

TECHNOLOGY FOCUS

टैक्नोलॉजी फोकस



VOL 27 ISSUE 5 OCTOBER 2019
ISSN No. 0971-4413

Protection Technologies for Soldiers





Technology Focus focuses on the technological developments in the organisation covering the products, processes and technologies.

Vol. 27 Issue 5

October 2019

Editor-in-Chief

Dr Alka Suri

Associate Editor-in-Chief

B. Nityanand

Managing Editor

Manoj Kumar

Editor

Dipti Arora

Designing

Raj Kumar

Printing

S.K. Gupta

Distribution

Tapesh Sinha, R.P. Singh

Local Correspondents

Agra:	Shri S.M. Jain, ADRDE		Smt Anjana Sharma, ISSA
Ahmednagar:	Shri S Muthukrishnan, VRDE		Dr D.P. Ghai, LASTEC
Ambarnath:	Dr Susan Titus, NMRL		Ms Noopur Shrotriya, SAG
Bengaluru:	Shri Subbukutti S., ADE		Dr Mamta Khaneja, SSPL
	Smt M.R. Bhuvanewari, CABS	Gwalior:	Shri R.K. Srivastava, DRDE
	Smt Faheema A.G.J., CAIR	Haldwani:	Dr Atul Grover, Dr Ranjit Singh, DIBER
	Shri R. Kamalakannan, CEMILAC	Hyderabad:	Dr J.K. Rai, ANURAG
	Ms Josephine Nirmala, DARE		Shri A.R.C. Murthy, DLRL
	Shri Nagesa B.K., GTRE		Dr Manoj Kumar Jain, DMRL
	Dr Sushant Chhatre, MTRDC		Dr K Nageswara Rao, DRDL
Chandigarh:	Shri Neeraj Srivastava, TBRL	Jodhpur:	Shri Ravindra Kumar, DL
	Dr H.S. Gusain, SASE	Kanpur:	Shri A.K. Singh, DMSRDE
Chennai:	Shri P.D. Jayram, CVRDE	Kochi:	Smt Letha M.M., NPOL
Dehradun:	Shri Abhai Mishra, DEAL	Leh:	Dr Tsering Stobden, DIHAR
	Shri J.P. Singh, IRDE	Pune:	Sh Ajay Kr Pandey, ARDE
Delhi:	Dr Rajendra Singh, CFEES		Dr (Mrs) J.A. Kanetkar, ARDE
	Dr Dipti Prasad, DIPAS		Dr Himanshu Shekhar, HEMRL
	Dr Dolly Bansal, DIPR		Dr Anoop Anand, R&DE(E)
	Shri Ram Prakash, DTRL	Tezpur:	Dr Sibnarayan Datta, Dr Sonika Sharma, DRL
	Shri Navin Soni, INMAS	Visakhapatnam:	Dr (Mrs) V VijayaSudha, NSTL

**Readers may send their suggestions to
The Editor, Technology Focus
DESIDOC, Metcalfe House
Delhi-110 054**

Telephone: 011-23902403, 23902472; Fax: 011-23819151; 011-23813465

E-mail: director@desidoc.drdo.in; techfocus@desidoc.drdo.in; technologyfocus@desidoc.deldom

Internet: www.drdo.gov.in/drdo/English/index.jsp?pg=techfocus.jsp

From the Guest Editor



The north-east (NE) India is one of the biodiversity hotspots of the world full of numerous indigenous flora and fauna, forests, hills, streams, rivers, and lakes. NE has its unique problems faced by the local populace as well as the armed/paramilitary forces deployed in this region. The main problems are associated with contaminated drinking water, lack of proper sanitary disposal, high density of disease vectors, haematophagous insects like mosquitoes, ticks, black-flies, leeches, snakes prevalence of fungal pathogens and dermatophytes and also poor availability of fresh fruits and vegetables in remote and high altitude locations. Defence Research Laboratory (DRL), Tezpur, under the aegis of DRDO, is working towards developing innovative solutions to these problems by utilizing natural resources present in the region.

Water in NE India in many cases does not conform to the potable water standards with respect to pH, colour, turbidity, Iron (Fe), Arsenic (As), etc., eventuating in several health ailments. To address these issues, DRL has developed products for water purification, waste management, personnel protection and water testing kit for water quality assessment and fungal detection kit for diagnosis of bacterial contaminants.

Apart from the natural contaminants, water bodies in the NE are also contaminated owing to improper natural degradation of fecal matters as the conventional waste treatment systems are ineffective because of extreme climatic conditions. To overcome these problems, DRL has designed and developed an innovative anaerobic microbial digestion-based eco-friendly and low power consuming treatment system (Biotank) especially for high mountain and low temperature areas. This technology can be suitably customized for other areas and is economical as compared to the conventional septic tank-based systems.

