrepreneurs, NGOs and SHGs.

Techno-economics : The process involves negligible investment with high return. The project-economics can be worked out on as per location and client requirement.

Technology Package : Technical consultancy and demonstration.



Vermi-compost production at Karsingsa village, Itanagar, Arunachal Pradesh with technical guidance of CSIR-NEIST Branch Lab (Itanagar)



Commercial Vermi—compost marketed by

- PAHARI Organic Fertilizer Centre, Barapani Market, Naharlagun
- Hari OM Organic Fertilizer Agency, Near Post Office, Naharlagun
- OMMI Enterprises, Papu Nallah, Naharlagun

Modular Brick from Brahmaputra River Bed Sand

Brief Description

Modular bricks are generally used in construction of building structures, boundary wall and foundations, etc. They can be used as an alternative building material in place of traditional burnt clay bricks. CSIR-NEIST has developed a unique process for production of modular bricks using Brahmaputra River bed sand. The process utilizes Brahmaputra River bed sand as main constituent and Ordinary Portland Cement (OPC) as binding material.



Modular Bricks

Salient Technical Features

- Cold eco-friendly stabilized based process.
- Does not require any coal and wood for burning unlike traditional burnt clay bricks.
- The bricks have high compressive strength, heat resistant, light weight and less water absorption.
- Fuel saving.
- Can be made in different shapes and sizes with good finish and aesthetic look.

Technology Validation

Physical/Engineering properties of Bricks have been validated with various experimental methods. Trial studies have been undertaken by constructing boundary walls at CSIR-NEIST campus for performance evaluation. The technology is suitable for Small, Medium and Large Enterprises/Industries.

Importance of the Technology

Brick industry is one of the booming industries in the country with increased number of brick manufacturing companies present today comprising mostly the SMEs. This is due to the various developmental sectors which includes mainly housing, urbanization and infrastructure. With the developmental projects in these sectors, the demand for building materials like bricks is expected to rise. Brick is a basic construction building material and Compressed Stabilized Earth Brick (CSEB) or Stabilized Earth Brick (SEB) is suitable for low-cost construction. CSIR-NEIST's process is

characterized by a fully mechanized process which is aimed to reduce the difficulties in handling labour, maintaining quality and meeting the increased demand for better-quality bricks. Modular bricks can be a potential competitive alternative building material against concrete blocks and burnt bricks.

Environmental Considerations : The process is eco-friendly, pollution free and does not require any heating or coal burning.

Level/Scale of Development : Large scale (24,00,000 bricks/annum).

Potential Customers: Brick manufacturing companies, construction companies and other interested companies.

Techno-Economics (Tentative)

Plant capacity: 2400000 bricks/annum

- Capital investment (plant & machinery): > Rs.68.00 lakhs.
- Total project cost and cost of production will vary depending upon the plant size and site location. The project-economics can be worked out as per location and client requirement.

Technology Package: Process know-how, demonstration and technical assistance in implementation.

Technology Transfer: The Modular Brick from Brahmaputra River Bed Sand technology has been transferred to 1 party for commercial production.

1. M/s P S Enterprises, Jorhat, Assam



Constructed wall at CSIR-NEIST premise using Modular bricks

VSK Mini Cement Plant

Brief Description

Cement is a critical material of any civil engineering construction. CSIR-NEIST took up R&D work of Vertical Shaft Kiln (VSK) for cement production sometime in the sixties. This has resulted in development of know-how of VSK technology for production of ordinary Portland cement of BIS quality. Essentially, the vertical shaft kiln constitutes the heart of the cement plant for the production of quality OPC to BIS specifications in various capacities up to 100 TPD, employing either a single kiln or multiple kilns. As a rule, the VSK is made up of a static vertical shaft lined internally with refractory bricks. Integrated within the kiln is a chimney, a raw-meal feeding inlet, a rotary grate with provision for entry of combustion air, a material block tube and discharge mechanism.

Salient Technical Features

- Flexibility in use of raw materials
- Efficient kiln performance
- Efficient clinker discharge mechanism
- Uniform air distribution at multiple level
- Utilization of small limestone deposits
- Low capital investment
- Lesser gestation period
- Reducing strain on transport system
- Enhancement of cement production
- Decentralization of the cement industry
- Employment avenues

Technology Validation

The first VSK mini cement plant of 9900 TPA capacity was commissioned at Kutch in Gujarat. Since then 39 cement plants ranging from 25 to 100 TPD have come up in different parts of the country with CSIR-NEIST's technology.



*VSK Mini cement plant of
CSIR-NEIST*

Importance of the Technology

In India, Cement is a vital part of the economy and Cement industry accounts for employment to millions of people. The largest consumer of Cement is from the housing sector. As per the recent reports, Cement demand in India is expected to increase due to government's push for large infrastructure projects, and this is expected to increase Cement demand in the next coming 3-4 years. India's cement demand is expected to reach 550-600 Million Tonnes Per Annum (MTPA) by 2025. The conventional cement plants that are normally placed in the large scale sector are in general capital intensive, longer gestation period and are located in places where large reserves of limestone are available. In order to meet this situation, the concept of mini/tiny cement plants is best suited in such places.

Patent Details : Patented in India (Patent No.223012).

Environmental Considerations

Owing to the method of manufacture and pollution abatement features adapted at various stages of manufacture, the overall cement-manufacturing process employing VSK MCP technology comply with acceptable national pollution standards.

Applications/Uses : Cement manufacturing.

Level/Scale of Development : 25 TPD, 50 TPD and 100 TPD.

Potential Customers : Cement manufacturing companies.

Techno-economics : The project-economics can be worked out as per location and client requirement.

Technology Package : Detailed Project Reports, TEFs for proposed locations, basic design, detailed engineering, turn-key engineering services, training of manpower, raw material evaluation and suitability study, commissioning and product standardization.

Technology Transfer : The VSK Mini Cement Plan technology has been transferred to 31 parties/entrepreneurs for commercial production.

1. Lodi Cement & Chemicals (P) Ltd., Andhra Pradesh in 1990
2. Shahi Cement (P) Limited, Tirunelveli Tamilnadu in 1990
3. Tirumala Cement Pvt. Ltd., Kuddapah, Andhra Pradesh in 1990
4. Radharani Chemicals Pvt. Ltd., Venkantraipalli, Ganjam, Orissa in 1991.
5. Laxmi Engineering Works, Madri, Udaipur in 1996

Essential Oil Distillation Unit

Brief Description

CSIR-NEIST has done considerable work on development of distillation plant suited to local conditions in North eastern region. The process involves steam distillation suitable for extraction of essential oils from oil bearing leaves, grass etc. Production of essential oils of citronella, lemongrass, patchouli, geranium, palmarosa, etc. will play an important role in export promotion. The organized cultivation of these non-traditional crops and extraction of oil from these crops will give impetus to the rural population in providing employment/self employment and revenue generation.

Essential oil distillation unit

(300 L/Day) at CSIR-NEIST experimental farm
Salient Technical Features

- Indigenous design with easy operation and maintenance
- Design for steam distillation of oil
- Environment friendly
- Low cost per unit

Technology Validation

To boost the cultivation of aromatic plants cultivation in the North East and benefit the farmers, CSIR-NEIST installed more than 160 oil distillation units ranging between 200-600 kg/batch capacity in different areas based on its design.

Importance of the Technology

Cultivation of aromatic plants has witnessed a significant increase over the past few decades in India making it as one of the major exporters/producers of essential oils. This is because of the growing demand for plant-based medicines, health products, pharmaceuticals, food supplements, cosmetics etc. in today's era. There is therefore a need to introduce organized commercial of these plants to



*Essential oil distillation unit
(300 L/Day) at CSIR-NEIST experimental farm*

meet the industry needs and thereby help the farmers and cultivators in commercial cultivation processing.

Environmental Considerations : No environmental issues.

Applications/Uses : Steam distillation of important aromatic plants such as Citronella, Lemongrass, Patchouli, etc.

Level/Scale of Development : 200-1000 kg/batch

Potential Customers : Small & medium enterprises, NGOs, SHGs and rural development agencies.

Techno-economics: The project-economics can be worked out as per location and client requirement.

Technology Package : Design, demonstration and technical assistance.

Technology Transfer : The Essential Oil Distillation Unit technology has been transferred to 4 parties/entrepreneurs for commercial production.

1. M/s Nagi Trade & Industries, Tinsukia, Assam
2. APSCST, Govt. of Arunachal Pradesh, Itanagar, Arunachal Pradesh
3. M/s Allied Engineers, Guwahati, Assam
4. M/s Finite Technologies, Ambala Cantt, Haryana



Dr G Narahari Sastry, Director, CSIR-NEIST handing over technology package of “Design Know-How for Fabrication of Essential Oil Distillation Unit ” to M/s Finite Technologies, Ambala Cantt, Haryana in presence of technology team members and business development team on 07 October 2021.

An Improved Grain Storage Structure

Brief Description

Stored Grain insect pest causes tremendous damage to grains quantitatively & qualitatively. These pests cause the grain unfit for consumption. Storage of food grains & pulses is very difficult in high humid region worldwide. As per reports, the average damage caused by the stored grain insect pest 15% and extends up to 30% causing great economic loss for a developing country like India. The storage losses due to insects alone account for nearly Rs.1300 crores. According to world bank report, post harvest losses in India amount to 12 to 16 million metric tonnes of food grains annually, an amount that the world bank stipulates could feed one by third of India's poor. CSIR-NEIST has designed a low cost storage structure to minimize storage loss of pulses/grains due to insect pest damage.



An improved Grain storage structure of CSIR-NEIST

Salient Technical Features

- Prohibit absorption of moisture by dried grains from outside environment
- Suitable for storing all types of food grains
- Provide 98% protection to the stored grains from insect pest
- Easy loading and unloading of stored grains
- Best suited to resource poor rural farmer level storage
- No sophisticated equipments required
- Low cost of production

Validation

CSIR-NEIST has validated the improved storage structure in farmers' level through different ICAR institutes and NGOs in NE Region of India. The simple technology is suitable for first generation entrepreneurs with low capital requirement.

Importance of the Technology

In India, 70-80% of the food grains produced is stored at innumerable storage points spread over 0.6 million villages, by the farmers who are unaware about the improved storage methods and have

insufficient capital even to provide for the necessary scientific handling and improved storage bins. Therefore, the present improved low cost storage structure will contribute in saving significant amount of stored grain damage.

Environmental Considerations : No environmental issues.

Applications/Uses : Storing of food grains including cereals and pulses.

Level/Scale of Development : Cottage scale (3000 units/annum).

Potential Customers : Govt. agencies and small/medium enterprises.

Techno-Economics (Tentative)

Plant size: 10 storage structures/day (1 quintal capacity) and 300 working days/annum.

- Capital investment cost: Rs.36000.00 (approx)
- Cost of production: Rs.1898190.00/annum (approx)
- Sales realization: Rs.2400000.00/annum
- Profitability: Rs.501810.00/annum

Technology Package : Design, demonstration and technical assistance.

Domestic Stove cum Charcoal Making Unit

Brief Description

Domestic stove cum charcoal making unit can be used for domestic cooking or heating and at the same time produce valued based charcoal. Unlike the conventional chullahs, the unit uses biomass materials widely available in the north eastern region such as *Ipomeae carnea*, *Mallotus albus*, *Tamarix dioica*, *Heteropanax fragrans*, *Oroxylum indicum*, etc. for charcoal making which are otherwise considered as waste with no timber value. The fuel characteristics of the produced charcoal are found to be same as the conventionally made charcoal from big wood plants. Charcoal produced from this device can be used as a source of energy as well as media for water purification.

Salient Technical Features

- The unit has greater heating efficiency than open chullahs.
- The time for producing wood charcoal is shorter than the conventional methods.
- Useful for converting biomass to wood charcoal.
- Environment friendly.
- Low cost per unit.

Technology Validation

The technology is ready for transfer to potential customers. The unit has been validated at the capacity of 15 kg of charcoal production per batch (30 minutes operating time). The design can be up-scaled as per client's requirement field of application.

Importance of the Technology

Around 800 million people in India are affected by indoor air pollution (IAP) due to the use of the traditional biomass stove and approximately 50000 deaths every year in India due to indoor air



*Stove cum charcoal making unit
developed by CSIR-NEIST*

pollution. It has been reported that 820 million people use traditional biomass cook stoves (2 out of every 3) in India.

Extensive studies have been made for biomass characterization & utilization worldwide. However, since such studies are region specific, the study of widely available biomass of the North eastern region was important. The device so developed can be used as household stove and mini/micro scale furnaces for small industry using biomass as fire wood.

Environmental Considerations : No environmental issues.

Applications/Uses : For charcoal making and use as household cooking stove.

Level/Scale of Development : 15 kg/batch charcoal production (30 minutes operating time).

Potential Customers : Small/medium enterprises and rural development agencies.

Techno-economics: The project-economics can be worked out as per location and client requirement.

Technology Package: Design, demonstration and technical assistance.

Low cost Honey bee box

Brief Description

In beekeeping, honey bee box is one of the vital input required for keeping bee colony. The conventional honey bee box is made with wood, which is obtained from substantially large and selected tree- a precious environmental resources. The cost of honey bee box production is mainly depending on the raw materials cost i.e. wood and the wages of carpenter. Price of wood is accelerating and therefore, cost of honey bee box has exponentially increased. Further, the special skill requires to prepare wooden bee boxes is restricted to a few skilled person i.e. carpenter. Therefore, overall price of the bee boxes are high. In this circumstances, it is needed to look on alternate material, which are ecofriendly, low cost, required no special skill to prepare and overall is good for honey bee.

By considering the sustainability, cost of raw materials, skill requires, CSIR-NEIST has developed the technology of low cost honey bee box, where wood is not used as construction materials of the bee box and instead of wood, other renewable, eco-friendly alternate materials are used.



Low cost Honey bee box

Salient features

- A low cost Bee box
- Environment friendly material
- Avoid using wood for conservation of trees
- Promote sustainable beekeeping practice
- Easy to prepare
- Maintain required temperature inside box irrespective to seasonal variations
- Better performance of honey bee than the conventional box

Technology Validation

The bee boxes are used to rear Honey bees in the field for last few years and observations were made on behavior of the bees. Brood growth, cell growth, weight of the bee colonies were calculated and compared with the conventional box. The requirement of honey bee like aeration, temperature, comfortability was considered during preparing the technology.

Importance of the Technology

Honey bee boxes are prepared extensively from wood, which is obtained from the trees. Trees are very precious resources and for the check of environment, we have to reduce the use of trees. The wooden boxes are costly due to higher price of wood as well as skill required to prepare it. Affordability and lack of skill for preparing the wooden bee box is one of the major hindrances for beekeepers to initiate beekeeping. For overcoming these issues and making beekeeping in the easiest way, CSIR-NEIST, Jorhat has developed the technology of low cost bee box.

Environmental Considerations : The materials used for making bee box are from renewable sources and no any chemicals are used in entire production process of the product.

Applications/Uses: Beekeeping.

Level/Scale of Development : CSIR-NEIST has developed the know-how and the product can be licensed/transferred to interested agencies for promotion of sustainable beekeeping.

Potential Customers: Beekeepers, NGOs, SHGs, Govt agencies who are involved in promotion of beekeeping among the farmers.

Equipment : No major equipments are necessary for production of the bee box.

Techno-economics : The project-economics can be worked out as per location and client requirement.

Technology Package: Process know-how, demonstration, trainings and technical assistance in production.

Technology Transfer: The low cost honey bee box technology has been transferred to 3 parties/entrepreneurs for commercial production.

1. SNEHPAD (NGO), Jorhat, Assam
2. M/s Khunai Abah Producer Company Ltd, Imphal, Manipur
3. Krishi Vigyan Kendra (KVK), East Kameng District, Arunachal Pradesh

Technology for Bioremediation of Hydrocarbon Contaminated Soil

Brief Description

Crude oil contamination in and around oil exploration sites, accidental leakage, transportation and abandonment of drilling site is a serious environmental concern in NE India. The complex composition, non-degradability and xenobiotic nature also pose immediate attention for remediation of crude oil contaminated soil/environment. To address this issue, CSIR-NEIST developed a technology for reclamation of crude oil/hydrocarbon contaminated soil by biological means. An integrated biotechnological approach with native 'crude oil degrading microbes and phytoremediation' has been used. Depending on the nature of crude oil composition, soil and severity of the contamination detail project report (DPR) for recovery of crude oil contaminated soil/environment through biological means can be prepared.

The technology package consists of two phases:

- ✓ Bioremediation using microbial bioformulation
- ✓ Phytoremediation

Salient Technical Features

- The process know-how is a mixed culture of native crude oil degrading microbes.
- Bio-formulation is prepared depending upon the bio-chemical nature of the contaminated soil.
- Environment friendly product.

Technology Validation

The technology has been validated by carrying out reclamation projects with different important clients like Oil India Limited and ONGC, Assam. So far, more than ten contaminated sites have been already reclaimed by applying the technology.



(Before treatment)



(After treatment)

Importance of the Technology

Restoration of degraded environment in 10% of total nation's declared degraded sites is an obligatory requirement to substantiate nation's intended emission level reduction. Hence, the technology has high relevance to restore the degraded environment and to the nation's claim of emission reduction of 30% to 35% by 2030.

Patent details : Patented in India (Patent No.222854).

Environmental Considerations : Eco-friendly process.

Applications/Uses : For reclamation of degraded environment.

Level/Scale of Development : The technology can be licensed/transferred as per location and client requirement.

Potential Customers : Corporate oil sectors and other interested industries and companies.