The local populace and defence force deployed in this part frequently face problems related to mosquitoes, black flies, ticks, snakes, leeches, which severely incapacitate troops during jungle operations and make them vulnerable to a number of disease including malaria, filariasis, Japanese encephalitis, dengue, etc. DRL has developed various herbal-based products to protect soldiers from these insects. In contrast to chemical-based repellents with strong odour, herbal-based repellents are helpful in genuine protection from vector-borne diseases during jungle operations.

DRL has also developed a novel and eco-friendly non-lethal weapon from oleoresin extracted from *Bhut Jolokia*, one of the hottest chillies in the world, for use in anti-insurgency operations and mob control.

It is a privilege to be the Guest Editor of this issue of *Technology Focus* highlighting the important contributions by researchers of this laboratory whose efforts have eased the lives of troops deployed in difficult locations of NE India as well as the local people. I sincerely invite comments and suggestions to make our efforts more fruitful and focused.

Jai Hind.

Dr Sanjai K Dwivedi
Director, DRL



Protection Technologies for Soldiers

Strategically important NE region of India has a predominantly sub-tropical climate with hot and humid summers, severe monsoons, and mild winters. Two-third area of the region is hilly. Security forces posted in the region, and the locals are vulnerable to diseases caused by haematophagus insects, and infections as well as communicable diseases. Besides, contaminated water adds to the hardship of the residents.

Defence Research Laboratory (DRL), Tezpur, was established in 1962 to pursue R&D programmes for the development of technologies for improving adverse conditions for sustaining operational capability of the troops serving in NE India. Scientific teams from the laboratory periodically visit the forward and inhospitable areas to have an 'on the spot' assessment of difficulties faced by the troops so as to evolve suitable mitigation technologies. The teams also conduct periodical interactions with the forces on combatant operational issues for evolving suitable remedial measures by R&D approaches. The spin-off benefits of the R&D outcomes are being extended to civil populace for socio-economic development of the region.

DRL has focused its R&D on vector borne diseases, improving the quality of drinking water, waste biodegradation and management, high altitude horticulture and protected cultivation for hilly and border areas. Interaction with various research establishments and academic institutions of national and international repute helps in achieving the focused objectives.

Apart from regular R&D activities, DRL imparts training on latest know-how on the above aspects and on skill development in technologies like food processing. Besides, laboratory also distributes quality mushroom spawn, seed and seedling for vegetable cultivation in high altitude and protected areas, vermicomposting, etc., to army/civilian establishments.

DRL has two detachments, one at Salari in West Kameng district and at Tawang in the state of Arunachal Pradesh. Salari unit is located in the mid hills at an altitude of 1250 m. The unit has a total area of 20 acres, which has been developed into a skill development centre for developing skill sets of the local farmers in the areas of value addition of farm produce, mushroom and spawn production, modern nursery techniques. Tawang detachment is at an altitude of about 3000 m above MSL. The detachment has facilities for field trials of vegetable crops in open & protected environment, facilities for mushroom cultivation and vermicomposting. Tawang also serve as field trial station for trial and testing of various products developed by other DRDO laboratories like Defence Institute of High Altitude Research (DIHAR), Defence Institute of Bio-Energy Research (DIBER), Defence Food Research Laboratory (DFRL), Defence Institute of Physiology & Allied Sciences (DIPAS), Institute of Nuclear Medicine & Allied Sciences (INMAS), Defence Institute of Psychological Research (DIPR), and Defence Bioengineering and Electromedical Laboratory (DEBEL).

Products for Decontamination/Purification of Water

Water Deferrization-cum Dearsenification Unit

For removal of excess contamination of Iron and Arsenic, a water Deferrization-cum-Dearsenification unit has been developed by the laboratory. The unit reduces the turbidity to the desirable limits and removes Arsenic via pH control, aeration, co-precipitation and filtration. The unit has a shelf-life of 10 years from the date of manufacturing.

Salient Features

- Removal Capacity: From 500 ppb to < 10ppb
- Filtration rate: 200 l/hr
- Non-electrical system
- Useful for removal of iron from water to acceptable limit (BIS/WHO standard)

Status: Technology transferred to industry.



Deferrization-cum-Dearsenification unit

Iron Removal Unit (300 l/hr)

The unit helps in removal of excess contamination of Iron from the water via pH control, aeration and filtration. It reduces turbidity to desirable limits.



Iron Removal Unit (300 l/hr)

Salient Features

- Removes iron content from 40 mg/l to < 0.3 mg/l (acceptable limit)
- Filtration rate: 300 l/hr
- Non-electrical system
- Shelf-life: 10 years from the date of manufacture
- Iron removal to acceptable limit (BIS/WHO standard)

Status: Technology transferred to industry.

Iron Removal Unit (3000 l/hr)

This Iron Removal Unit has a filtration rate of 3000 l/hr. The unit removes Iron via pH control, aeration and filtrations with reduction of turbidity to desired limits. The unit has a shelf-life of 10 years from the date of manufacturing. The unit is suitable for large community population.

Salient Features

- Removes iron content from 40 mg/l to < 0.3 mg/l (acceptable limit)
- Non-electrical system

Status: Technology is ready for transfer.



Iron Removal Unit (3000l/hr)

Household Water Filter

DRL Pure has been developed for domestic usage. It reduces turbidity to desirable limits. The contaminants are removed via aeration, adsorption and filtration. The unit has shelf-life of five years from the date of manufacturing.



DRL Pure: Household Water Filter

Salient Features

- Removes As from 0.2 mg/l to < 0.01 mg/l; iron, from 30 mg/l to < 0.3 mg/l and Mn from 2 mg/l to < 0.3 mg/l
- Filtration rate: 1.2 l/hr

Status: Technology transferred to industry.

Mobile Comprehensive IRU (300 l/hr)

Mobile Comprehensive IRU is a trolley-based transportable purification system for purification of water from any source. It removes turbidity to desirable limit and can be deployed during emergency situations.

Salient Features

- UV system for removal of microbes
- Use of solar power for functioning of water pump and UV system
- Removes iron from 40 ppm to < 0.3 ppm



Mobile Comprehensive IRU (300 l/hr)

Products for Waste Management

DRDO Bio-toilet

DRDO Bio-toilet is an eco-friendly, customizable, maintenance-free technology for human faecal matter digestion. It comprises a specially designed reaction vessel (Bio-tank), and a consortium of microorganism immobilizer on suitable matrix for degradation of organic matter.

Salient Features

- Smaller than conventional septic tank system
- Consortium of bacteria degrades organic waste into water and gases
- Biogas generated can be harnessed
- No-slurry system reduces maintenance (no manual scavenging/cesspool emptying



Bioilet-cum-Reed bed system for plains

- required)
- Reduced sewage load & pathogen
- Reed bed can be incorporated for secondary treatment of effluent water
- Treated water can be reused for flushing, gardening, etc.

Status: Technology transferred to private firms.

DRDO Bio-toilet for High Altitude Low Temperature

FRP-based double walled rugged reaction vessel with PUF insulation to minimize heat loss and external damage. The unit has an electronically controlled heating system along with data logger to ensure precise maintenance and monitoring of core

temperature with minimum input of energy.

Salient Features

- Specially arranged baffle wall structures to increase retention time within smaller vessel volume
- Specially designed bacterial attachment matrices (roof hanging and baffle attached type) for faster degradation
- Provided with overhead shed to protect the system from natural calamities

Status: Patent filed (application number 201811026733). Fifty bio-toilets have been installed at different high altitude army locations around Tawang. Technology transferred to industry for wide implementation.



Prototype of high altitude electronically-controlled bio-toilet at 4250 m (top) and DRDO Bio-toilets at different high altitude army locations in and around Tawang

Testing kits for Armed Forces and Civil Sectors

DRDO Water Testing Kit

The kit has been developed by the laboratory for testing of 11 important water quality parameters (pH, total hardness, iron, chloride, fluoride, nitrate, residual chlorine, sulphate, arsenic, TDS and faecal coliform bacteria) in field condition. The kit has shelf life of two years from the date of manufacturing.

Salient Features

- Yields semi-quantitative results
- Each kit carries high quality reagents for 100 tests
- Test can easily be performed by a semi-skilled person with brief training
- Cost-effective, lightweight and portable

Status: Technology transferred to industry.



DRDO Water Testing Kit

Fungal PCR Detection Kit

Fungal PCR Detection Kit is rapid, sensitive and species specific for detection of *T. rubrum* and *T. mentagrophytes*. The kit includes two SCAR primer pair; TRS1F/TRS1R for *T. rubrum* detection and TMS1F/TMS1R for *T. mentagrophytes* detection.

Salient Features

- Validated with clinical isolates of both species

- Specificity cross checked with range of fungi and common bacterial contaminants
- Capable of detecting 1 pg DNA of respective species
- Two control DNA samples: Control 1 (*T. rubrum* genomic DNA) and Control 2 (*T. mentagrophytes* genomic DNA)

Status: Technology ready for transfer.



Fungal PCR Detection Kit

Products for Personal Protection

Capsispray™—Non-lethal Chilli Spray

A novel, eco-friendly, non-lethal weapon for self-defence, low-intensity conflict (LIC), riot control, hostage crisis situation, etc.

Salient Features

- Based on oleoresin extracted from *Bhut Jolokia*, one of the hottest chillies in the world, endemic in NE India
- Product available in different sizes, different container material, and with different delivery mechanism for varied situations

Status: Technology transferred to industry.