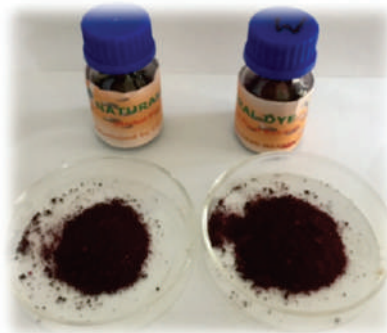
Techno-economics : The project-economics can be worked out as per location and client requirement.

Technology Package : Process know-how, demonstration and technical assistance in implementation.

Process for Separation and Purification of Natural Dyes

Brief Description

Demand for natural dyes in Textile, Food and Pharmaceutical industry has been increasing gradually for replacing synthetic dyes. Most of the presently used dyes in these industries are synthetic and carcinogenic in nature. CSIR-NEIST has developed a process for production of natural dyes from plant sources with a purity of 99%. The process involves use of indigenously developed membrane and a green solvent.



Salient Technical Features

- Extraction from edible plants and membrane separation process for separation and purification of natural dyes.
- Cost-effective process.
- Environmentally benign process.
- Colour stability of the dyes are more than 30 days at ambient and refrigerated conditions at pH 6 to 7.



Purified Natural Dye

Technology Validation

CSIR-NEIST developed the technology recently and has been validated in lab with trial production at 1 kg input level.

Importance of the Technology

Dyes and pigments constitute the largest segment in the world with a market size of 1.3 million ton and market value of \$16 billion. With India's total requirement of natural dye of 750 tons/year, the technology for natural dye is highly potential to meet the market demand.

Patent details : Patent filed in India (Application No. 201711001422).

Environmental Considerations: The process is continuous and effluent that comes out from the process can be reused as extractant for the same process.

Level/Scale of Development: Small scale level (1 kg input).

Potential Customers: Dye manufacturers, Food, Pharmaceutical and Textile industries.

Techno-Economics (Tentative)

Plant size: 1 kg input per day.

- Capital investment (Plant & Machinery) cost: ~Rs.15.00 lakhs
- Project capital cost will vary depending on site location and plant size. The project-economics can be worked out as per location and client requirement.

Technology Package: Process know-how, demonstration and technical assistance.

Technology Transfer: The Process for Separation and Purification of Natural Dye technology has been transferred to 1 party for commercial production.

1. M/s Nabarun Enterprise, Guwahati, Assam



Dr D Ramaiah, Director, CSIR-NEIST handing over the technology package 'Natural Edible Dye-Deep Pin Colour' to Mr Ujjal Hazarika, Proprietor, M/s Nabarun Enterprise, Guwahati on 23 May, 2018 in presence of Technology Development Team.

Natural Vanillin from New Renewable Resource

Brief Description

Natural vanillin is mainly obtained from *Vanilla planifolia* pods which is very much expensive compared to synthetic vanillin derived from various compounds. However, there is no report till now, on the extraction of vanillin from other than *Vanilla planifolia* pods. Considering the environment-polluting, non-economic, heavy investment i.e. biotechnological route is not very economical, take more time, in multiple steps employed in the existing methods.

Therefore, a new variety of plant resource and new process aimed at preparation of vanillin has been developed at CSIR-NEIST. The plant resource is renewable, abundantly available all over the India as well as some parts of the world and the process is very cheap and easily available chemicals have been used.

Salient Technical Features

- The solvent and chemicals used in the extraction process is green and environment friendly.
- Extraction process cost effective and environment friendly.
- Raw material of the product is widely available in all over India.
- The purity of the product is very high.

Technology Validation

The technology has been transferred to 1 party. The Technology has also been validated with different end users and toxicity studies for its safety and effectiveness.

Importance of the Technology

Vanillin is one of the most important and popular aromatic flavour materials used extensively in foods, beverages, perfumes, cosmetic and pharmaceuticals industries. More than 10 thousand tons per year had been produced by the industries all over the world through chemical synthesis. With the increasing demands, the technology for vanillin has high potential to meet the market demand.

Patent details : Patent filed in India (Application No. 201611005768).

Environmental Considerations : This is purely a green process and no any hazards chemicals will be used in entire production process of the product.

Level/Scale of Development : Small scale level (1 kg input).

Potential Customers : Food industry, Beverages industry, Pharmaceutical industry, Cosmetics industry, Agro based industry, Poultry industry.

Techno-Economics (Tentative)

- Project capital cost for production unit of capacity, 2 Kg/day: ~ ₹ 54,00,000.00. Cost analysis carried out based on 1 Kg dry plant material and product yield is 30 gm.
- Project capital cost will vary depending on site location and plant size. The project-economics can be worked out as per location and client requirement.

Technology Package: Process know-how, demonstration and technical assistance.

Technology Transfer: The Process for production of Natural Vanillin from New Renewable Resource has been transferred to 1 party for commercial production.

1. BioTrans Axom Pvt. Ltd, Guwahati, Assam



Dr G Narahari Sastry, Director, CSIR-NEIST handing over the Technology Transfer Agreement and technology package on Natural Vanillin to M/s BioTrans Axom Pvt.Ltd., Guwahati in presence of the Technology and Business Development team members on 20 September 2019.

Mosquito Repellent Candle

Brief Description

Candle is commonly used as light sources and has already an established market. Candle having mosquito repellent properties will repel mosquitoes in addition to emit light and pleasant fragrance. Easily available non-toxic plants are used as ingredients for the mosquito repellent property.

Salient Technical Features

- Effective for repelling mosquitoes.
- Safe to use.
- Can be used in indoor and outdoor conditions.
- Three in one product for providing light, emitting fragrance and repelling mosquitoes.

Technology Validation

The efficacy of mosquito repellent technology has been validated with trial applications/study. The technology has been licensed and demonstrated to industry client. **Commercial Product**

Importance of the Technology

Mosquitoes are widespread and prefer to live in warm, humid tropical regions. The incidence of mosquito transmitting disease is increasing around the world. Nowadays, plant based repellent products are much preferred by the people than the chemical based one. Herbal mosquito repellent liquid candle is effective to ward off mosquitoes.

Environmental Considerations: Eco-friendly process.

Level/Scale of Development: The technology can be licensed /transferred as per location and client requirement.



Mosquito repellent candle developed by CSIR-NEIST



Commercial Product

Potential Customers: Bio-pesticide companies, MSME and other interested companies.

Techno-economics: The project-economics can be worked out as per the requirement of the client.

Technology Package: Process know-how, demonstration, trainings and technical assistance.

Technology Transfer: The Mosquito Repellent Candle technology has been transferred to 4 parties/entrepreneurs for commercial production.

1. M/s DSP Agrofoods & Chemical Industries, Bhubaneswar, Odisha
2. M/s Medtronic Biolead Systems, Hyderabad, Telangana
3. M/s Kudos Laboratories India, New Delhi
4. Sewali Home Enterprise, Jorhat



Commercial Mosquito Repellent Candles based on CSIR-NEIST Technology

Mosquito Repellent Ointment

Brief Description

Mosquito population is a major problem in tropical and subtropical countries like India. The insect is known to transmit deadly pathogen of the diseases like Japanese encephalitis, malaria, dengue and many more. Synthetic insecticides like DDT have been using extensively to control the mosquito population since 1940s. However, insecticides have contaminated the ecosystems by their residues and become one of the major threat factors for biodiversity. Also, insecticides resistant strains of mosquitoes have been developed in many parts of the world. Therefore, emphasis has been provided to develop safer, effective mosquito management products throughout the world.

CSIR-NEIST has developed an Herbal Mosquito Repellent ointment/cream for repelling mosquitoes from exposed body area. The formulation can be conveniently used for external application.

Salient Technical Features

- Effective formulation for repelling mosquitoes.
- Useful for repelling mosquitoes from exposed bodyparts.
- Safe to use.
- Easy to use.

Technology Validation

CSIR-NEIST has developed the technology and its efficacy has been validated in through experiments.

Importance of the Technology

Mosquitoes are widespread and mostly thrive in warm, humid tropical regions. African and Asian countries are the worst affected countries with large mosquito population. The problem of mosquito



Mosquito repellent cream commercial product based on CSIR-NEIST Technology

is more severe in urban as well as in rural areas with poor drainage system and densely populated conditions. For taking precautionary measure to reduce the outbreaks of mosquito borne diseases, products like mosquito repellent ointment/cream is a need.

Environmental Considerations : Completely green process with no use of chemicals.

Level/Scale of Development : The technology can be licensed/transferred to interested parties/companies.

Potential Customers : Bio-pesticide companies, MSME and other interested companies.

Techno-economics : The project-economics can be worked out on as per client requirement.

Technology Package : Process know-how, demonstration, training and technical assistance.

Technology Transfer : The Mosquito Repellent ointment technology has been transferred to 1 party for commercial production.

1. M/s Kudos Laboratories India, New Delhi



Dr D Ramaiah, Director, CSIR-NEIST handing over the technology package 'Herbal Mosquito Repellent Liquid Vaporiser', 'Mosquito Repellent Spray' and 'Mosquito Repellent Ointment' to Mr Karan Goomar, Proprietor, M/S Kudos Laboratories, New Delhi on 4 May, 2018 in presence of Technology Development Team.

Mosquito Repellent Spray

Brief Description

Mosquito is one of the major problems in tropical and subtropical countries like India. As a vector, mosquito transmits many lethal diseases and cause death of several lakhs of people every year. Synthetic insecticides that is used to manage mosquito population is not safe to environment and in addition, develop insecticide resistant mosquito population. Therefore, effective, safe, eco-friendly alternate mosquito repellent product has great demand in market. In this context, CSIR-NEIST has developed Herbal Mosquito Repellent Spray. The spray is convenient to use inside the room as well as in outside environment for repelling mosquitoes. Along with mosquito repellent properties, the spray also gives a subtle fragrance.

Salient Technical Features

- Effective formulation for repelling mosquitoes.
- Herbal formulation.
- Safe to use.
- Pleasant fragrance inside the room.
- Useful in both outside and inside environment.

Technology Validation

The efficacy of Mosquito Repellent Spray technology has been validated with trial applications/study.

Importance of the Technology

Safe, eco-friendly and effective mosquito repellent products are basic home care products used by people on daily basis. Mosquito repellent spray is easy to handle, operate and fit for both indoor and outdoor use.



Mosquito repellent spray commercial product based on CSIR-NEIST Technology

Environmental Considerations: Eco-friendly process

Level/Scale of Development: The technology can be licensed/transferred to interested parties.

Potential Customers: Bio-pesticide companies, MSME and other interested companies.

Techno-economics: The project-economics can be worked out as per client requirement.

Technology Package: Process know-how, demonstration, training and technical assistance.

Technology Transfer: The Mosquito Repellent Spray technology has been transferred to 3 parties/entrepreneurs for commercial production.

1. M/s SOM Phytopharma (India) Limited, Sangareddy District, Telangana
2. M/s Kudos Laboratories India, New Delhi
3. M/s BIOME, Guwahati



Some Commercial Mosquito Repellent Spray based on CSIR-NEIST Technology

Mosquito Repellent Liquid Vaporizer

Brief Description

Mosquito repellent vaporizer is one of the important interventions for management of mosquito from indoor environment. The use of vaporizer inside a room is convenient and useful. Many commercial vaporizer contain synthetic pyrethroids, which induce knock-down of mosquitoes. Mosquito repellent vaporizer containing herbal ingredients for inducing repelling as well as knock-down activities of mosquito is one of the significant contributions towards safe and effective alternate management of mosquitoes.

In this context, CSIR-NEIST has developed Herbal Mosquito Repellent Liquid Vaporizer. The vaporizer is useful to use in electric plug. The rod wick when heated emits the absorbed liquid in the form of vapour.



*Liquid vaporizer
developed by
CSIR-NEIST*

Salient Technical Features

- Effective formulation for repelling mosquitoes.
- Induce knock-down of mosquitoes.
- Safe to use.
- Pleasant fragrance inside the room.

Technology Validation

CSIR-NEIST has developed the technology recently and its efficacy has been validated with trial applications/study.

Importance of the Technology

Nowadays, plant based repellent products are much preferred by the people for safety than the chemical based one. Herbal mosquito repellent liquid vaporizer is effective to ward off mosquitoes and it is also safe to humans. It can be used in electric plug easily for repelling mosquitoes. Liquid vaporizer is popular among the users and has considerable market.

Environmental Considerations: Eco-friendly process

Patent details: Patent filed in India (Application No.201711025754)

Level/Scale of Development: The technology can be licensed/transferred as per location and client requirement.

Potential Customers: Bio-pesticide companies, MSME and other interested companies.

Techno-economics: The project-economics can be worked out as per client requirement.

Technology Package: Process know-how, demonstration, training and technical assistance.

Technology Transfer: The Mosquito Repellent Liquid Vaporizer technology has been transferred to 2 parties/entrepreneurs for commercial production.

1. M/s Medtronic Biolead Systems, Hyderabad, Telangana
2. M/s Kudos Laboratories India, New Delhi



Some Commercial Mosquito Repellent Vaporiser based on CSIR-NEIST Technology



Dr D Ramaiah, Director, CSIR-NEIST handing over the technology package 'Herbal Mosquito Repellent Liquid Vaporiser', 'Mosquito Repellent Spray' and 'Mosquito Repellent Ointment' to Mr Karan Goomar, Proprietor, M/S Kudos Laboratories, New Delhi on 4 May, 2018 in presence of Technology Development Team.

Mosquito Repellent Incense Sticks

Brief description

Since time immemorial, people in India have the habit of using incense sticks in various religious and social occasions. They are made by rolling/moulding the incense paste around a bamboo stick. Incense sticks are also regularly used by people because of its soothing and psychological benefits. Therefore, efforts have been made by CSIR-NEIST to produce mosquito repellent product in the form of Agarbatti or incense sticks. The formulation comprises of plant extracts and found to be quite effective in repelling mosquitoes. The technology is low capital intensive and hence can be easily adopted by small and medium entrepreneurs for income generation and entrepreneurship development.



Mosquito repellent incense sticks developed by CSIR-NEIST

Salient technical features

- Effective for repelling mosquitoes
- Safe to use
- Can be used in indoor and outdoor conditions

Technology Validation level

CSIR-NEIST has developed the technology recently and its efficacy has been validated with trial applications/study. The technology has been licensed and demonstrated to four clients.

Importance of the Technology

Mosquitoes are widespread and prefer to live in warm, humid tropical regions like India. India has a rich tradition of using incense sticks in various religious and social occasions, the product has therefore high market potential. Made from plant sources, the formulation is effective to ward off mosquitoes and completely safe to humans.

Environmental Considerations: Eco-friendly process

Level/Scale of Development: The technology can be licensed/transferred to interested parties.

Potential Customers: Bio-pesticide companies, incense stick manufacturers, MSME and other interested companies

Techno-Economics: The project-economics can be worked out on as per client requirement.

Technology Package: Process know-how, demonstration and technical assistance

Technology Transfer: The Mosquito Repellent Incense Sticks technology has been transferred to 4 parties/entrepreneurs for commercial production.

1. M/s Premier Agro Products, Sivasagar, Assam
2. M/s Cane and Bamboo Technology Centre (CBTC), Guwahati, Assam
3. M/s Asian Evergreen World, Amguri, Sivasagar, Assam
4. M/s Sukanta Self Help Group, Jiramia, West Tripura, Tripura



*Commercial Herbal Mosquito Repellent
Incense Sticks based on CSIR-NEIST technology*

Anti-Arthritis Ointment

Brief Description

Arthritis is a major socio-economic burden of the modern life style that continues to attract major research and development efforts for new effective therapy. Rheumatoid arthritis alone is estimated to affect 1% of the world's population and is twice as prevalent in women as in men. In India, close to 15% of the general population could have one or other form of arthritis. The two most common types of arthritis are osteoarthritis and rheumatoid arthritis.

CSIR-NEIST developed an Anti-Arthritis formulation from rich biodiversity of NE India, which is proven to be very effective in managing arthritic problem of a wide section of people in different parts of the country.



*Anti-Arthritis ointment developed by
CSIR-NEIST*

Salient Technical Feature

- Effective against osteo and rheumatoid arthritis.
- No adverse side effects have been found.
- Active ingredients derived from plant sources.
- Eco-friendly process.

Technology Validation

CSIR-NEIST has successfully popularized the technology as an affordable formulation since its development in the year 2012. The product has been well received in the market and benefitted large sections of the society from India as well as abroad. CSIR-NEIST has also manufactured the product at its premise and has transferred the marketing rights to various enterprises.

Importance of the Technology

With high rate of Arthritis affected population in India and throughout the world, the demand for

effective drug against this major health issue has always gained substantial attention. The Herbal Anti-Arthritis ointment is aimed at providing affordable healthcare to the society. The product is effective for management of Arthritis.

Environmental Considerations: Eco-friendly process

Applications/Uses: The product is effective against both Osteo and Rheumatoid Arthritis and other joint pains.

Level/Scale of Development: Large scale level (22.5 tonnes/annum).

Potential Customers: Pharmaceutical companies and Small/Medium enterprises.

Techno-Economics (Tentative)

- Capital investment (plant & machinery): Rs.3.00 lakhs (approx)
- Project capital cost will vary depending on site location and plant size. The project-economics can be worked out as per location and client requirement.

Technology Package: Process know-how, demonstration, training and technical assistance in production.

Technology Transfer: The Anti-Arthritis Ointment technology has been transferred to 6 parties/entrepreneurs for commercial production.

1. M/s Kudos Laboratories, New Delhi
2. M/s Altis Life Sciences, Himachal Pradesh
3. M/s Multani Pharma Ltd., New Delhi
4. M/s Ayur Force Organics Pvt.Ltd., New Delhi
5. M/s Naturoveda Organics Pvt.Ltd., Kolkata
6. M/s Ridhi Sidhi Medicare, New Delhi



Commercial products based on CSIR-NEIST Anti Arthritis technology

Anti-Fungal Ointment

Brief Description

Skin fungal infections are prevalent and common in all parts of the world. About 200 fungal species can cause infection to human host, out of which only 20-25 species are dominant. Most of the fungal infections are airborne and acquired by inhalation or contact of air, soil or surfaces contaminated with spores. Immune-suppressed patients are more vulnerable to fungal infections.

The herbal Anti-Fungal formulation developed by CSIR-NEIST, is a broad-spectrum Anti-Fungal formulation and effective against wide range of human pathogenic fungi. Made from plant sources of NE India, the formulation eliminates fungal infections after few applications.

Salient Technical Features

- Potential for killing various fungi.
- No adverse side effects have been found.
- Active ingredients derived from plant sources.
- Eco-friendly process.

Technology Validation

CSIR-NEIST has successfully commercialized the technology since its development in the year 2011. CSIR-NEIST has also manufactured the product at its premise and has transferred the marketing rights to various small and medium entrepreneurs. The product received encouraging feedback from the users.

Importance of the Technology

At present, limited numbers of Anti-Fungal drugs are available with many side effects and with the possibility of appearance of resistance. CSIR-NEIST's anti-fungal ointment is herbal in nature with no toxicity or adverse side effects have been observed and have high market potential.

Patent details: Patent filed in India (Application No.0650DEL2007)

Environmental Considerations: Eco-friendly process



*Fungi-Destruct (Anti-fungal)
ointment developed
by CSIR-NEIST*

Applications/Uses: Ointment for external use against fungal and bacterial skin infection.

Level/Scale of Development: Medium scale level (13.5 tonnes/annum).

Potential Customers: Pharmaceutical companies and Small/Medium enterprises.

Techno-Economics (Tentative)

- Capital investment (plant & machinery) for medium scale: Rs.7.00 lakhs (approx)
- Project capital cost will vary depending on site location and plant size. The project-economics can be worked out as per location and client requirement.

Technology Package: Process know-how, demonstration, training and technical assistance in production.

Technology Transfer: The Anti-Fungal Ointment technology has been transferred to 1 party for commercial production.

1. M/s Kudos Laboratories, New Delhi



Commercial product based on CSIR-NEIST Fungal Ointment technology

Anti-Acne Face Cream

Brief Description

Face skin is very sensitive and is always exposed to outer environment. Atmospheric humidity, temperature, dust act rigorously on face skin. Such exposure causes various skin issues in humans. Human sheds

thousands of skin cells every hour. The dead cells should not stick on the skin as it can block the skin pore and encourage forming acne, wrinkles etc. To protect the face skin from those factors, many face creams are available in the market; however, most of them are synthetic and costly.

CSIR-NEIST has developed a face cream from the common plant materials, which provide immediate effect and significantly reduce the acne, scar of the face skin, giving a glowing appearance of the face.



Anti-Acne face cream

Salient Technical Features

- The product is purely herbal
- The cream generates pleasant smell
- Initial input of production is lower
- Raw materials are easily available
- Efficacy is high

Technology Validation

The technology has been developed and validated with different clinical trials and toxicity studies for its safety and effectiveness.

Importance of the Technology

Acne is one of the common problems of face skin. A safe face cream for management of acne as well as the acne scar has significant importance. People prefer to use herbal cream than other cream due to safety and other advantage of herbal cream. Therefore, an effective, herbal anti-acne face cream will have considerable demand.

Level/Scale of Development: The technology can be licensed/transferred as per location and client requirement.

Environmental Considerations: This is purely a green process and no any chemicals will be used in entire production process of the product.

Potential Customers: Pharmaceutical and Cosmetic companies

Techno-economics: The project-economics can be worked out as per location and client requirement.

Technology Package: Process know-how, demonstration, training and technical assistance.

Technology Transfer: The Anti-Acne Face Cream technology has been transferred to 1 party for commercial production.

1. M/s Kudos Laboratories, New Delhi



Commercial product based on CSIR-NEIST Anti Acne Face Cream technology

Decorative Candle

Brief description

Candle has good market demand in different parts of the world. Use of candles in different festivals makes them more demandable. Rural people frequently use candles to light their house at night in absence of electricity. Candles are also extensively used in religious and parties as sacred symbol and pleasing light. Therefore, demand of candles remains round the year. Candles can be prepared as cottage industries. Individual and cluster approach can be used in preparing candles. Candle making do not need much physical labour and therefore, rural women can easily be engaged in this activity.

Along with normal candle, other value added candles like fragrance candle, decorative candles can be prepared to get more niche in the market. These value added candles have high demand and manufacturer can get more price. Like incense stick, different scented herbal ingredients can be added for fragrance candles. Decorative candles can be prepared of different shapes and sizes. Special moulds and skills are required to prepare decorative candles. Art works can also be added in decorative candles. Decorative candles are highly priced and have special market demand.



Decorative Candle

Salient features

- ❖ Emit pleasant fragrance
- ❖ Creative art can be added
- ❖ Attractive and good looking
- ❖ Customized as per the need

Validation level

The technology is validated through field study with different users.

Relevance of the technology in present times

The demand of decorative candle is higher for different occasions. Addition of different art works on these candles makes them more suitable for celebrating in various occasions. These candles are popular among some sections of people in the society. Therefore, manufacturing of such decorative candles may open a new area of marketing.

Environmental considerations: There are no any chemicals used in entire production process of the product.

Applications/Uses: Occasion specific.

Level/Scale of development: The technology can be scale-up as per the requirement of the clients.

Potential customers: SHGs, MSME, NGOs etc.

Equipment: No major equipments are necessary for production of the decorative candles.

Techno-economics: The project-economics can be worked out as per client requirement.

Technology package: Process know-how, demonstration, trainings and technical assistance in production.

Technology transfer: The technology is ready to transfer.



Commercial Scented Candles based on CSIR-NEIST Technology

Liquid Deodorant Cleaner

Brief Description

Liquid deodorant cleaners are widely used nowadays for a variety of purposes viz., cleaning of floors and tiles, polishing glass & ceramic articles etc. Deodorant cleaners are widely used in nursing homes and hospitals, hotels and restaurants, business and private houses, seminar halls and auditorium as floor cleaners.

CSIR-NEIST has developed an improved Liquid Deodorant Cleaner. The formulation is herbal based for use in cleaning floors, tiles, etc. and at the same time produces good fragrance. Developed with easily available ingredients, the process is simple and suitable for semi-skilled entrepreneurs and small scale industries.

• Salient Technical Feature

- Use of eco- friendly raw materials
- Can be adopted as cottage scale technology in rural areas.
- No sophisticated machineries involved
- No highly skilled labors required
- No by-product generation
- Low cost investment

Technology Validation

CSIR-NEIST has licensed the technology to a large no. of companies and entrepreneurs spread across the country. The technology has contributed immensely in creating employment opportunities and entrepreneurship development particularly in the NE region.

Importance of the Technology

According to India Household Cleaning Market Outlook, 2021, the overall market for household cleaning is anticipated to grow with a CAGR of 22.74% in the next five years. Floor cleaners dominate category revenues, followed by specialized and multi-purpose cleaners. Surface cleaners are targeted mainly at urban households and thus are more popular in urban markets. Liquid deodorant cleaner has the potential to capture surface and floor cleaner market. Because of its low capital investment the technology has huge potential for development of small & medium entrepreneurs.



Commercial products based on CSIR-NEIST technology

Environmental Considerations: Eco-friendly process

Applications/Uses: The product can be used for surface cleaning of floors, tiles, glass materials, etc.

Level/Scale of Development : Small scale level (200 L/Day).

Potential Customers: Small/Medium scale industries, Homecare products manufacturing companies and other interested companies.

Techno-Economics (Tentative)

Plant capacity: 200 L/Day

- Capital investment (plant & machinery): Rs.3.00 lakhs (approx)
- Project capital cost will vary depending on site location and plant size. The project-economics can be worked out as per location and client requirement.

Technology Package: Process know-how, demonstration and technical assistance in production.

Technology Transfer: The Liquid Deodorant Cleaner technology has been transferred to 19 parties/entrepreneurs for commercial production.

1. M/s Thangching Herbs Entyprises, Churachandpur, Manipur
2. M/s S K Industries, Raja Maidam, Jorhat, Assam
3. M/s Ethereal Aromatics, R G Baruah Road, Guwahati
4. Shri Arindam Ghosh, M/s SAPMG, Agartala, Tripura
5. M/s DSP Agrofoods & Chemical Industries, Bhubaneswar, Odisha
6. M/s MT Enterprise, Imphal, Manipur,
7. M/s MIDC Enterprises, Irom Meijarao, Imphal West, Manipur
8. M/s Sayon Industries, Imphal Manipur



Commercial products based on CSIR-NEIST Liquid Deodorant Cleaner technology

Solid Deodorant Freshener

Brief Description

Similar to Liquid Deodorant Cleaner, Solid Deodorant Freshener is another useful product for surface cleaning of various items and floor cleaning and can be used also as room/air freshener. The deodorants which are commonly available in the market are in the liquid form having certain disadvantages. Liquid cleaners occupy more spaces during transportation and possibility of leakage during transport. In order to minimise the damage and disadvantages of the liquid form, solid dispersible freshener has been developed by CSIR-NEIST.

The product is developed from easily available raw materials and involves a simple process for production.



Solid deodorant freshener tablets

Salient Technical Features

- Use of eco- friendly raw materials
- Can be adopted as cottage scale technology in rural areas.
- No sophisticated machineries involved except for a Hydraulic Press (manual or automatic) with mould of required size and shape
- No highly skilled manpower is required
- No by-product generation
- Low cost investment

Technology Validation

The technology has been developed recently and CSIR-NEIST has licensed the technology to one party so far for commercialization.

Importance of the Technology

The surface cleaning market is growing rapidly which is evident from the rising awareness about brands due to heavy promotion by leading companies. Surface cleaner occupy significant position in

the household cleaning market and is further split into floor cleaner, specialized and multipurpose cleaner. CSIR-NEIST's Solid deodorant freshener is a multipurpose product which can be used in multi-purpose cleaning job and as well as for room/car freshener because of the pleasant fragrance. The technology has high potential in creating employment opportunities and entrepreneurship development in the country and particularly in the NE region.

Environmental Considerations: Eco-friendly process

Applications/Uses: The tablets can be dissolved in water and used for cleaning floors and surface cleaning of tiles, glass materials, etc. and also as a room/car freshener.

Level/Scale of development

- Small scale level (1200 Tablets/Day)
- Large scale level (10,000 Tablets/Day)

Potential Customers: Small/Medium scale industries, Home care products manufacturing companies and other interested companies.

Techno-Economics (Tentative)

Plant capacity: 1200 Tablets/Per Day or 10,000 Tablets/Per Day

- Capital investment (plant & machinery): Rs.5.00 lakhs (approx) for small scale
- Capital investment (plant & machinery): Rs.10.00 lakhs (approx) for large scale

*Project capital cost will vary depending on site location and plant size. The project-economics can be worked out as per location and client requirement.

Technology Package: Process know-how, demonstration and technical assistance in production

Technology Transfer: The Solid Deodorant Freshener technology has been transferred to 2 parties/entrepreneurs for commercial production.

1. M/s DSP Agrofoods & Chemical Industries, Bhubaneswar, Odisha
2. M/s Khuman Enterprises, Imphal, Manipur

Wood Care Formulation

Brief Description

Wood and bamboo are two important forest resources used extensively as building and furnishing materials. Wood is commonly used for making doors, windows, ceilings, partition panels etc. in addition to use as furnishing material. Similarly, bamboo is used for rural housing as well as furnishing material and for making various handicraft materials of day to day use. Both wood and bamboo are prone to infection by fungus and insects leading to degradation. More often, the climatic conditions also contribute to the attack of fungus on wood and bamboo products. CSIR-NEIST has developed a number of formulations useful for different applications. One among them has been found potential to prevent the damage of wood and bamboo from fungal and insect attack enhancing the durability and strength. The product is developed from easily available raw materials and involves a simple process for production.



Wood care formulation

Salient Technical Features

- Made from plant sources and hence, there is no adverse effect on environment and human health
- Low cost high efficiency product, having good insect & fungal resistant properties and easy to use
- No sophisticated equipments and machineries involved
- No highly skilled manpower required
- No bye-products generated during manufacturing process

Technology Validation

The technology has been recently developed and CSIR-NEIST has licensed and demonstrated the know-how to an industry client.

Importance of the Technology

According to the Coatings World, it is predicted that the demand for wood care solutions and preservatives is expected to advance 4.5 percent per year through 2018 to \$4.8 billion. With the growing market demand, the technology based on plant extracts has the potential to capture good market share. The simple technology has therefore high business and employment opportunities.

Environmental Considerations: Eco-friendly process with no by-products generation during manufacturing.

Applications/Uses: The product is applied for protecting wood and bamboo products from fungal and insect attack.

Level/Scale of Development: Small scale level (100 L/Day).

Potential Customers: Wood care products manufacturing companies, MSME entrepreneurs, etc.

Techno-Economics (Tentative)

Plant capacity: 100 L/Day (30000 L/annum)

- Capital investment (plant & machinery): Rs.7.50 lakhs (approx)
- Project capital cost will vary depending on site location and plant size. The project-economics can be worked out as per location and client requirement.

Technology Package: Process know-how, demonstration and technical assistance in production.

Technology Transfer: The Wood Care Formulation technology has been transferred to 1 party for commercial production.

1. M/s DSP Agrofoods & Chemical Industries, Bhubaneswar, Odisha



Commercial product based on CSIR-NEIST Woodcare technology

Room/Air Freshener

Brief Description

Household repellent products currently being used for domestic purposes are mostly synthetic products with high mammalian toxicity. In India, most people have the habit of mopping floors daily to ward off house hold insect pests.

CSIR-NEIST has developed a safe mosquito repellent in the form of a household freshener.

Made from plant extracts and aromatic oils, the freshener is quite effective for repelling household insect pests. The product not just keeps the room protected from insects but also gives it fresh fragrance and sanitized.



Commercial product based on CSIR-NEIST technology

Salient Technical Features

- Made from plant sources, there is no adverse effect on environment and human health
- Low cost technology with high market potential
- No sophisticated equipments and machineries involved
- No highly skilled manpower required
- No bye-products generated during manufacturing process

Technology Validation

CSIR-NEIST has licensed and demonstrated the technology to several parties from NE region from essential oil industry to first generation entrepreneurs. The technology is low capital intensive and therefore suitable for small and medium level companies/entrepreneurs.

Importance of the Technology

The global air freshener market size was estimated at US\$ 12.20 billion in 2021 and is projected to hit around US\$ 27.7 billion by 2030, growing at a CAGR of 9.54% from 2022 to 2030. Herbal room

fresheners are mostly preferred by consumers nowadays than chemical based fresheners available in the market. Herbal room freshener has high potential for business and employment opportunities.

Environmental Considerations: Eco-friendly process with no by-products generation during manufacturing.

Applications/Uses: The product can be used as room/air freshener and as well as floor sanitizers.

Level/Scale of Development: CSIR-NEIST has developed the know-how and the product can be licensed/transferred as per location and client requirement.

Potential Customers: Fragrance and flavour industries and small & medium entrepreneurs

Techno-economics: The project-economics can be worked out as per location and client requirement.

Technology Package: Process know-how, demonstration and technical assistance in production.

Anti-Fungal Ointment for Domestic Animal

Brief Description

Fungal infections in animals cause dermatophytosis leading to skin diseases. Prolonged infection leads to other health problems of animals such as weight loss, growth deficiency, reduced quality of meat and milk production causing economic loss in the market. In cattle, the lesions of infections are most commonly found on the neck, head and perineum and consist of heavy, grey-white crusts raised perceptibly above the skin, or simply alopecia. Ringworm in cattle is a common infection caused by *Trichophyton verrucosum*, a spore forming fungi. The spores can remain alive for years in a dry environment and can be transmissible to other animals.

CSIR-NEIST has developed herbal formulation i.e. powder and ointment for protecting domestic animals from skin infection. The formulation need to apply to the affected skin of the animals for protection.

Salient Technical Features

- Made from plant sources, there is no adverse effect on environment and human health
- Effective for management of dermal infection in domestic animals like cow, goat and dog
- Broad spectrum in activity
- No toxicity

Technology Validation

CSIR-NEIST has recently developed the technology and the technology package is ready for licensing to potential companies. The formulation has been tested and validated with different field trials for its effectiveness and safety.



Anti-Fungal ointment for domestic animals

Importance of the Technology

The importance of livestock animals is generating growth in the animal healthcare market because of more people consuming meat and dairy products. Synthetic fungicides are used in domestic animals for management of their dermal infections. These fungicides often leave residues to animals or their products and may transmit to humans, as domestic animals live closely to people. Therefore, herbal, safe and effective anti-fungal product for curing animal infection is a good alternative.

Environmental Considerations: This is purely a green process and no any chemicals are used in entire production process of the product.

Applications/Uses: For external use in skin fungal infections of animals.

Level/Scale of Development: CSIR-NEIST has developed the know-how and the product can be licensed/transferred as per location and client requirement.

Potential Customers: Veterinary products manufacturers, pharmaceutical companies, etc.

Techno-economics: The project-economics can be worked out as per location and client requirement.

Technology Package: Process know-how, demonstration, training and technical assistance in production.

Technology Transfer: The Anti-Fungal Ointment for Domestic Animal technology has been transferred to 1 party for commercial production.