Capsispray variant for delivery through door key

Capsigrenade™—Non-lethal Chilli Grenade

Non-lethal Chilli Grenade, Capsigrenade, an indigenous non-lethal weapon based on '*Bhut Jolokia*

oleoresin' extracts, packed in a grenade format. It is ideal for applications in riot control, mob dispersal and hostage-crisis management.

Salient Features

- Organic, less toxic and non-explosive
- Effective in any climate including rain
- Easy to handle and can be operated without canon
- Extensive tests carried out with armed and paramilitary forces, special forces and state police forces

Status: Technology transferred to industry.



Capsigrenade™

Herbal Mosquito Repellent Cream and Spray, SAFE

SAFE is a herbal formulation-based cream for topical applications. Its single application gives protection against mosquitoes for four hours.

Salient Features

- Contains essential oils from local herbs

- Non-irritant and non-toxic
- Useful for jungle operations
- Shelf life of 2 years

Status: Technology ready for transfer.



Herbal Anti-mosquito Vaporizer, Mosout

Herbal anti-mosquito vaporizer, Mosout, is made of essential oils of indigenous plant species. It is compatible with commercially available vaporizing devices.

Salient Features

- Non-toxic, eco-friendly, cost-effective with natural fragrance
- Does not contain any harmful chemical insecticides
- The product complies standard regulatory documentation including MSDS, Chemtox, etc.

Status: Technology ready for transfer.



Herbal Anti-mosquito Vaporizer

Herbal Air Sanitizer and Anti-bacterial Formulation, AeroClean

AeroClean is a 100 per cent herbal formulation for air sanitization. It sterilizes air by the natural antimicrobial and bactericidal agents could be beneficial for human health in aroma-therapy. It has aesthetic importance as well.

Salient Features

- Effective in air-conditioned and air closed chambers like trench and underground
- Can neutralize the cigarette smoke, chemical fumes like ether, ammonia, etc.
- Effective against almost all pathogenic bacteria specially the air-borne infections
- Safe, highly effective and does not contain harmful chemicals

Status: Technology ready for transfer.



Herbal Air Sanitizer and Anti-bacterial Formulation

Herbal Leech Repellent

Herbal Leech Repellent comprises an inert carrier and an essential oil of plant origin as active ingredient. Its application effectively repels land leeches and prevents their attachment. It is useful for forces deployed in jungle areas.

Salient Features

- Stable in hot and humid climates and is not washed away by rain or perspiration
- Effective for more than 10 hours after single application
- Easy to apply and free from unpleasant odours and toxic effects

Status: Technology ready for transfer.

Snake Repellent

Non-toxic, non-hazards, no phenolic Snake Repellent is effective against deadly poisonous snakes like Spectacled cobra (*Naja naja*), Banded krait (*Bungarus fasciatus*), Monocled Cobra (*Naja kaouthia*), Saw-scaled viper (*Echis carinatus*) Russell's viper (*Daboia russelii*). It has a shelf-life of one year.

Salient Features

- Does not harm the snake, only repels
- Can be used in garden and the home
- Based on ethnic herbs mainly from eastern India

Status: Patent filed (No. 3217/Del/2013). Technology transferred to industry.

Herbal Larvicidal Floating Tablet, FlotKil

FlotKil, is a herbal, biodegradable



sustained release larvicidal tablet effective in vector management through controlling mosquito at the immature larval stage. It is safer to the environment as compared to other chemical larvicides.

Special Features

- Effective against *Culex quinquefasciatus* and *Aedes albopictus* larvae in aquatic environment
- Application of the tablet at 5 ppm results in 100 per cent mortality after 24 hrs
- The active crude extract of the tablet is released in a sustained manner for a period of 14 to 30 days
- Patent granted

Status: Technology ready for transfer.



Herbal Mosquito Larvicidal Floating Tablet

High SPF Sunscreen Cream

High SPF sunscreen cream contains Avobenzone and other active chemicals with herbal adjuvant to protect skin damage from ultraviolet rays type-B (UV-B). It retains the flow property even at -20 °C (glacial condition) and is stable at up to 60 °C (desert condition). It is useful against skin burn in high altitude areas and dry skin due to low humidity.

Salient Features

- The SPF value is 50+
- Batch process validation, other requisite regulatory clearance obtained
- Single application provides 4 hrs

protection against UV-A and UV-B rays

- Stable for 24 months

Status: Technology transferred to industry.



High SPF Sunscreen for glacier and desert conditions

Herbal Anti-fungal Ointment

The herbal, non-toxic, broad spectrum ointment comprising plant seed extract and essential oil, is effective against broad range of dermatophytes including *Trichophyton* (*T. rubrum*, *T. mentagrophytes* and *T. ajelloi*), *Microsporum* (*M. canis*, *M. gypseum*, *M. fulvum* and *M. boulardii*); opportunistic yeasts such as *Candida albicans* and *Trichosporon beigeli* (white piedra); molds such as *Aspergillus* (*A. flavus* and *A. ochraceus*). It is also effective against bacteria-*Staphylococcus*

aureus, *Klebseilla pneumoniae* and *Pseudomonas aeruginosa* involved in secondary infections of skin and nail. The ointment is stable for 24 months from manufacturing date, when stored in cool and dark place.