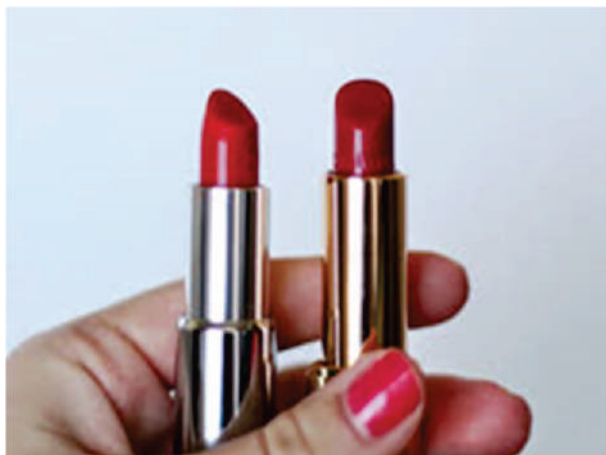
1. M/s RR Animal Health Care Limited, Hyderabad.

Herbal Lipsticks with Lipcare

Brief Description

Cosmetic product like lipstick is one of the extensively used by the people and having incredible demand from the historical time to present day. Lipstick is one, having great demand and most widely used by the people, particularly women to enhance the beauty of lips and add glamour to touch to the makeup.

Therefore, CSIR NEIST has developed a natural ingredients based herbal medicated lipstick. The manufacturing process is easy, cost effective and environment friendly. Using natural herbals helpful for lip healing, improving smoothness, keep the lips hydrated making supple and beautiful. The product is loaded with vitamin rich and healthy ingredients, which will help for alleviate hyperpigmentation and restore the lip's original color, act as an anti-oxidant property, repair damaged and dry lips and moisturizer for soften or smoothen the lips. It can be used as a cosmetic as well as remedial lip care product by women.



Herbal Lipsticks

Salient Technical Features

- The formulation is green, cost effective, easily available and environment friendly.
- No any hazardous chemicals and heavy metals.
- It can be used as a cosmetic as well as remedial lip care product by women.
- The product is loaded with vitamin rich and healthy ingredients.
- Manufacturing process is easy.

Technology Validation

The technology has been successfully commercialized. Toxicity studies for its safety and effectiveness and validated with different end users.

Importance of the Technology

Lipstick Market was valued at US\$ 9.57 billion in 2021 and is projected to reach US\$ 14.68 billion by

2029, growing at a CAGR of 5.5% during the forecast period. Rising consciousness regarding personal grooming and appearance among young female consumers across the world is expected to be one of the key drivers. Furthermore, increasing purchasing power of the women population due to rising female workforce is expected to fuel the product's demand in the near future. CSIR NEIST developed herbal Lipsticks is affordable as well as it also has price competitiveness with compared to the recent market price. So, the product has the prominent marketable price for the recent time.

Environmental Considerations: Eco-friendly process

Applications/Uses: The herbal lipstick with lip care is specifically aimed at individuals suffering from dry and chapped lips. It can both be used as a cosmetic as well as remedial lip care product.

Level/Scale of Development: 2500 lipstick per day (4 gm).

Potential Customers: Pharmaceutical companies, Cosmetics companies and Small/Medium enterprises.

Techno-Economics (Tentative)

- Project capital cost will vary depending on site location and plant size. The project-economics can be worked out as per location and client requirement.

Technology Package: Process know-how, demonstration and technical assistance in production.

Technology Transfer: The Herbal Lipstick technology has been transferred to 1 party for commercial production.

1. M/s Atithya, Guwahati, Assam



Commercial product based on CSIR-NEIST Herbal Lipsticks technology

Herbal Ingredient based Antibacterial Hand Wash

Brief Description

Skin is the first line of defense of our body against various microbial infections, which requires protection and care. Protection of skin from microbial infections can be achieved by appropriate skin hygiene, which comprises hand washing. Hand washing is important because contaminations spread through hands is often taken place as hands are directly exposed to the environment and utilized mostly for the handling purpose. Thus, appropriate hand wash with antimicrobial agent must require assuring removal of transient microorganisms.

The Herbal Ingredient based Antibacterial Hand Wash developed by CSIR-NEIST, not only washed away harmful microbes from hands but also other dirt. Plants with medicinal properties are being used as a traditional medicine from ancient time. The extract from the different parts of various medicinal plants have been employed as a natural remedy in curing various ailments and diseases.

Salient Technical Features

- The active ingredients are plant-based material
- Cost effective
- Clinically safe to use
- Effective against broad range of skin pathogens
- Pleasant fragrance
- No sophisticated machineries required for the product preparation
- No toxicity or environmental issue

Technology Validation

CSIR-NEIST has developed the technology recently and its efficacy has been validated in many experiments. Primary skin irritation test and oral toxicity tests of the product formulation has been carried out and found to be safe for the purpose.



Herbal Antibacterial Hand Wash

Importance of the Technology

Hand hygiene is one of the important measures to contain cross transmission of different microorganisms and to reduce the incidence of health care-associated infections. Therefore, this product is well aligned with current requirement of hand hygiene.

Environmental Considerations: Eco-friendly process.

Applications/Uses: For external use for hand washing.

Level/Scale of Development: 500 litre/day (scalable as per requirement of the client).

Potential Customers: Pharmaceutical companies and Small/Medium enterprises.

Techno-Economics (Tentative)

- Project capital cost will vary depending on site location and plant size. The project-economics can be worked as per location and client requirement.

Technology Package: Process know-how, demonstration and technical assistance in production.

Flexible Composite Sheet from Tannery Wastes

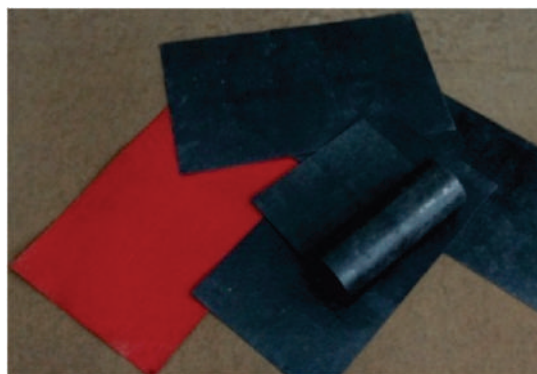
Brief Description

The leather industry is one among few industries that utilizes by-products such as skin, hides etc. generated by meat and meat processing industries. These pure fibre waste materials are converted into useful consumer products through a series of steps like pre-tanning, tanning, post tanning and finishing. These processes leads to the generation of solid leather wastes like splits, shavings and trimmings along with liquid wastes and other gaseous emissions. The solid wastes alone or in combination with natural fibres can be further used for making products through certain mechano-chemical processing.

CSIR-NEIST has developed a high flexible composite sheet from dyed trimmings in combination with natural fibres like jute and cotton using polymeric binder. Utilization of such waste materials not only help to reduce environmental pollution, but also help for making alternative product substitute to leather which can be used for making apparels and goods of day-to-day use.



Flexible composite sheets & products



Leather board sample from dyed trimmings

Salient Technical Features

- The product is highly flexible and possess higher. mechanical strength properties.
- Simple process suitable for recycling of waste material.
- Product suitable to use as pressure gasket.
- Cost effective process.

Technology Validation

CSIR-NEIST has developed the technology recently and its various properties have been validated with in-depth studies.

Importance of the Technology

The increasing demand of leather products in the market has led to the increase in production and demand of virgin leather throughout the world. According to UN's Food and Agriculture Organization, the global leather industry boomed during 1981 to 2006 with rapid expansion in the exports of light bovine leather. Leather industry in India has grown manifold over the last few decades and occupies a substantial prominence in the economy in the light of its export earnings and employment generation. Considering the increasing demand of leather products, the composite sheet would make a suitable alternative product for making various items.

Environmental Considerations: Simple process for development of eco-friendly product.

Applications/Uses

Composite sheet can be used for making apparels and goods like sandals, shoe, bags, wallet, cap and other items of leather. It can also be used as a pressure gasket in different machines and equipments.

Level/Scale of Development: CSIR-NEIST has developed the technology at 200 sheets/day and the technology can be licensed/transferred as per location and client requirement.

Potential Customers: Leather product manufacturing companies, garments and apparels industries and other interested companies

Techno-Economics (Tentative)

Plant capacity: 200 Sheets (1x1m)/Day.

- Capital investment (plant & machinery): Rs.32.00 lakhs (approx).
- Project capital cost will vary depending on site location and plant size. The project-economics can be worked out as per location and client requirement.

Technology Package: Process know-how, demonstration and technical assistance.

Process for Extraction and Purification of Oxyresveratrol

Brief Description

Oxyresveratrol is an important organic compound with multi-faceted uses. It is naturally found in the bark of *Artocarpus lakoocha* Roxb., and is used as a starting material for synthesis of organic compounds like trans-2-methoxy-4,3',5'- trihydroxystilbene, trans-2,3'-dimethoxy-4,5'- dihydroxystilbene, etc. Oxyresveratrol has potential anti-cancerous as well as neuroprotective properties against neurodegradation in Alzheimer's disease. It can be used as skin brightener. There are various methods available for synthesis of Oxyresveratrol from the plant source through synthetic routes which gives a mixture of cis and trans isomer as the end product. The anti-oxidant property of Oxyresveratrol is found in the trans isomer only. CSIR-NEIST has developed a process for production of oxyresveratrol as trans isomer with a purity of 99%. The process involves use of indigenously developed membrane and a green solvent.

Salient Technical Features

- Extraction and membrane separation process for purification of Oxyresveratrol.
- Cost-effective process.
- Environmentally benign process.
- The process gives trans isomer of Oxyresveratrol.
- Membrane can be reused up to 10 cycles.

Technology Validation

CSIR-NEIST developed the technology recently and has been validated in lab with trial production at 2 kg/day scale.

Importance of the Technology

Oxyresveratrol has an ever growing demand in the world market of drug & pharmaceuticals, phytochemicals and fine chemical industries due to its various medicinal properties. Furthermore, the product is used for producing several other derivatives. It is a well known fact that high purity



Membrane Module

products (trans isomers) has greater demand in chemicals and pharma market for the ability to produce targeted and improved results. The process developed by CSIR-NEIST gives transisomer Oxyresveratrol responsible for its anti-oxidant property.

Patent details: Patent filed in India (Application No.2853DEL2014) and abroad (Application No.PCT/IN2015/050129).

Environmental Considerations: The process is continuous and effluent that comes out from the process can be reused as extractant for the same process.

Level/Scale of Development: Small scale level (2 kg per day).

Potential Customers: Pharma companies, chemical industries and other interested companies.

Techno-Economics (Tentative)

Plant size: 2 kg product per day

- Capital investment (Plant & Machinery) cost: ~Rs.60.00 lakhs
- Project capital cost will vary depending on site location and plant size. The project-economics can be worked as per location and client requirement.

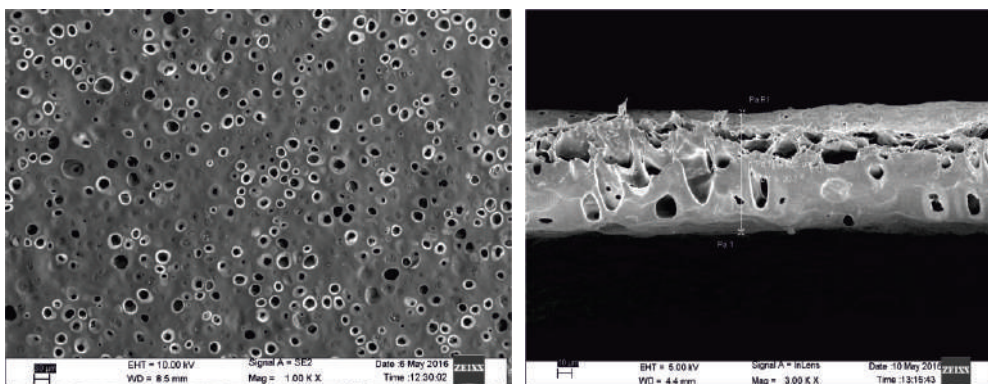
Technology Package: Process know-how, demonstration and technical assistance.

Novel Membrane with Controlled MW Cut off for Racemic Resolution of Drug Molecules

Brief Description

Chemical synthesis of drugs results in the formation of an optically in-active two components mixture known as enantiomers containing an equal amount of two stereoisomers. Out of these two stereoisomers, only one form is optically active for the therapeutic value, the other form is a waste unless it is valorized by chemical transformation. The technology that enhances the production of optically active enantiomers at lower cost is a much needed one in the global market scenario of drugs and pharmaceuticals.

CSIR-NEIST has developed a membrane of Controlled MW (Molecular Weight) Cut off made from special proprietary Chiral Polymeric (CP) material and was used for a process for resolution of drugs such as trans Sobrerol, Atenolol and Propranolol etc. The membrane is suitable for resolution of racemic compounds with high purity (ee>98%).



SEM photographs of the membrane

Salient Technical Features

- The membrane can be used in modular form like Spiral Wound and Hollow Fibre module for effective separation of racemic mixtures.
- Low energy intensive, recyclable and cost-effective process as compared to available technology of HPLC, chromatographic separation using chiral stationary phase.
- Resolution performance of the membrane is independent of functional groups, provide faster separation, lower energy consumption and zero waste.
- The mini units are simple in construction and can be operated continuously to derive benefit of lower operational cost.

Technology Validation

CSIR-NEIST developed the technology recently and has been validated in lab for trial production/Application.

Importance of the Technology

Enantioselective solid polymeric membrane would become the future technological innovation for isomer separation from racemic compound for production of enantiomerically pure compounds. It can replace the HPLC and asymmetric synthesis.

Environmental Considerations: Eco-friendly process

Level/Scale of Development: Small scale level (500 sq cm)

Potential Customers: Membrane manufacturing companies, Drug/Pharmaceutical companies and Fine Chemical Industries.

Techno-Economics (Tentative)

Plant size: 10 sq metre membrane per batc

- Capital investment (Plant & Machinery) cost: ~Rs.90.00 lakhs
- Project capital cost will vary depending on site location and plant size. The project-economics can be worked out as per location and client requirement.

Technology Package: Process know-how, demonstration and technical assistance.

Novel Membrane with Controlled MW Cut off for Racemic Resolution of Amino Acids

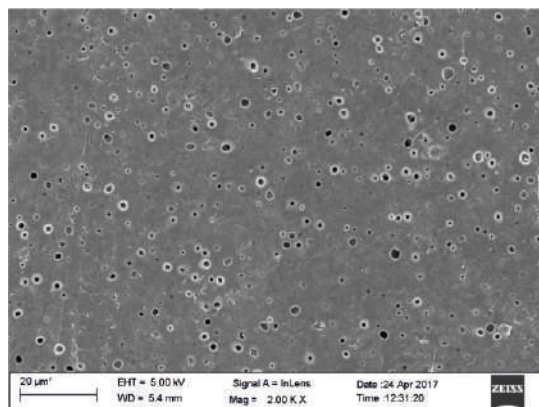
Brief Description

Amino acids are produced in large amounts through chemical synthesis and/or by microbial fermentation of cane or beet molasses with generally selected bacterial strain. These are obtained in aqueous solution and have to be separated from excess reagents or substrates and nutrients in case of fermentation, from impurities introduced through feed and from by products. For their recovery, separation and purification from the fermentation broth, a series of separation steps like filtration, crystallization and ion exchange are used. Final purification and recovery is achieved by chromatography techniques and by fractional crystallization. However, there is an increasing trend of using single enantiomer of amino acids and other compounds in food and pharmaceutical industries, instead of racemates which actually are composed of equimolar amounts of enantiomers. Conventionally, large scale production of optical isomers is based on chromatographic processes with chiral stationary phases. However, Chromatography is a time consuming and cost effective process. Thus, there is a need to design a suitable membrane for separation of isomers of amino acids with the ultimate aim for a membrane based process.

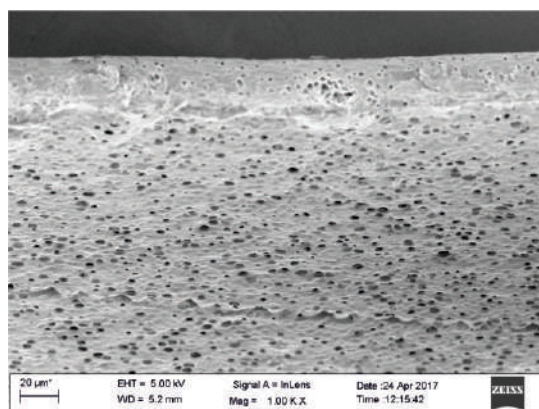
CSIR-NEIST has developed a novel membrane of Controlled MW (Molecular Weight) Cut off and was used for a process for resolution of amino acids with high purity (ee>98%).

Salient Technical Features

- Membrane can discriminate approximately all racemic amino acids.
- Effective separation of D and L isomers amino acids with reasonably high enantioselectivity.
- The membrane can be used in modular form like spiral wound and Hollow Fibre module for effective separation of racemic mixtures.



SEM photograph of the membrane (Front view)



SEM photograph of the membrane (Cross section)

- Low energy intensive, recyclable and cost effective process as compared to available technology of HPLC, chromatographic separation using chiral stationary phase
- Resolution performance of the membrane is same for amino acids, provide faster separation and zero waste generation
- The mini units are simple in construction and can be operated continuously to derive benefit of lower operational cost

Technology Validation

CSIR-NEIST developed the technology recently and has been validated in lab for trial production/application.

Importance of the Technology

Enantioselective solid polymeric membrane would become the future technological innovation for isomer separation from racemic compound for production of enantiomerically pure compounds. It can replace the HPLC and asymmetric synthesis.

Environmental Considerations: Eco-friendly process

Level/Scale of Development: Small scale level (500 sq cm)

Potential Customers: Membrane manufacturing, Drug and Pharmaceutical, Fine Chemical Industries etc.

Techno-Economics (Tentative)

Plant size: 10 sq metre membrane/batch

- Capital investment (Plant & Machinery) cost: ~Rs.90.00 lakhs
- Project capital cost will vary depending on site location and plant size. The project-economics can be worked out as per location and client requirement.

Technology Package: Process know-how, demonstration and technical assistance.

Membrane Technology for Removal of Acetic Acid from Process Effluent

Brief Description

In chemical/petrochemicals industries, organic solvents are generated with the industrial effluent, most notably, in the process stream of polyester and ethanol industries, low concentrated acetic acid is generated with the process stream. Several methods such as distillation, extraction, neutralization, over-liming, vacuum evaporation, stream stripping, charcoal adsorption, ion exchange resin adsorption etc. are available to remove acetic acid from the process stream. However, removal of acetic acid ($\leq 3\%$) from process stream is very challenging. Application of membrane technology for removal of acetic acid from process stream is an efficient process. CSIR-NEIST has developed a membrane for removal of acetic acid from the process stream containing $\leq 3\%$ acetic acid with highest separation efficiency (95%).

Salient Technical Features

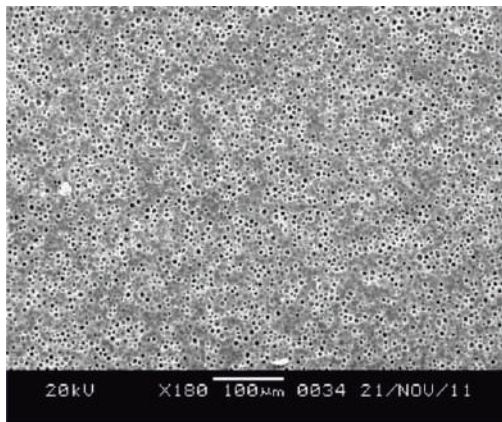
- The membrane can be used in modular form like spiral wound and Hollow Fibre module for high separation efficiency.
- The process is lower energy intensive, recyclable and cost effective.
- Separation efficiency of the membrane is $>95\%$.

Technology Validation

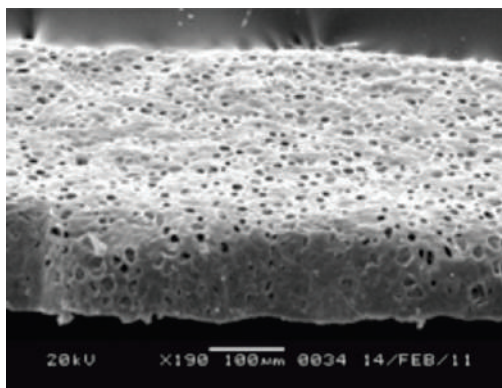
CSIR-NEIST developed the technology recently and has been validated in lab for trial Applications.

Importance of the Technology

Several methods such as distillation, extraction, neutralization, over-liming, vacuum evaporation, stream stripping, charcoal adsorption, ion exchange resin adsorption etc. are available to remove



SEM photograph of the membrane (Front view)



SEM photograph of the membrane (Cross section)

acetic acid from the process stream. CSIR NEIST developed membrane can save energy of the process with high efficiency.

Environmental Considerations: Effective for removal of organic pollutants like acetic acid (generated by industrial activities) thus providing clean environment.

Level/Scale of Development: Small scale level (500 sq cm).

Potential Customers: Fine Chemical and Petrochemical Industries etc.

Techno-Economics (Tentative)

Plant size: 10 sq metre membrane per batch

- Capital investment (Plant & Machinery) cost: ~Rs.80.00 lakhs
- Project capital cost will vary depending on site location and plant size. The project-economics can be worked out as per location and client requirement.

Technology Package: Process know-how, demonstration and technical assistance.

Composite Board from Agro-waste

Brief Description

Medium density boards or Composite boards are a type of board used in false partition, ceiling, table tops, furniture fixtures, mirror backings, etc. These are high grade composite material usually made various types of cellulosic materials. A board manufactured from particles of wood or other lingo-cellulosic materials agglomerated, formed and pressed together by use of an organic or synthetic binder together with one or more of the agents such as heat, pressure, moisture, catalyst, etc.

CSIR-NEIST has developed a process technology for making medium density composite boards from agricultural wastes like paddy husk, paddy straw and certain reed materials.

Salient Technical

- Environment friendly process.
- The process utilizes agricultural waste, low density timber scrapings and a binder.



Medium density particle/fibre board

Technology Validation

The technology has been licensed and demonstrated to a local firm.

Importance of the Technology

Use of medium density particle/fibre boards (MDF) gives an added advantage of saving money instead of using real wood products in partitions and furniture products. Medium density boards are often preferred over low density particle boards and provides for economical, stable and aesthetic end products.

Environmental Considerations: Eco-friendly process.

Applications/Uses: Composite boards can be used in false partitions, ceiling and furniture items.

Level/Scale of Development: 120 Sheets/Day (2"x2")

Potential Customers: Board making companies and furniture industry.

Techno-economics

Plant capacity: 120 Sheets (size 2"x2")/Day

- Capital investment (plant & machinery): Rs.30.00 lakhs (approx)
- Project capital cost will vary depending on site location and plant size. The project-economics can be worked out as per location and client requirement.

Technology Package: Process know-how, demonstration and technical assistance in implementation.

Process for Extraction of Fibres from Banana Pseudo Stem

Brief Description

Industrial utilization of natural resources from plant kingdom without affecting ecological balance is a global phenomenon today. Banana plants are one of the major natural resources abundantly available in the hill and plain areas of almost all the states of our country. Being perennial in nature, the plants grow from rhizomes and after bearing fruits, the plants gradually decompose and remain as field/forest waste. Thus, a sizeable amount of this cellulosic waste remains available for appropriate use.

CSIR-NEIST has extensively worked on utilization of various natural fibres and developed processes for extraction of fibres from Banana pseudo stem. Banana fibres find immense use in making wide variety of products of both industrial and commercial importance. A major utilization of the fibres is in making ropes and twines. The process is suitable for small and micro industries and promoting entrepreneurship development.

Salient Technical Features

- Less capital intensive
- Short gestation period
- Utilisation of locally available bio-waste
- Eco-friendly process with less disposal problem
- Products obtained are bio-degradable
- No skilled manpower required
- Mechanical and chemical methods of extraction

Technology Validation

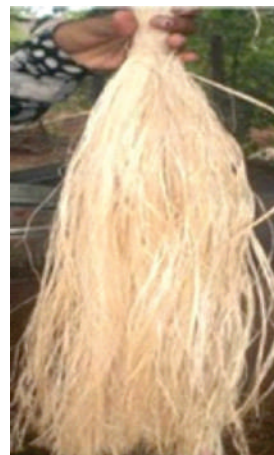
So far, the process know-how has been transferred to four industries from Assam and Tamil Nadu. Besides, CSIR-NEIST has been disseminating and popularizing the technology for promoting local entrepreneurship in NE India through various training programmes and workshops. This has



Banana Fibre after extraction



Twines from Banana Fibre



Banana Fibre

encouraged a number of women entrepreneurs and unemployed youth to adopt the process for making various value added products.

In a major ever international assignment of UNDP programme and invitation from the Ministry of Traditional Industries and Small Enterprise Development of the Government of Sri Lanka in 2011, CSIR-NEIST also provided practical training and demonstration on extraction of fibre and development of value added products from Banana pseudostem to rural masses of Sri Lanka.

Importance of the Technology

- Potential for skill and entrepreneurship development.
- Potential for productive utilization of abundantly available cellulosic waste.

Environmental Considerations: Eco-friendly process

Level/Scale of Development: 1 tone banana fibre per day.

Potential Customers: MSME industries, private enterprises, NGOs, SHGs.

Techno-economics: The project-economics can be worked out as per location and client requirement.

Technology Package: Process know-how, demonstration and technical assistance.

Technology Transfer: The Process for Extraction of Fibres from Banana Pseudo Stem technology has been transferred to 5 parties for commercial production.

1. M/s Ganapathy Fibre Industries, Baruani Bat, Jorhat, Assam
2. M/s Usha Trading Corporation, Quilon, Kerala
3. M/s U.R. Industry, Trichy, Tamilnadu.
4. APSCST, Govt. of Arunachal Pradesh, Itanagar, Arunachal Pradesh
5. M/s JC Lang Enterprises, Imphal, Manipur



Some value added products made from Banana fibre

Process for Making Handmade Paper

Brief Description

Handmade paper and boards have manifold uses in office stationery as file covers, file boards as well as in printing and packaging industries as invitation and visiting cards, lamp-shades, carry bags and a wide range of decorative items.

CSIR-NEIST developed a simple process for making handmade paper and boards from various materials such as natural fibres and waste papers. Apart from the conventional raw materials like rags and waste paper, a few other raw materials like water hyacinth, banana fibres, etc. can also be used depending on the availability in that locality. However, the process parameters will vary for each type of raw material.

Technical Feature

- Utilisation of locally available bio-waste
- Eco-friendly process
- Products obtained are bio-degradable
- No skilled manpower required
- Low capital investment

Technology Validation

CSIR-NEIST successfully transferred the process for making handmade paper from water hyacinth and press cuttings to two companies. The Institute also provided training on handmade paper making to a number of entrepreneurs and unemployed youth from NE region.

Importance of the Technology

According to the Khadi & Village Industries Commission, the handmade paper industry has huge potential to cater to the growing demand of paper products in environmentally sound manner. The last decade witnessed rapid growth in export as a number of Handmade Paper and paper products manufacturing units have become export oriented units and helped in increasing the foreign exchange of the country.



File covers and utility bags made from handmade paper at CSIR-NEIST

Though India is viewed as a potential country with maximum growth in the industry, there has been a phenomenal rise in the export of handmade paper and paper products especially to developed countries like US, Germany etc. over the past few decades. The industry can be vital for economy growth and generation of local entrepreneurs and local employment.

Environmental Considerations: Eco-friendly process

Level/Scale of Development: Pilot plant scale

Potential Customers: MSME industries, private enterprises, NGOs, SHGs.

Techno-economics: The project-economics can be worked out as per location and client requirement.

Approximate project cost for 200 Sheets/Day (size: 1x1 m): Rs.25.00 lakhs.

Technology Package: Process know-how, demonstration and technical assistance.



Some commercial products made from handmade paper

Process for Making Low Dust Chalk Pencil

Brief Description

Chalk pencils are used for writing on blackboard in all the educational institution right from the pre primary school to the university. It is an essential educational aid having substantial demand in the domestic as well as international market. Presently the demand is met through conventional chalk pencils which release dust particles while writing on black board. Moreover, as they are soft and brittle in nature, there is a major problem of breakage during transportation as well as writing on the board.



Low dust chalk pencils

Considering the disadvantages associated with the conventional chalk pencils, CSIR-NEIST undertook a programme under 9th five year plan for development of a superior grade chalk pencil with improved qualities. Low dust chalk pencil as developed by CSIR-NEIST is a small but very popular technology meant for the first generation and established entrepreneurs.

Salient Technical Feature

- Generates low dust
- Less brittle thereby reducing wastage
- Bright marking and more mileage
- Less damage in transportation
- Eco-friendly process
- No sophisticated equipments required
- No skilled manpower required
- Low capital investment



Commercial products based on CSIR-NEIST technology

Technology Validation

CSIR-NEIST has released this technology to more than 30 customers/clients from different parts of the country. Based on the commercial success of the technology and its acceptance by the small entrepreneurs mostly, the technology is best suited for first generation entrepreneurs and industries from the MSME sector. The technology has high market potential and can be adopted easily for commercialization

Importance of the Technology

Chalk pencil is a basic stationery item for writing purpose. The production of chalk pencils in India are mostly from unorganized sector with large number of manufacturing units of small and medium level engaged in the production and export. Over the course of time, improved products like dustless chalk pencils have gained importance because of its added advantage and demand in the market. CSIR-NEIST's low dust chalk pencil has the potential for business and employment opportunities in the country and particularly in the NE region because of its low capital investment and good return.

Patent details: Patented in India (Patent No.185578)

Environmental Considerations: Environment friendly process.

Level/Scale of Development: Cottage scale (15000 chalk pencils/day).

Potential Customers: Stationery industries, MSME and other interested companies/entrepreneurs.

Techno-economics

Plant size: 250 boxes/day (60 chalk pencils/box) and 300 working days/annum.

- Capital (plant and equipment) investment cost: Rs.2.00 lakh (approx).
- Project capital cost will vary depending on site location and plant size. The project-economics can be worked out as per location and client requirement.

Technology Package: Process know-how, demonstration and technical assistance.

Technology Transfer: The Process for Making Low Dust Chalk Pencil technology has been transferred to 31 parties/entrepreneurs for commercial production.

1. M/s Generation Lunchpad, Rukminigaon, Guwahati, Assam
2. M/s Green Foundation, Imphal, Manipur
3. Sri Sanjib Gogoi, Sivasagar, Assam
4. M/s Skylight Screen Tech, Dibrugarh, Assam
5. Shri Abonti Kr. Dutta, Jorhat, Assam
6. Ms Papori Pujari Jorhat, Assam
7. Shri Bhaskar Baishya, Jalukbari, Guwahati, Assam
8. Shri Kulen Kalita, Karbi Anglong, Assam.
9. M/S Vensys Technologies private ltd. Chennai
10. Shri Onenjungshi, Mokokchung, Nagaland
11. Smt Anju Sarmah, Nagaon, Assam
12. Sri Amal Das, C/o Sri Nakul Chandra Das (Ex-MLA), Agartala, Tripura
13. Snehalaya, NGO, Tinsukia (Assam)

Process for Making Coloured Wax Crayons

Brief Description

Coloured wax crayons are popularly used in schools especially by elementary students for drawing or colouring sketch books. The product is also popular amongst artists and drawing enthusiasts. Improved plas-wax crayons can be sharpened with normal pencil sharpener and the markings can be erased with a pencil eraser. CSIR-NEIST has developed a process for manufacturing coloured plas-wax crayons.



Salient Technical Features

- Eco-friendly process
- No sophisticated equipments required
- No highly skilled manpower required
- Low capital investment
- Quick return on investment



*Commercial product based
on CSIR-NEIST technology*

Technology Validation

CSIR-NEIST has licensed this technology to one local party who successfully commercialized. The simple technology is suitable for first generation entrepreneurs and industries from the MSME sector. The product has substantial market demand and can be easily adopted by semi-skilled or unskilled persons.

Importance of the Technology

One of the main reasons for the exponential growth of stationery industry is the rise of the educational sector. The demand for stationery at schools has risen resulting in stationery retailers raking in good profits. Many schools provide stationery to students from their in-house stationery shops. Coloured wax crayons are often used by school students for drawing/art. In recent times, focus has been given on quality and affordable product. CSIR-NEIST's wax crayon technology is cost-effective with less capital intensive and potential for small/medium level industries.

Environmental Considerations: Environment friendly process.

Level/Scale of Development: Cottage scale (3000 crayons/day).

Potential Customers: Stationery industries, MSME and other interested companies/entrepreneurs.

Techno-Economics (Tentative)

Plant size: 250 boxes/day (12 crayons/box) and 300 working days/annum.

- Capital investment (plant & equipment) cost: Rs.3.50 lakhs (approx).
- Project capital cost will vary depending on site location and plant size. The project-economics can be worked out as per location and client requirement.

Technology Package: Process know-how, demonstration and technical assistance.

Technology Transfer: The Process for Making Coloured Wax Crayons technology has been transferred to 1 party for commercial production.

1. Parsha Purbo Bordoloi, C/O Shri Urbi Bordoloi, Tinsukia, Assam

Carbon Quantum Dots (CQDs)

Brief Description

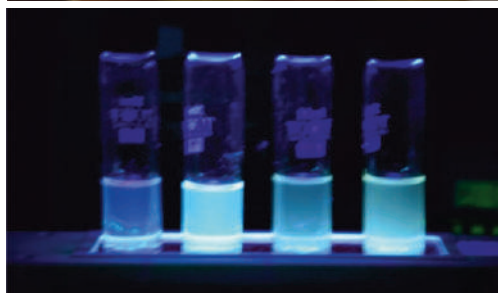
CQDs are technogenic carbon nanoparticles consisting of amorphous or nanocrystalline centers with dominantly graphitic or turbostratic carbon (sp^2 carbon) or graphene sheets. CQDs are being used in diverse fields of applications such as bioimaging, medical diagnosis, biosensing, chemical sensing, photocatalysis, agricultural fields, and photovoltaic devices etc.

A variety of methods exist for the synthesis of CQDs, however, there is constantly a sustainable demand for a “golden standard” to produce effortlessly universal CQDs from low-priced materials for their versatile applications. The earth's abundant coal is found to be superior and inexpensive among the carbon sources available now.

The CSIR-NEIST, Jorhat has found a way to turn common coal into carbon quantum dots (quantum materials), tiny specks of matter with properties expected to prove useful in electronic, optical, and biomedical applications. This technology is a patented technology (US 10,655,061 B2 (May 19, 2020))

Salient Technical Features

- The methodology used for the production of CQDs in this technology is facile, eco-friendly, highly reproducible, and scalable.
- One of the great advantages of this technology is that post-functionalization steps are not required and the technology is a zero-discharge technology as the residue generated could be used as a carbon electrode material for supercapacitor applications.
- The CSIR-NEIST developed technology could produce CQDs from cheap and earth-abundant low-quality coal by using a single-step ultrasonic-wet-chemical process. Although some of the established techniques use high-grade coals and mineral acids to produce CQDs, but the processes or chemical precursors are expensive, and not environmentally friendly as compared to the CSIR-NEIST technology.
- The solvent used in this technology is only water and hydrogen peroxide, which finally decompose into water and oxygen during the reaction.