Status: Patent no, 201611027544 filed. Technology ready for transfer.



Herbal Antifungal Ointment

Products for Health Enhancement

Mushroom-based Functional Foods

Mushroom-based oil and non-oil pickles blended with a number of ingredients have been developed.

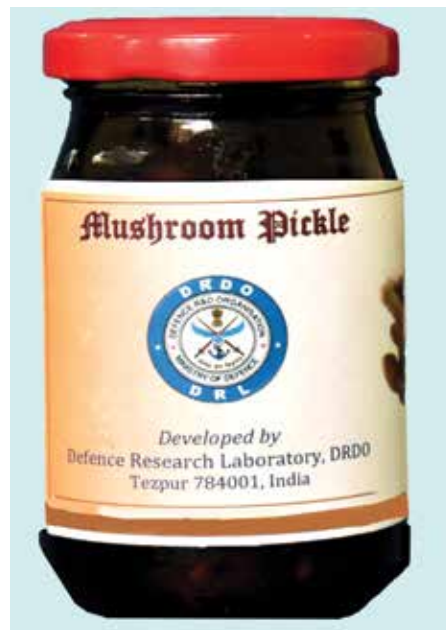


These functional foods are nutritionally rich and contain protein, vitamin and minerals. These delicious and flavoured products have shelf-life of 12 months at room temperature.

Status: Technology of mushroom pickle transferred to industry.



Mushroom cultivation at high altitude



Mushroom-based Pickle

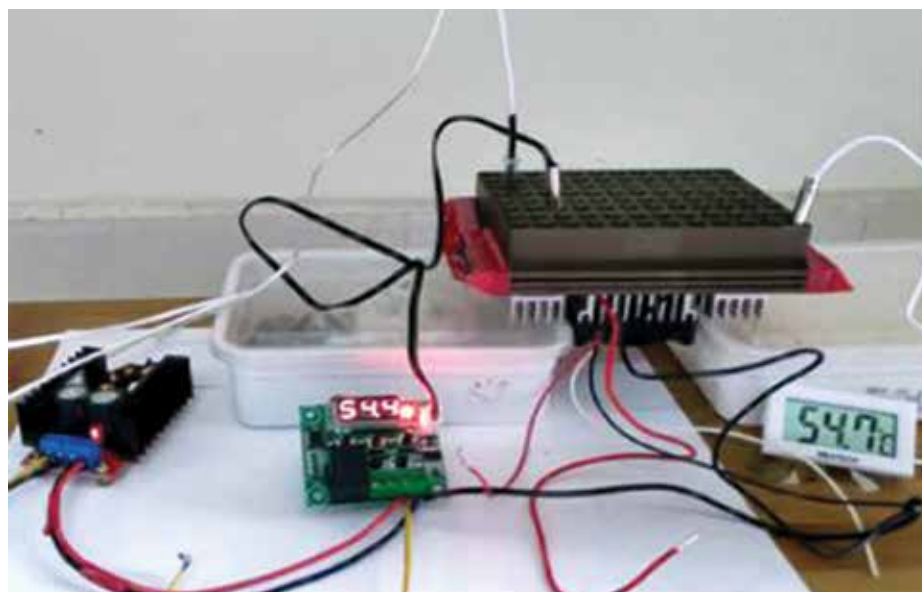
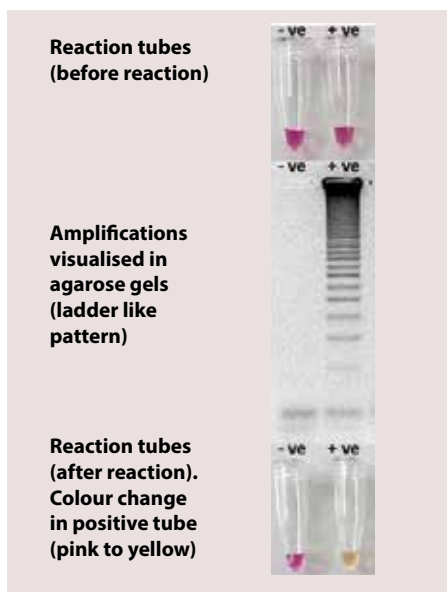
Biotechnologies

Field Deployable Assay for Pathogen Detection

DRL has developed a rapid isothermal DNA amplification-based assay for detection of pathogens in

wild-collected vector specimens. The method, does not requires sophisticated high power requiring thermal cyclers. A low-cost, battery-powered, electronically-controlled isothermal heating device

has been designed and fabricated for conducting the isothermal amplification in field settings. System is suitable for surveillance and monitoring of a wide range of vector-borne and other pathogens.