Carbon Quantum Dots

- The CQDs produced by this technology are highly functionalized, water-soluble, and non-toxic. The method is less time-consuming, the neutralization step is simple, and a large volume of water is not required for neutralization as compared to the other reported methods. The purification steps via dialysis or tangential flow filtration in this technology are simple and less time-consuming. The product is not required to be stored under a pre-conditioned chamber; simply it could be stored in a household refrigerator with greater shelf life. The dialysis procedure and tangential flow filtration procedure are optimized for the purification of CQDs produced in this technology.

Technology Validation

The technology has been developed and third party validated with different experimental trials and toxicity studies for its safety and effectiveness.

Importance of the Technology

Carbon Quantum Dots (CQDs) exhibit unique optical and electronic properties due to their quantum confinement and edge effects and have a variety of novel applications, such as low-toxicity and photostable fluorescence probes for optical-imaging and bio-imaging for high-end biological applications, biosensing, road stickers, road signs, eating, dathing, paints, photographic processing materials, agriculture etc. In addition, it could be used for metal ion sensing, optoelectronics, photocatalysis, and as a nano-fertilizer for plant growth.

Patent details: Patent filed in India (Application No. 201711007354).

Environmental Considerations: Eco-friendly process

Level/Scale of Development: Batch-scale level (650 mL per day)

Potential Customers: Researchers, Membrane manufacturing, Drug, and Pharmaceutical, Fine Chemical Industries, fertilizer industries, etc.

Techno-Economics (Tentative)

- At large scale, the cost of production of CQDs is US \$0.80 per ml compared to the market price of US \$3.00–5.00 per ml of equivalent CQDs.
- Profit to investment ratio is high.

• Plant Capacity	:	650 ml per day
• Cost of Production per ml	:	Rs. 50
• Selling price per ml	:	Rs. 100.00
(2 times of the cost of production)		
- Project capital cost will vary depending on site location and plant size. The project economics can be worked out *as per client requirement*.

Technology Package: Process know-how, demonstration and technical assistance.

CSIR-NEIST Centres for Entrepreneurship Development, Jorhat

SCIENCE & TECHNOLOGICAL INTERVENTION FOR NORTH EAST INDIA (STINER)

CSIR-NEIST STINER has executed a mammoth Technology Demonstration and Incubation hub at the institute in the areas encompassing Textile, Food Technology, Dairy Technology, Poultry Science, Bamboo Technology, Apiculture, Plastics, Pulp and Paper, and Agrotechnology. The institute traditionally emphasized in the broad social responsibility outlook and touched new heights in many areas of CSIR Skill and Entrepreneurship Development Programs such as Promoting Innovations in Individuals, Start-ups and MSMEs (PRISM), Science & Technological Intervention for North East India (STINER), CSIR-NEIST Rural Women Technology Park. The technologies available for Incubation under STINER are- Essential oil extraction plant, Paper Plate Making Machine, Paper Cup making machine, Lamination Machine, Handmade Paper Unit, Egg plate making unit, Egg Hatching Unit/Setter: Two different capacity of egg hatching units with capacity of 30,000 and 5000 have been installed, Super Critical Extractor, Vermicomposting unit, Bio fertilizer Unit (Bioreactor plant), Banana Fibre extraction machine, Plastic produce designing facility, Weaving unit, Machining and welding facility, Milk Processing & Packing Plant, Sealing, Filling and Packaging Facilities and Layer Farm. A State of art Food Testing Laboratory is being established at CSIR-NEIST under the flagship project “Science and Technology Intervention for North Eastern Region (STINER) at CSIR-NEIST. The laboratory is developed by installing of sophisticated equipment to analyses the parameters for Nutritional Labelling and physical parameters. Presently we are providing testing to the farmers, entrepreneurs, NGOs, Industries and Govt. institutions particularly in the North East India. Currently, the parameters like protein, carbohydrate, fat, soluble dietary fibre, insoluble dietary fibre, total dietary fibre, micro nutrients (Fe, Ca, Na, K etc.), moisture, water activity, texture profile analysis (firmness, hardness, chewiness, crispiness etc.) and colour analysis of food products are estimated. Testing of moisture, refractive index, saponification value, unsaponifiable matter, acid value, specific gravity in oil samples is also conducted. Honey testing is one of the new and vibrant scopes to cater the needs of the entrepreneurs and farmers of North Eastern Region of India. A few parameters of honey viz. moisture, specific gravity, acid value and ash content are estimated and the scope will be expanded to other parameters of honey. More than 300 samples have been tested with the facility. Supercritical CO₂ Extraction System is procured under the project for extraction of high end plant products like extraction of high value agar oil, clove oil from clove, capsaicin from green chilli and caffeine from black tea.



STINER Hub for Entrepreneurship



STINER Hub Incubation Centre

Technologies available with CSIR-NEIST for Incubation under STINER

1. **Essential oil extraction plant:** An essential oil extraction plant with a capacity of 500 litre is installed. The unit is useful to extract essential oil from citronella, lemongrass and patchouli. The unit is being using for demonstration and training to aromatic plant growers.
2. **Paper Plate Making Machine:** The unit is installed at STINER facility and presently in operation as trial run. Waste and recycle paper is being used to prepare paper plate currently. Already, process has been initiated for training and incubation of the facility to entrepreneurs.
3. **Paper Cup making machine:** The unit is in operation and now in production. It is now ready for incubation to entrepreneurs and the process of incubation has been initiated.
4. **Lamination Machine:** The technology is in operation and paper plate prepared from waste and recycle paper is being laminated in the unit. The technology is ready for training and incubation.
5. **Handmade Paper Unit:** The handmade paper technology is already installed and in operation.
6. **Egg plate making unit:** The technology is used preparing egg plate/tray from recycle paper waste. Already 1000 egg plate per day have been started as trial.
7. **Egg Hatching Unit/Setter:** Two different capacity of egg hatching units with capacity of 30,000 and 5000 have been installed.

8. **Super Critical Extractor:** For extraction of high value plant extracts like agarwood oil, capsaicin etc. the super critical extractor will be used. The extractor has been installed and optimization of some high value plant extracts is in process.
9. **Vermicomposting unit:** The vermicompost unit is already established and now in operation. Already a few trainings program have been conducted on vermicomposting.
10. **Bio fertilizer Unit (Bioreactor plant):** The plant with bioreactor has been installed. Training programs have been initiated among farmers, entrepreneurs for preparing biofertilizers.
11. **Banana Fibre extraction machine:** The unit is installed and in operation. It is used for demonstration to farmers and entrepreneurs.
12. **Plastic produce designing facility:** The facility is installed and ready for demonstration and incubation.
13. **Weaving unit:** Fifteen Jacquard looms are installed for training and incubation. Women weavers will be trained in scientific methods of design and improved production using the jacquard loom.
14. **Machining and welding facility:** The facility is installed and is ready for operation.
15. **Milk Processing & Packing Plant:** The plant is installed and completed trial run. Now process has been initiated for incubation of the facility to entrepreneurs.
16. **Sealing, Filling and Packaging Facilities:** The facility is installed ready for operation.
17. **Layer Farm:** A modern Layer farm with 4000 eggs/day capacity is in operation.

State of Art Food Testing Laboratory

A State of art Food Testing Laboratory is being established at CSIR-NEIST under the flagship project “Science and Technology Intervention for North Eastern Region (STINER) at CSIR-NEIST. The laboratory is developed by installing of sophisticated equipment to analyses the parameters for Nutritional Labelling and physical parameters. Presently we are providing testing to the farmers, entrepreneurs, NGOs, Industries and Govt. institutions particularly in the North East India. Currently, the parameters like protein, carbohydrate, fat, soluble dietary fibre, insoluble dietary fibre, total dietary fibre, micro nutrients (Fe, Ca, Na, K etc), moisture, water activity, texture profile analysis (firmness, hardness, chewiness, crispiness etc.) and colour analysis of food products are estimated. Testing of moisture, refractive index, saponification value,

unsaponifiable matter, acid value, specific gravity in oil samples is also conducted. Honey testing is one of the new and vibrant scopes for CSIR-North East Institute of Science & Technology to cater the needs of the entrepreneurs and farmers of North Eastern Region of India. Already a few parameters of honey viz. moisture, specific gravity, acid value and ash content are estimated and the scope will be expanded to other parameters of honey. Already more than 300 samples have been tested with the facility.

Supercritical CO₂ Extraction System is procured under the project for extraction of high end plant products like extraction of high value agar oil, clove oil from clove, capsaicin from green chilli and caffeine from black tea.



Fabrication (Machining) Unit



Automatic Paper Cup Machine



Hatcher cum Setter



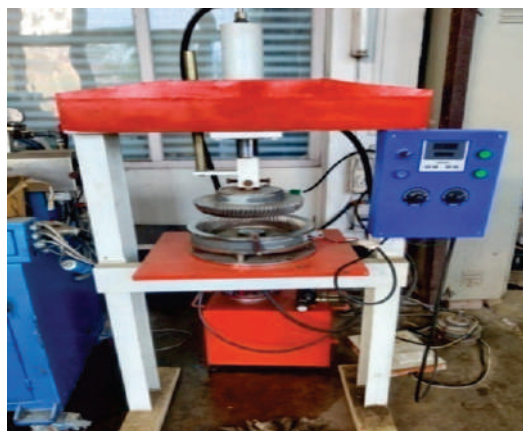
Jacquard Loom



Lamination Machine



Essential Oil Distillation Unit



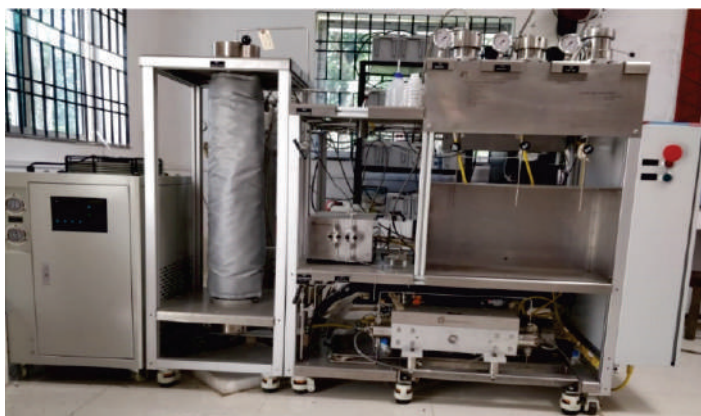
Paper Plate Making Unit



Biofertilizer Unit



Packaging Unit



Supercritical CO₂ Extraction Closed Loop System



Plastic Molding Unit



Egg Plate Production Unit



Layer farm



STINER Hub: Training & Skill Development Centre

REGIONAL-CUM-FACILITATION CENTRE FOR NORTH EASTERN REGION

Regional-cum-Facilitation Centre for North Eastern Region (RCFC-NER) is acting as one stop centre for the growers, cultivators, researchers, traders and other stakeholders of medicinal plants in eight states of NER. The centre is working in close co-ordination with State Medicinal Plants Board (SMPB) of these eight NER states and the state implementing agencies of the medicinal plants component of the AYUSH Mission. In order to promote medicinal plants sector, Government of India has set up National Medicinal Plants Board (NMPB) on 24th November 2000. The board is working under the Ministry of AYUSH (Ayurveda, Yoga and Naturopathy, Unani, Siddha & Homeopathy), Govt. of India.

The primary mandate of NMPB is to develop an appropriate mechanism for coordination between various ministries/ departments/ organizations in India and implement support policies/programs for overall (conservation, cultivation, trade and export) growth of medicinal plants sector both at the Central State and International level. NMPB has established seven Regional-cum-Facilitation Centres (RCFCs); namely RCFC Northern Region-I, RCFC Northern Region-II, RCFC Central Region, RCFC Eastern Region, RCFC Southern Region, RCFC Western Region and RCFC North Eastern Region. Regional-cum-Facilitation Centre for North Eastern Region (RCFC-NER), has been established by National Medicinal Plants Board (NMPB) at CSIR-NEIST. Objectives of RCFC-NER is to co-ordinate activities of NMPB in the region, develop co-ordination with organizations related to medicinal plants sector and thereby, creating an efficient platform for stakeholders of medicinal plants in the region, provide a service window for growers of medicinal plants for supporting conservation, development, marketing, cultivation in the region, provide handholding support to stakeholders in terms of technology dissemination and also for establishing quality planting materials (QPM) primary processing facilities, creation of database on medicinal plants available in the region, carry out research on issues relevant to the area concerned, facilitate development of agro-technology on prioritized, endangered and demandable medicinal crops of the region, documentation and dissemination of success stories on activities supported by NMPB, assists various organizations in preparing project proposals listed under NMPB grants and monitoring of schemes, activities and projects allotted by NMPB to the region as and when assigned by NMPB.



Director, CSIR-NEIST and Dr. Mohan Lal, Coordinator, RCFC-NER addressing the cultivators on Certification of Medicinal Raw Materials & Good Agricultural Practices of MAPs

BIONEST BIO-INCUBATOR

CSIR-BioNest support is another worth mentioning capacity building by the institute to provide analytical services, technology development platform, and mentorship accessibility to prospective young entrepreneurs of NER, particularly in agrotechnology, nutrition, health, and biomedical solutions for commercialization and self-sustainability. This centre will play a leadership role in the economic empowerment of local youths by grooming them in the area of modern science and technology. Under this program, the services which are provided are: infrastructure, technical mentorship, funding support, business mentoring, networking, regulatory advisory, IPR facilitation and capacity building.



Former DG, CSIR Dr. Shekhar C. Mande, Inaugurating BioNEST Facility at CSIR-NEIST



BioNEST incubatee showcasing their work at i-connect 2022 & Assam Biotech Conclave



BioNEST incubate presenting in Assam Biotech Conclave

RURAL WOMEN TECHNOLOGY PARK

CSIR-NEIST Rural Women Technology Park is playing an instrumental role in women's training for economic independence through the dissemination of CSIR-NEIST developed technologies for commercial exploitation. In addition, CSIR-NEIST is reaching remote rural masses with primary CSIR missions such as Aroma Mission and Floriculture Mission for dissemination of institute-developed quality planting materials, training and awareness for generating economic benefit from farming of medicinal and floriculture cash crops. CSIR-NEIST is also a frontrunner in indigenous development, technology transfer, and promotion of commercially successful advanced biofertilizer for improving agricultural productivity with environmentally-safer farming practices in both draught and flood affected conditions.



Dr Ramasami inaugurated 'Rural Women Technology Park' on 10 May 2019 at CSIR-NEIST with the support of DST, Govt. of India wherein technologies suitable for rural women entrepreneurs will be disseminated for providing livelihood and source of income in presence of Dr G Narahari Sastry, Director, CSIR-NEIST and other staff members.

QUALITY CONTROL & ASSURANCE LABORATORIES, CSIR-NEIST

A NABL accredited laboratory "Quality Control & Assurance Laboratories (TC-10099; Lab ID: T-6648, Certificate No. 10099)" as per ISO/IEC 17025:2017 was established at CSIR-NEIST, Jorhat for Coal Testing, and the Laboratory was accredited on 30.11.2021 and Inaugurated on 04.01.2022 by Padmashri Dr. Harsh K Gupta, President of Geological Society of India in presence of Dr. G Narahari Sastry, Director CSIR-NEIST, Jorhat.

National Accreditation Board for Testing and Calibration Laboratories (NABL) is a constituent board of Quality Council of India under Department for Promotion of Industry and Internal Trade (DPIIT), Ministry of Commerce and Industry, Government of India. NABL provides accreditation in all major fields of Science and Engineering including medical science.

CSIR-NEIST Jorhat received NABL accreditation in 2021 as the Quality Control and Assurance Laboratories (QCAL) (with lab ID T-6648) for testing including major test parameters like Proximate analysis, Moisture (M), Ash, Volatile Matter (VM), Fixed Carbon (FC), Ultimate Analysis, Carbon (C), Hydrogen (H), Total Sulfur (TS), Gross Calorific Value (GCV). Other testing parameters like food testing are in process for inclusion in its next assessment. The potential customers of this coal testing laboratory includes power as well as non-power sectors of the region and country e.g., NTPC, GSI, DGM, QCI, Adani power, and tea garden industries of the region.

Certificate of NABL accreditation

Quality Manager:

Dr. Binoy K Saikia, HoD & Pr. Scientist

Technical Manager:

Dr. Tonkeswar Das, Scientist

Present sample analysis capacity:

1000 samples/month

Facilities are extending to analysis of 3000 samples/month



Certificate of NABL accreditation



Inauguration by Padmashri Dr. Harsh K Gupta, President of Geological Society of India.



Quality Control & Assurance Laboratory for coal testing

CSIR-NEIST Experimental Animal House Facility

CSIR-NEIST is actively engaged in experimental biological and pharmacological R&D activities and as a support it hosts a modern laboratory animal experimental facility of 6000 square feet size. This facility was initiated on August 2018 with CPCSEA, Govt. of India approval number 2028/GO/ReBi/S/18/CPCSEA and actively started providing laboratory animal experimentations services from 2021 for in house, extramural R&D projects and CSIR Missions.