Reaction mix before and after amplification reaction. Prototype isothermal heating system under testing.

Salient Features

- Simple, robust and sensitive (~10 copies of pathogen nucleic acids) method
- Amplification can be performed within 60-90 minutes of incubation at 60-65 °C
- Stabilized reagents enable storage and transportation at normal temperatures
- Dye incorporated reaction buffer enables naked eye interpretation of results signified by colour change from pink to yellow in positive reaction tubes

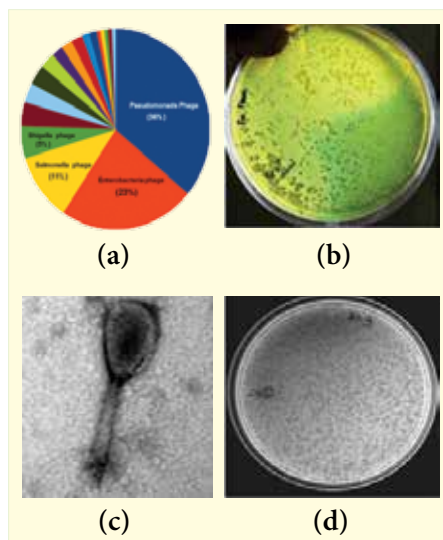
(TEM) and whole genome-based characterization protocols have been optimised using a *Pseudomonas aeruginosa* bacteriophage isolated from wastewater. The expertise developed is being used for bacterial decontamination in various fields.

Nano-technology for Removal of Contaminants from Water and Mosquito Larvicidal Agent

The laboratory has developed technologies for synthesis of nano/mesoporous materials using green as well as chemical route approaches.

Bacteriophage Technology based Applications for Bacteria Control

Various protocols and methodologies have been optimised to isolate, enrich and store bacteriophages from various sources to control water-borne, including multidrug resistant (MDR), bacteria. Transmission electron microscopy



(a) Diversity of bacteriophage in wastewater (through metagenomic study), (b) Plaques by bacteriophage on agar plates, (c) TEM photo of bacteriophage, Enriched and (d) bacteriophage plaques at 10^9 PFU/ml



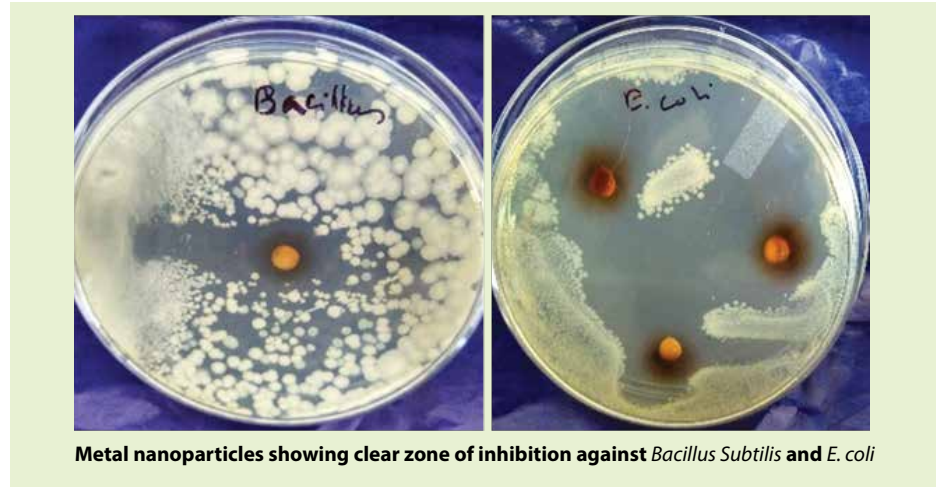
(a) Optical Microscopy Images of Untreated *Culex quinquefasciatus* larva, (b) Treated *Culex quinquefasciatus* larva, (c) Untreated *Culex quinquefasciatus* pupa, (d) Treated *Culex quinquefasciatus* pupa, (e) Untreated *Anopheles Stephensi* larva and (f) Treated *Anopheles Stephensi* larva

Locally available plant resources and waste food stuffs have been utilised to synthesise nanomaterials.

These nanoparticles are found effective for removing As and F1 from contaminated and in controlling bacteria. Synthesised nanoparticles are also effective as mosquito larvicidal agent and are found to be effective against *Anopheles stephensi* and *Culex quinquefasciatus* mosquito species.