This scientifically designed structure with separation of clean and service areas have controlled



*Ingruation of Experimental Animal House
By Dr G Narahari Sastry, Director, CSIR-NEIST*

environmental conditions suitable for housing laboratory rodent and non-rodent species. The facility is well segregated into animal quarantine rooms, animal housing rooms, animal experimentation rooms, animal feed and other stock storage room, cage washing area, health monitoring and analytical laboratory etc. The facility is managed by specialized trained veterinarians as per the latest ethical and biosafety regulatory guidelines for laboratory animal experimental research.



Experimental House at CSIR-NEIST

This facility is fully equipped with animal housing systems for both rodent and non-rodent species. It is complemented with all necessary haematology, biochemistry and pathology laboratories for experimental animal sample processing and analysis. This facility is serving a major backbone of Institutional mandated projects on herbal formulation development, bioprospection of natural products, microbiology, regulatory safety, acute and chronic toxicology, pharmacological, pharmaceuticals studies. This facility houses several breeds of laboratory mice and rat, including Swiss Albino, Balb/C, C57/BL6, Sprague Dawely, Wister etc. This animal facility is also supported by institutional bio-incineration facility as per the stipulated biomedical waste policy. In addition to safe disposal, the R&D activities are monitored by Institutional Biosafety Committee. All animal experimentations are conducted with prior approval and as per the laid out best animal ethics principles monitored by Institutional Animal Ethics Committee.



High-End Instrument Facilities available at CSIR-NEIST, Jorhat

Sl.No	Instrument Name	Sl.No	Instrument Name
1.	X- ray Photoelectron Spectrometer (XPS)	23.	Electro Kinetic Analyzer
2.	Nuclear Magnetic Resonance Spectrometer (500 MHz)	24.	Hollow Fibre Membrane Making Machine
3.	Nuclear Magnetic Resonance Spectrometer (400 MHz)	25.	Trace DSQ Gas Chromatography Mass Spectrometry (GCMS)
4.	Fluorescence Spectrophotometer	26.	GC-Flame Ionization Detection (FID)
5.	High Resolution Mass Spectrometer (HRMS)	27.	Spray Drier
6.	High-resolution transmission electron microscopy (HRTEM)	28.	Automatic Colour Measurement System
7.	Isotope Ratio Mass Spectrometry (IRMS)	29.	Climate controlled greenhouse facility
8.	ICP-MS Mass Spectrometer	30.	Nano-Spectrophotometer
9.	Raman Spectrometer	31.	Automatic N ₂ /Protein estimation system
10.	Confocal Laser Scanning Microscopy (CLSM)	32.	CO ₂ supercritical extractor
11.	Atomic force microscopy (AFM)	33.	High Performance Liquid Chromatography (HPLC)
12.	Field Emission Scanning Electron Microscopy (FESEM)	34.	Biosafety Cabinet
13.	Fluorescence Activated Cell Sorter (FACS) & Flow Cytometry	35.	Solvent Extraction Plant
14.	Carbon - sulphur analyzer for solid sample	36.	Automatic Fat Extraction System
15.	Powder X-Ray Diffractometer	37.	Phase Contrast Microscope
16.	Atomic Absorption Spectrometer	38.	CO ₂ Incubator
17.	BET Chemisorption and Physisorption analyzer	39.	Micro reaction calorimeter
18.	Pore size analyzer	40.	Contact Angle Analyzer
19.	CCD Based Single Crystal X-ray Diffractometer	41.	Flatsheet Membrane Making Machine
20.	Fluorescent microscope	42.	Capillary Condensation Flow Porometer
21.	Olympus Stereo Zoom Microscope	43.	Multimode ELISA reader and plate washer
22.	Next Generation genomic facility (NGGF): Oxford Nanopore sequencing, Sanger sequencing	44.	Fourier Transform Infrared Spectrophotometer (FTIR)

Major Instrument Facilities at CSIR-NEIST, Jorhat

Liquid Chromatography Mass Spectrometry (LCMS)



Parameters	Details
Equipment Name	LCMS
In Charge Name	Dr. H.S.Dutta
Equipment Code	CSIR-NEIST-1048
Current Status	Active
Make	Agilent
Model No	LCMS/TQ6470
P.O Number	1(PEQ)/20/19-20/PUR/292(20-21)
Cost	1,48,56,045.00
Installed Date	20.04.2021
Installed Location	Experimental Animal House
Internal Sample	255
External Sample	0
Total Sample	255
Total ECF Generated	0
Warranty period	5 Years
AMC	NO
Log Book Status	Up to date
Service History	NO
Remarks	In Operating Condition

Chromatography Mass Spectrometry (GCMS)



Parameters	Details
Equipment Name	GCMS
In Charge Name	Dr. Saikat Haldar
Equipment Code	CSIR-NEIST-1048
Current Status	Active
Make	Agilent
Model No	7010B GCTQ
P.O Number	1(PEQ)/19/19-20/PUR/914(19-20) Date: 23/03/2020
Cost	92,89,400.00
Installed Date	15/01/2021
Installed Location	Experimental Animal House
Internal Sample	2608
External Sample	-
Total Sample	2608
Total ECF Generated	35000.00
Warranty period	5 Years
AMC	NO
Log Book Status	Up to date
Service History	NO
Remarks	In Operating Condition

High Resolution Mass Spectrometry (HRMS)



Parameters	Details
Equipment Name	HRMS
In Charge Name	Dr. P.Pahari and Dr. P.Gogoi
Equipment Code	CSIR-NEIST-
Current Status	Active
Make	Waters
Model No	XRVOG2-XS QT
P.O Number	1(PEQ)/13/15-16/PUR/F-25 Date : 31/12/2015
Cost	2,36,00,000.00
Installed Date	26/05/2016
Installed Location	SAIF, Bhatnagar Building
Internal Sample	11814
External Sample	98
Total Sample	11912
Total ECF Generated	1,15,640.00
Warranty period	Over
AMC	15/11/2026
Log Book Status	Up to date
Service History	NO
Remarks	In Operating Condition

X-Ray Photoelectron Spectroscopy (XPS)



Parameters	Details
Equipment Name	XPS
In Charge Name	Dr.Manas.R Das
Equipment Code	CSIR-NEIST-1056
Current Status	Active
Make	Thermo-Fisher Scientific Pvt. Ltd.
Model No	ESCALAB Xi+
P.O Number	1(PEQ)/11/16-17/PUR/F-22
	Date : 23/03/2017
Cost	6,19,38,000.00
Installed Date	22/12/2017
Installed Location	SAIF, Bhatnagar Building
Internal Sample	2501
External Sample	1935
Total Sample	4436
Total ECF Generated	62,48,044.00
Warranty period	22-12-2022
AMC	NO
Log Book Status	Up to date
Service History	NO
Remarks	In Operating Condition

Field Emission Scanning Electron Microscopy (FESEM)



Parameters	Details
Equipment Name	FESEM
In Charge Name	Dr. Lakshi Saikia and Dr. J.Jarugala
Equipment Code	CSIR-NEIST-1008
Current Status	Active
Make	Carl Zeiss Microscopy
Model No	SIGMA
P.O Number	1(PEQ)/22/13-14/PUR/F-29/ Date: 26/11/2014
Cost	2,17,00,000.00
Installed Date	19/10/2015
Installed Location	SAIF, Bhatnagar Building
Internal Sample	-
External Sample	-
Total Sample	6100
Total ECF Generated	8,78,000.00
Warranty period	Over
AMC	Applying for AMC
Log Book Status	Up to Date
Service History	12/07/2022
Remarks	In Working Condition

High Resolution Transmission Electron Microscopy (HRTEM)



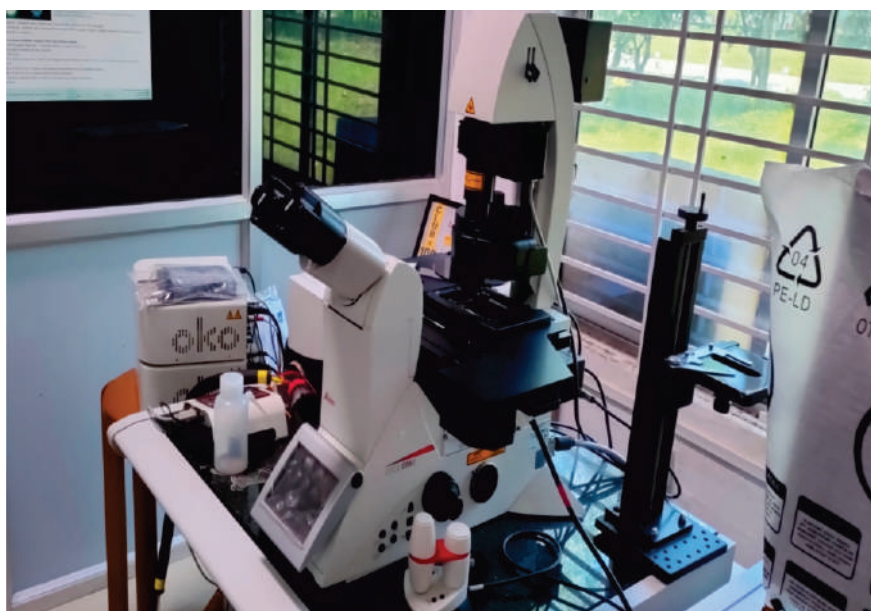
Parameters	Details
Equipment Name	HRTEM
In Charge Name	Dr. Lakshi Saikia and Dr. P.G.Ingole
Equipment Code	CSIR-NEIST-1010
Current Status	Active
Make	JEOL
Model No	JEM2100 Plus
P.O Number	1(PEQ)/17/15-16/PUR/F-4 Date: 17/03/2016
Cost	4,03,00,000.00
Installed Date	09/08/2017
Installed Location	SAIF, Bhatnagar Building
Internal Sample	-
External Sample	-
Total Sample	1557
Total ECF Generated	9,50,000.00
Warranty period	Till May 2023
AMC	Applying for AMC
Log Book Status	Up to Date
Service History	April 2022
Remarks	In Working Condition

Raman Spectrometer (RAMAN)



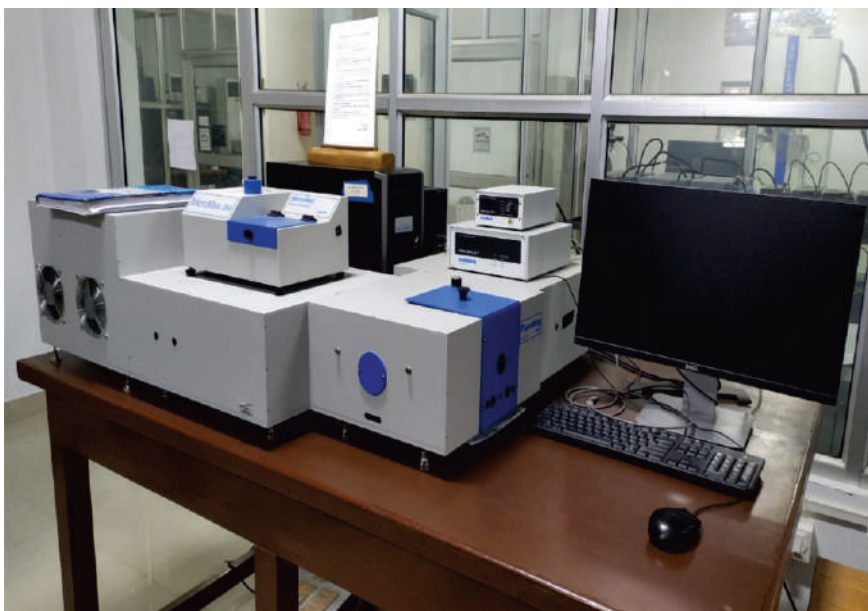
Parameters	Details
Equipment Name	RAMAN
In Charge Name	Dr. M.R.Das
Equipment Code	CSIR-NEIST-1122
Current Status	Active
Make	Thermo fisher Scientific, USA
Model No	DXR2 smartRaman
P.O Number	1(PEQ)/05/17-18/PUR/F-16 Date : 31.03.2018
Cost	41,50,000.00
Installed Date	07.03.2019
Installed Location	SAIF, Bhatnagar Building
Internal Sample	278
External Sample	-
Total Sample	278
Total ECF Generated	-
Warranty period	Up to March 2022
AMC	On Process
Log Book Status	Up to date
Service History	-
Remarks	In Working Condition

Laser Scanning Confocal Microscope (LSCM)



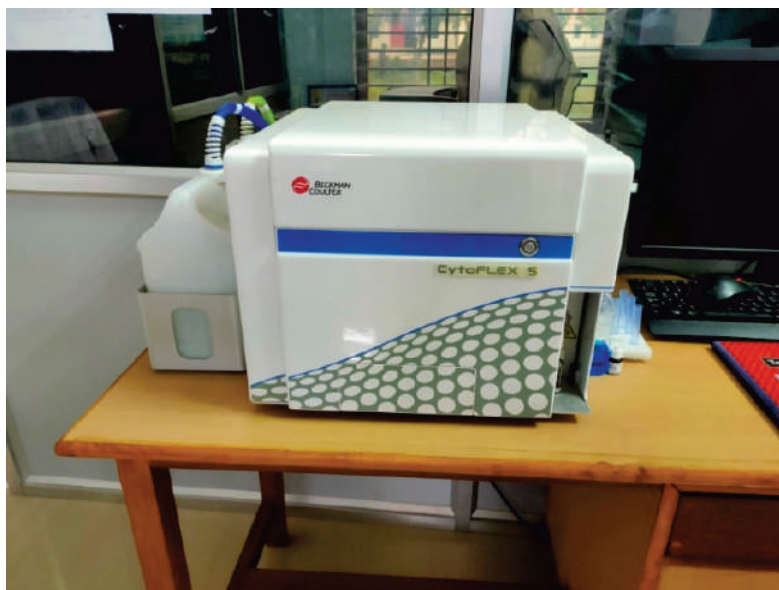
Parameters	Details
Equipment Name	LSCM
In Charge Name	Dr. Channa K Chikkaputiah
Equipment Code	CSIR-NEIST-1045
Current Status	Active
Make	Leica Microsystems, Germany
Model No	Leica TCS-SP8
P.O Number	1(PEQ)/13/16-17/PUR/F-21 Date : 23.03.2017
Cost	1,75,00,000.00
Installed Date	24.09.2017
Installed Location	SAIF, Bhatnagar Building
Internal Sample	1000+
External Sample	25
Total Sample	1025
Total ECF Generated	50,000.00
Warranty period	5 Years
AMC	-
Log Book Status	Up to Date
Service History	-
Remarks	In Working Condition

Fluorescence Spectrometer (FS)



Parameters	Details
Equipment Name	Fluorescence Spectrometer
In Charge Name	Dr. HS Dutta and Dr. Anil Singh
Equipment Code	CSIR-NEIST-1013
Current Status	Active
Make	Horiba
Model No	Fluorolog-3
P.O Number	1(PEQ)/25/15-16/PUR/F-42 Dt 22.03.2016
Cost	80,52,500.00
Installed Date	14.09.2016
Installed Location	SAIF, Bhatnagar Building
Internal Sample	2458
External Sample	28
Total Sample	2486
Total ECF Generated	19,647.00
Warranty period	Over
AMC	26/10/2021 to 25/10/2026
Log Book Status	Up to Date
Service History	-
Remarks	In Working Condition

Fluorescence Activated Cell Sorter



Parameters	Details
Equipment Name	Fluorescence Activated Cell Sorter
In Charge Name	Dr. Channa K Chikkaputiah
Equipment Code	CSIR-NEIST-1026
Current Status	Active
Make	Beckman Coulter, USA
Model No	MoFlo XDP; CytoFlex S
P.O Number	1(PAQ)/12/16-17/PUR/F-25 Dt 31.03.2017
Cost	1,88,00,000.00
Installed Date	04.01.2018
Installed Location	SAIF, Bhatnagar Building
Internal Sample	1000+
External Sample	20
Total Sample	1020
Total ECF Generated	40,000.00
Warranty period	5 Years
AMC	-
Log Book Status	Up to Date
Service History	-
Remarks	In Working Condition

Atomic Force Microscopy (AFM)



Parameters	Details
Equipment Name	Atomic Force Microscopy
In Charge Name	Dr. Swapnali Hazarika and Dr. Binay K. Saikia
Equipment Code	CSIR-NEIST-1011
Current Status	Active
Make	Nanomagnetics
Model No	HpAFM
P.O Number	1(PEQ)/12/15-16/PUR/F-36 Date : 07.03.2016
Cost	1.02 Crore
Installed Date	13/01/2017
Installed Location	SAIF, Bhatnagar Building
Internal Sample	85
External Sample	-
Total Sample	85
Total ECF Generated	-
Warranty period	13/01/2020
AMC	NO
Log Book Status	-
Service History	-
Remarks	Not in Working Condition