Protected Cultivation Technologies for High Altitude

Due to harsh climatic conditions like heavy snow, rain and landslide, there is scarcity of freshly grown fruits and vegetables at high altitude low temperature areas. The laboratory has promoted installation of a number of poly-carbonate green houses from



Metal nanoparticles showing clear zone of inhibition against *Bacillus Subtilis* and *E. coli*

Bomdila (2400 m) to Bumla (4500 m) at different army units. The protected structures like polycarbonate green houses for high altitudes and shade net houses at lower altitude where scorching sunshine is the problem, have been installed. Protected cultivation with improved agronomic package of practices of crop specific

to the locality will ensure continuous supply of fresh fruits and vegetables and will keep the local farmers engaged throughout the year ensuring regular income. DRL, Tezpur is popularizing protected cultivation of vegetables in forward army units as well as among the farmers located near forward areas like Tawang.



Protected cultivation in polycarbonate green houses at high altitude locations

Hi-tech Soil-less Nursery Raising Technique

To increase the production of fruits and vegetables at high altitude areas DRL has standardised and popularised soil less or pro-tray nursery raising technology. The technology is cost-effective and provides quality planting material. The technology has been successfully applied on crops like cole crops (cauliflower, cabbage, knoll-khol,



etc.) solanaceous crops (tomato, chilli, capsicum and brinjal). DRL is also using poly bag nursery for growing cucurbitaceous crops (cucumber, bottle gourd, sponge gourd, bitter gourd and squash, etc.). Vegetable seedlings regularly grown at DRL on mass scale distributes are to army units, farmers and local people of two DRL adopted villages—Seru and Namet in Arunachal Pradesh.

👉 Pro-tray and polybag nursery

Research and Infrastructures Facilities

Organic Solid Waste Composting Facility

Decomposition of organic solid waste is usually carried out by the action of both microorganisms and earthworm (vermin-composting). DRL has facility to compost solid waste by using organic material like garden and kitchen wastes. The process involves:

- Systematic and regular waste collection
- Waste segregation and microbial composting
- Addition of earthworms with partial compost material
- Complete decomposition
- Earthworm recovery
- Vermin-compost drying, sieving and packaging



Vermicomposting facility at DRL, Tezpur

Infrastructure Facilities

Various infrastructure facilities available at DRL and its detachments include:

- Fruit and vegetable processing plant (demonstration scale) at Salari
- Various types of model green house (polycarbonate) for protected cultivation at Salari
- Field demonstration for open cultivation of vegetables at Salari
- Model fruit orchard
- DBT approved BSL-2 laboratory facility.
- Mammalian cell culture facility
- Fully equipped molecular biology laboratories for handling DNA/RNA/Protein works
- Dedicated mycology laboratory for fungus related work
- Facilities for Mushroom and vermi-compost production in both plains and at high altitude areas
- Inoculum generation facility for Biotank cum reed bed system

Instrumentation Facilities

The facilities include:

- BSL-2 Biosafety Cabinets

- PCR and Real-time PCR
- Multimode Plate reader
- Image Documentation and analysis System
- Low and Ultra-low temperature freezers
- Lyophilizer
- Microscopes (Fluorescent, Upright, Inverted, compound, Stereo)
- CO₂ Incubators
- Hybridization chamber
- High Performance Liquid Chromatography (HPLC)
- High-performance thin-layer chromatography (HPTLC)
- Fourier-transform infrared spectroscope (FT-IR)
- Gas chromatography–Mass Spectrometer (GC-MS)
- Liquid chromatography–Mass spectrometrer (LC-MS)
- Atomic absorption spectroscopy (AAS)
- Flow Cytometer,
- COMET assay platform
- Ultra Centrifuge,
- Fully automated biochemical analyzer
- Immunofluorescence assay for hormone
- In-vivo imager
- Accelerated solvent extractor

Animal House Facility

Animal experimentation is an important part of life sciences research. DRL, Tezpur has a well maintained animal house facility housing four species of animals, namely Swiss Albino Mice (*Mus musculus*), Wistar Rats (*Rattus norvegicus*), English Guinea pigs (*Cavia porcellus*) and New Zealand White Rabbits (*Oryctolagus*

cuniculus). The animals have been provided with optimal husbandry conditions and proper temperature, humidity and lighting arrangements are in place. They are fed a balanced ration and have access to clean drinking water.

DRL animal house is registered with the Committee for the Purpose of Control and Supervision of Experiments on Animals under the

Prevention of Cruelty to the Animals Act, 1960 (Chapter 4, Sec.15-1). The laboratory has a CPCSEA approved standing Institutional Animal Ethical Committee (IAEC). The committee conducts regular meetings as per CPCSEA guidelines. Protocols for animal experiments are submitted to the Committee which studies each submission meticulously before approving the protocols.



Animal models at Animal House Facility

Plant Tissue & Algal Culture Facility

The facility is being used for *in vitro* culture of plants and microalgae under controlled condition for

their optimum growth. The growth condition is maintained at $25 \pm 2^\circ\text{C}$ with a photoperiodic light and

dark cycle of 16:08 hours. It also has facility for cell suspension cultures for production of secondary metabolites.



Plant Tissue and Algal Culture Facility

Medicinal Plant House and Orchidarium

Medicinal plants, orchids are propagated in specially designed houses. These indigenous plants are being grown for conservation and demonstration. DRL has a collection

of 50 indigenous medicinal plants comprising herbs, rhizomes, grasses, creepers, climbers and shrubs.

This facility also serves as mother stock for further multiplication of

the medicinal plants. A special house meant for growing orchids provides them 50 per cent shade and humidity. It houses around 25 tropical and sub-tropical orchids indigenous to NE

India. Most of the orchids housed in the orchidarium are epiphytic

with few terrestrial ones. One of the endangered orchid Lady's Sleepers is

being conserved in the facility.



Medicinal House and Orchidarium

Mosquito Rearing and Bioassay Facility

The laboratory has a well-maintained mosquito rearing and bioassay facility in which all developmental stages of *Anopheles*,

Culex and *Aedes* mosquitoes are being reared at ambient temperature and humidity for experimental purpose. The larvae are used for evaluating the efficacy of natural or synthetic larvicides, whereas the adult females are used for evaluating mosquito

repellents or other mosquito control agents.

DRL detachments at High Altitudes

DRL Detachment Salari

DRL has a detachment at Salari in West Kameng district of Arunachal Pradesh. It is located in the mid hills at an altitude of 1250 m. The unit has a total area of 20 acres. It has a fruit and vegetable processing unit, a mini laboratory, mushroom cultivation and vermicomposting unit. It has three different protected structures, viz., polycarbonate greenhouse, polyhouse and net house for conducting different vegetable trials. It also has various fruit germplasm collection comprising



Mosquito Rearing Facility



of 1000 plants and an herbal garden as well. Training on food processing is conducted for the local farmers periodically.

The unit has been developed into a skill development centre for developing skill sets of the local farmers in the areas of value addition of farm produce, mushroom spawn production and modern nursery techniques.

DRL Detachment Tawang

The field detachment is about 3000 m above MSL. The detachment has facilities for field trial of vegetable crops in open and protected environment, facilities for mushroom cultivation and vermicomposting. Besides DRL, other sister DRDO laboratories like DIHAR, DIBER, DFRL, DIPAS, INMAS, DIPR,

DEBEL are also contributing in the research activities at this detachment. The Tawang area has tremendous scope for R&D activities in the multi-disciplinary areas of life sciences, bio-technology, physiology and allied sciences like agriculture and horticulture. The detachment in the near future will play a major pivotal role in establishing a civil-military interface in the region.



DRL detachment, Tawang



DRL detachment, Salari

TECHNOLOGY FOCUS

READERS' FEEDBACK

Your feedback is important to us for further improve the content and presentation of information. The editorial team requests you to kindly fill in the feedback form and give your level of satisfaction and newer aspects you would want to incorporate in the *Technology Focus*.

Rate the *Technology Focus* as a medium to present DRDO's technology and product developments?

Excellent Good Satisfactory Needs improvement

How do you rate the quality of photographs in the *Technology Focus*?

Excellent Good Satisfactory Needs improvement

Optimal number of pages you would like for the *Technology Focus*?

16 Pages 20 Pages 24 Pages 28 Pages

Preferred medium of *Technology Focus*?

Print Online (PDF) E-pub Video Magazine

Whether magazine is delivered on time?

Yes No

What should be the frequency of *Technology Focus*?

Bimonthly Quarterly Half-yearly

For updates on *Technology Focus*, Kindly provide your e-mail id.

Suggestions, to further improve the *Technology Focus* ?

Name:

Signature

Address:



Please Mail to:

The Director

Defence Scientific Information & Documentation Centre (DESIDOC)

DRDO, Ministry of Defence, Metcalfe House, Delhi - 110 054

Local Training Programmes

DRL is the nodal laboratory for DRDO's Arunodaya Programme, "Soldier Preparedness in High Mountain of NE Region" to impart latest know-how on the research/technologies developed by the laboratory. The objective of the Arunodaya is to develop the skills of

the soldiers of the various Army units located in the NE, and that of the local farmers in vegetable and mushroom farming in high altitude and protected areas and in technologies like food processing. DRL also distributes quality mushroom spawn, seed and seedling for vegetable cultivation,

vermi-composting, etc., to army and civilian establishments.

The workshops/training courses/skill development programmes conducted by the laboratory not only helps soldiers in acquiring latest farming skills but also in boosting the economy of the local farmers.



Training programmes for development of local entrepreneurs



Greenhouse, a boon for troops at forward locations



Cultivation of Seabuckthorn (*Hippophae salicifolia* D. Don.) in Tawang