MW Assisted Automatic Peptide Synthesized



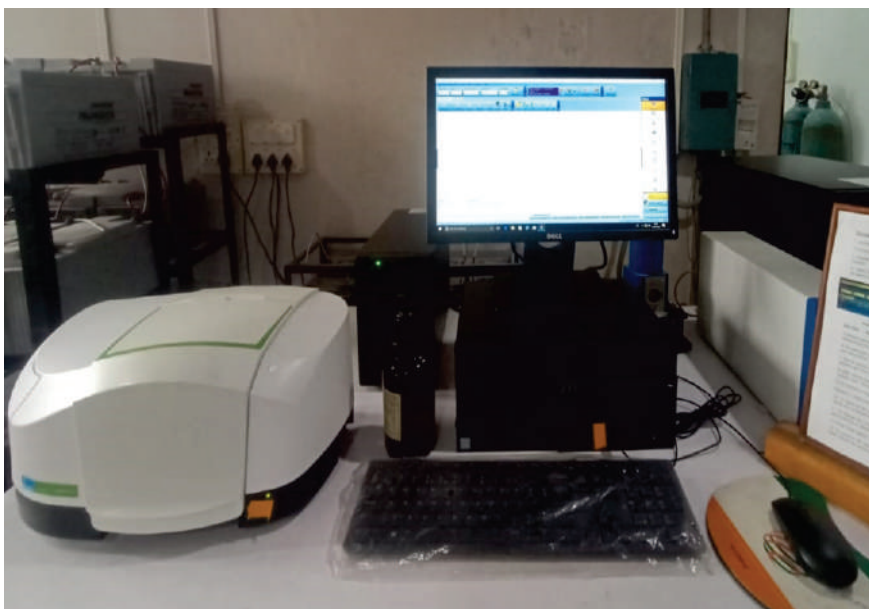
Parameters	Details
Equipment Name	MW Assisted Automatic Peptide Synthesizer
In Charge Name	Dr. Arup Roy
Equipment Code	CSIR-NEIST-1123
Current Status	Active
Make	CEM, USA
Model No	Liberty Blue
P.O Number	1(PEQ)/02/18-19/PUR/F-08 Date : 06/03/2019
Cost	1,04,00,000.00
Installed Date	09.09.2019
Installed Location	CSTD
Internal Sample	81
External Sample	0
Total Sample	81
Total ECF Generated	Nil
Warranty period	5 years
AMC	AMC terms agreed upon for the next 5 years after warranty
Log Book Status	Up to Date
Service History	Under Warranty, Up to date
Remarks	In Working Condition, Not an analytical Instruments

Atomic Absorption Spectrometer



Parameters	Details
Equipment Name	Atomic Absorption Spectrometer
In Charge Name	Dr. Ankana Phukan
Equipment Code	CSIR-NEIST-1065
Current Status	Active
Make	Analytik Jena
Model No	Zeemitt 700P
P.O Number	1(PEQ)/08/19-20/PUR/F-07 Date : 06/03/2019
Cost	1,60,52,400.00
Installed Date	21/02/2022
Installed Location	Analytical Chemistry (Admin)
Internal Sample	563
External Sample	500
Total Sample	1063
Total ECF Generated	4,21,496.00
Warranty period	Upto 2026
AMC	NA
Log Book Status	Up to Date
Service History	-
Remarks	In Working Condition

Fourier Transform Infrared Spectrometer



Parameters	Details
Equipment Name	FTIR
In Charge Name	Dr. Ankana Phukan
Equipment Code	CSIR-NEIST-1020
Current Status	Active
Make	Perkin Elmer
Model No	Spectrum-2
P.O Number	1(PEQ)/11/18-19/PUR/F-13 Date : 22/03/2018
Cost	22,50,000.00
Installed Date	20/08/2019
Installed Location	Analytical Chemistry (Admin)
Internal Sample	7461
External Sample	40
Total Sample	7501
Total ECF Generated	37,760.00
Warranty period	Under Warranty
AMC	NA
Log Book Status	Up to Date
Service History	-
Remarks	In Working Condition

500MHz Nuclear Magnetic Resonance Spectrometer



Parameters	Details
Equipment Name	500MHz NMR
In Charge Name	Dr. Prakash J. Saikia
Equipment Code	CSIR-NEIST-1012
Current Status	Working
Make	BRUKER
Model No	AV500 ADVANCE III
P.O Number	1(PEQ)/445/11-12/PUR/F-44 Date : 21/03/2012
Cost	Rs: 2,82,97,849.00, (Euro3,42,285.00)
Installed Date	27/08/2013
Installed Location	Analytical Chemistry (Admin)
Internal Sample	40591
External Sample	21
Total Sample	40612
Total ECF Generated	32,878.00
Warranty period	Over
AMC	NA
Log Book Status	Up to Date
Service History	07/05/2022
Remarks	In Working Condition

400MHz Nuclear Magnetic Resonance Spectrometer



Parameters	Details
Equipment Name	400MHz NMR
In Charge Name	Dr. Prakash J. Saikia
Equipment Code	CSIR-NEIST-1120
Current Status	Working
Make	JEOL
Model No	JEOL Resonance ECZ400R
P.O Number	1(PEQ)/03/17-18/PUR/F-14 Date : 26/03/2018
Cost	Rs: 3.41,37717.00 (USD 4,53,000.00)
Installed Date	20/08/2019
Installed Location	Analytical Chemistry (Admin)
Internal Sample	10,177
External Sample	100
Total Sample	10277
Total ECF Generated	1,76,610.00
Warranty period	Under Warranty
AMC	NA
Log Book Status	Up to Date
Service History	13/07/2020
Remarks	In Working Condition

BET Surface Analyzer



Parameters	Details
Equipment Name	BET Surface Analyzer
In Charge Name	Dr. Swapnali Hazarika
Equipment Code	CSIR-NEIST-
Current Status	Working
Make	Quantachrome, USA
Model No	195336 & 192977
P.O Number	1(PEQ)/23/18-19/PUR/1458 Date : 26/03/2018
Cost	71,25,023.00
Installed Date	11/02/2020
Installed Location	Experimental Animal House
Internal Sample	567
External Sample	23
Total Sample	590
Total ECF Generated	1,62,840.00
Warranty period	11/02/2023
AMC	NA
Log Book Status	Up to Date
Service History	-
Remarks	In Working Condition

GEL Permeation Chromatography



Parameters	Details
Equipment Name	GEL Permeation Chromatography
In Charge Name	Dr. Ajit Singh
Equipment Code	CSIR-NEIST-1035
Current Status	Working
Make	Agilent
Model No	Infinity-1260
P.O Number	1(PEQ)/04/18-19/PUR/1256(18-19)
Cost	39,01,610.00
Installed Date	01/08/2019
Installed Location	Experimental Animal House
Internal Sample	175
External Sample	-
Total Sample	175
Total ECF Generated	Nil
Warranty period	5 Years
AMC	NO
Log Book Status	Up to date
Service History	NO
Remarks	In Operating Condition

Testing and Analytical Services of CSIR-NEIST, Jorhat

Sl.No	Sample	Description of Job
1	Engineering Materials	Tensile Test (Ultimate Tensile Strength, Yield Strength and Elongation)
2		Bend Test
3		Hardness Test (conducted in 3 scales/types viz., Rockwell, Brinell & Vickers)
4		Unit weight
5	Water	Total count (bacterial)
6		Bacteriological Analysis (Total count, Coliform & <i>E.coli</i>)
7		Yeast & Mold count
8		SRB Count
9		pH, Total Solids, Turbidity, Alkalinity, Hardness, Calcium, Magnesium, Sulphate, Chloride & Iron
10		pH, Total Solids, Turbidity, Alkalinity, Hardness, Calcium, Magnesium, Sulphate, Chloride, Iron, Sodium, Potassium, Manganese and Zinc
11		Iron only
12		Silt
13		pH/Conductivity- each
14	Other samples	Yeast & Mold Count
15		Total Count (bacterial)
16	Soil	Atterberg's Limit
17		Natural moisture content
18		Grain size analysis: sieve
19		Grain size analysis: Hydrometer
20		Dry and Bulk Density
21		Specific Gravity and Void Ratio
22		Unconfined Compression Test

23		Triaxial Test (Undrained unconsolidated)
24		Permeability Test (Laboratory)
25		Vane Shear Test
26		Consolidation Test
27		Free Swelling Index Test
28		Field Protor Density and CBR values
29		Laboratory CBR Tests as specified soaked condition
30		Swelling Pressure Test
31		Shrinkage Limit Test
32		Clay and Gravel Content
33		pH/Conductivity- each
34		Organic Matter
35		SRB Count
36		Total Count (bacterial)
37	Food	SRB Count
38		Salmonella, Streptococcus, <i>Vibrio cholerea</i> Count
39	Macro Nutrients in Cereals, Vegetables, Fruits, Process Food Feed etc	Protein
		Fats
		Dietary Fibre
		Carbohydrate
40	Macro Nutrients in Cereals, Vegetables, Fruits, Process Food Feed etc	N, K, Ca, Fe, Mn, Zn etc
41	Alcoholic Beverages	Alcohol Percentage
42	Solid, Liquid and Paste products	Colour (a, L, b)
43	Fruits,	Texture Analysis (Hardness, Softness)

	Vegetables, Bakery products	
44	Honey	Moisture
		Refractive Index
		Specific Gravity
		Total Ash
45	Edible Oils	Moisture
		Refractive Index
		Free Fatty Acid (FFA)
		Saponification Value
		Unsaponifiable Matter
		Iodine Value
		Peroxide Value
46	Tea	Moisture, ash, alkalinity of ash and ash insoluble in acid
47	Mustard oil	Composition
48	Fertilizers	Sulphate of Ammonia for Nitrogen only
49		Urea for Nitrogen only
50		Super-Phosphate for P_2O_5
51		Muriate of Potash for K_2O
52		Mixed Fertilizer for NPK
53		P_2O_5 and K_2O
54		Zinc Sulphate
55		Organic Matter
56		Each Additional Element
57		Phosphate only
58	Natural products	Analysis of Natural products (Major active ingredients- each)

59	Soil from Brick	Clay, Silt and Sand Content
60	Field	Atterberg's Limit
61		Green Brick Mix composition (can be done only when Sl.Nos. 52 & 53 are also done)
62		Drying Shrinkage
63		Evaluation by Preparing Test Brick sample
64	Fine & Coarse	Aggregate Impact Value (soft)
65	Aggregate	Aggregate Impact Value (coarse)
66		Aggregate Crushing Value
67		Mech. Sieve Analysis (sand)
68		Sieve Analysis (combined)
69		Sieve Analysis (stone)
70		Sieve Analysis (single size)
71		Specific Gravity
72		Unit Weight/Bulk Density of sand/stone
73		Determination of Material Finer than 75 Micron for Aggregate
74		Elongation Index
75		Water Absorption Capacity
76		Deleterious Material
77		Soundness Test
78		Alkali Aggregate Reactivity Test (Mortar Bar Method in 11 aging period in one year)
79		Alkali Aggregate Reactivity Test (Chemical Method)
80		Organic Impurities
81		Bulk Density
82		Particle Size Analysis by Andersson Pipette
83		Particle Size Analysis by Laser Diffraction Particle Size Analyzer
84		Mineralogical analysis for sand & detrital samples
85	Brick & Hollow	Compressive/Crushing Strength
86	Bricks	Water Absorption Capacity

87		Visual Observation and Dimension
88		Efflorescence
89	Cement & Concrete	Setting Time
90		Compressive Strength 3, 7 and 28 days
91		Fineness by Specific Surface Area method
92		Soundness by Le-Chatellier Expansion
93		Compressive Strength of Concrete cubes
94		Porosity
95		Bulk Density
96		Specific Gravity
97		Chemical Analysis of Cement for the constituents- LOI, SiO ₂ , Al ₂ O ₃ , Fe ₂ O ₃ , CaO, MgO
98		Chemical Analysis of Cement for each Additional Components like IR, SO ₃ , Na ₂ O, K ₂ O, Chloride, etc.
99	Concrete admixture	Lignosulphates, carboxylic acids, etc.
100	Clay, Ash, Minerals like	Chemical Analysis for the constituents- LOI, SiO ₂ , Al ₂ O ₃ , Fe ₂ O ₃ , CaO, MgO
101	Limestone,	Each Additional Components like IR, SO ₃ , Na ₂ O, K ₂ O, Chloride, etc.
102	Dolomite, Rock,	Phosphate
103	Metallic minerals,	Petrographic analysis of rock sample (Thin section under transmitted light)
104	Refractory Materials and Iron Ore	Optical Microscopy under reflected light of ores and metallic minerals
105	Timber	Water Absorption

106	Crude oil	API Gravity
107		Pour Point
108		Viscosity
109		Asphaltene Content
110		Asphaltene+Resin Content
111		Wax Content
112		Water Content
113		Distillation Characteristics
114	Petroleum Products	Total Acidity
115		Ash Content
116		Carbon Residue
117		Pour Point
118		Copper Strip Corrosion
119		Distillation Characteristics
120		Flash Point
121		Kinematic Viscosity
122		Density
123		Water Content
124		Water Content by Karl Fisher Titration
125		Interfacial Tension
126		Specific Resistance
127	Bitumen	Absolute Viscosity
128		Kinematic Viscosity
129		Flash Point
130		Solubility in Trichloroethylene
131		Penetration
132		Softening Point
133		Test on RTFOT- Viscosity Ratio
134		Test on RTFOT- Ductility after TFOT

135	Oil Field	Baryte
136		Sodium Formate
137		Bentonite Clay
138	Coal	Moisture (Oven drying)
139		Moisture at 60% RH & 40°C
140		Free Moisture
141		Ash & Volatile Matter
142		Full Proximate Analysis
143		Volatile Matter
144		Gross Calorific Value
145		Carbon & Hydrogen
146		Total Sulphur
147		Nitrogen
148		Caking Index
149		Swelling Index
150		LTC (GK) Coke Type
151		LTC (GK) Assay
152		Distribution of Sulphur
153		Handgrove Grindability Index
154		Ash analysis of coal/coke (major oxides)
155		Bulk handling of coal/coke (upto1000 kg) for Sub-sampling
156		Logging of boreholes coal core sample per metre or part
157		Hardness and Total Dissolve Solid
158		Ash Fusion Temperature Range
159		Sieve analysis (combined)
160		Ignition Temp. Test by TGA method (Thermogravimetric Analysis Method)
161		Carbonate as CO ₂ (estimated)
162*		Particulate matter (PM _{2.5} , PM ₁₀ & SPM) in ambient air
163*		Particulate matter (PM _{2.5} , PM ₁₀) in stack samples

164*		Fuel Gas analysis (CO, CO ₂ , SO ₂ , H ₂ S, NO _x , C _x H _y , O ₂)
165*		Selective Cation & Anion Analysis in Aerosols, Soil and Liquid samples (per ion)
166*		Testing of coal (caking, non-caking, blends) in Non-recovery Pilot Coke Ovens (750 kg/batch)
167*		Management of Acid Mine Drainage of NER coal in Pilot Scale
168	Paper, Paper Board & Pulp Testing	Grammage
169		Tensile Index
170		Bursting Index
171		Tear Index
172		Double fold
173		Brightness
174		Cobb sizing
175		Moisture
176		Wax pick
177		Opacity
178		pH
179		Ash content
180		Fibre length
181		Thickness
182		Mechanical pulp
183		Quality of paper
184	Wood, Board, Bamboo, Twines, Ropes sample, Particle Board & Ply Board etc.	Tensile strength
185		MOR/Flexural Strength
186		Density
187		Moisture content
188		Thickness of rope/twine
189		Constituents of rope/twine

190	Solid samples & highly scattering samples	UV visible Spectrophotometer
191	Samples for	Diffraction
192	Powder X-Ray	XRD + Single Phase Identification
193	Analysis	Additional Phase
194	Samples for Single Crystal X-Ray Diffraction	Single Crystal X-Ray Diffraction
195	Samples for	BET Surface Area
196	Surface Area	BET Surface Area and Complete Isotherm
197	Analysis	Pore Size and Pore Volume Determination
198	Samples for	Differential Scanning Calorimetry- Ambient temperature to 550°C
199	Differential	Thermal Analysis upto 1200°C (Thermogram only)
200	Analysis	Thermal Analysis above 1200°C (Additional charges Rs.200.00 if the required atmosphere is other than air)
201		Thermogram with Interpretation
202		Kinetic Study
203	Samples for	CHN Analysis
204	other	LC-MS
205	Instrumental	MS only
206	Analysis	GC (Basic Analysis)
207		GC-MS
208		AAS- each element
209		HPLC
210		Single Zeta Value Measurement

211		Zeta Potential Vs P^H /additive dose (determination of isoelectric point)
212		IR (FT-IR)
213		UV-VIS Spectra
214		NMR (60 MHz, 300 MHz and 500 MHz)
215		Gel Permeation Chromatography- in tetrahydrofuran
216	Earthquake data	Earthquake report (seismic parameters) for North East region & adjoining region
217		Earthquake report (seismic parameters) for North East region & adjoining region
218	Weather data	Monthly Weather Bulletin

**SI Nos.162 to 167 will be done under Consultancy mode.*

Details regarding testing/analysis fee is available on our website, www.neist.res.in.

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CSIR-NEIST BRANCH LABORATORIES



CSIR-NEIST Itanagar Branch, Arunachal Pradesh

Council of Scientific & Industrial Research-North East Institute of Science & Technology (formerly RRL) Jorhat, established a Branch Laboratory in Itanagar (BLIT), Arunachal Pradesh, which was inaugurated in 1981 with the vision of Socio-Economic and Human Resources Development utilizing local resources of Arunachal Pradesh through scientific interventions. The objectives of the institute are:

- To assess the scope of R&D activities for societal sustainable development
- To undertake sponsored and consultancy work
- To establish linkage with academic institution
- To organize motivation and orientation programs to develop S&T consciousness in students and entrepreneurs amongst local population
- To offer technical service and advice as and when called upon



CSIR-NEIST Imphal Branch, Manipur

The then CSIR- RRL Substation Imphal was established in Manipur in 1973 as a Field station with the main objective of R & D on oil yielding plants. The Field Station has been upgraded in 2012 as Branch Laboratory with expanded scope by establishing Skilled Development Training Centre for fabrication of novel products based on local fabrics, leather & natural fibre. The Branch Lab is actively working on Bio-prospection, propagation, cultivation and conservation of economically important plants more importantly on medicinal, aromatic, spices plants & other economic crops. The Branch Laboratory is also now working on vermicomposting and mushroom cultivation techniques under societal programs. Studies on river and other ecological aspects are also undergoing.



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