

DBT-TDNBC-DEAKIN— RESEARCH NETWORK ACROSS CONTINENTS FOR LEARNING AND INNOVATION (DTD-RNA) NEWSLETTER



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The Energy and
Resources Institutes

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MESSAGE FROM DR PUSHPLATA SINGH, DTD-RNA INVESTIGATOR

“Walk away from the mean team and join the green team.”

Sustainable agriculture is a pivotal part of the move to address the proliferation in demand for food for nearly 6 billion, with almost 50% living in Asia. Researchers in

India and several other countries across the globe are working to develop nanopesticides that are less threatening to the biota, in contrast with traditional formulations and evaluate whether these new materials would be able to outperform the existing formulations in terms of their performance, risk and cost benefit. Another adjunct to this problem is how to amplify the income of farmers. Nanotechnology has answers to many of these challenges. Some of the world’s largest makers of pesticides, fertilizers, and other farm technologies are betting on nanotechnology to bring unprecedented precision and enhancement of crop and livestock productions.

Manufactured nanomaterials are already revolutionizing the way we produce different materials, which raises questions regarding potential unintended hazards to humans and the environment, and whether nanomaterials need special measures to deal with potential risks.

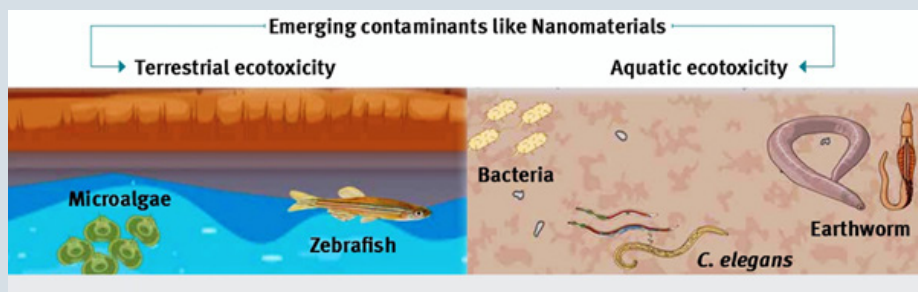
There is a need for a responsible and coordinated approach to ensure that potential safety issues are addressed simultaneously as the technology is developing.

In this quarter we conducted **three** webinars under DTD-RNA network for knowledge sharing on varied topics related to nanotechnology.

The consultative webinar on “International Test Guidelines & Methods for Nanosafety” was conducted on July 22-23.

Globally, as multiple nanoproducts aim to reach the application and commercial stages, it becomes vital to understand any potential risks associated with their synthesis and application. The nanotoxicology field, however, suffers from inconsistent methodologies that affect the results significantly. The use of ratified international guidelines assists in establishing consistencies in nanotoxicity related research and enhances reproducibility. The key

focus of this webinar, therefore, was to define the scope and use of the OECD and other international test guidelines for toxicity assessment of the nanomaterials using a variety of in vitro, ex vivo and in vivo model systems, including plants, bacteria, nematodes, microalgae, fruit-fly, zebrafish and rodents and mammalian cell lines.



It brought together leading academic researchers to share their wet-lab work and the standard guidelines for ecotoxicity assessments of nanoproducts that are useful for agricultural, food, pharmaceutical, and cosmetic industries.

The second webinar was on Nanostructured materials (NSMS) in food packaging, preservation and diagnostics on 26th august, 2021.

Food package and the packaging material play an essential and decisive role in food quality and shelf life. Packaging chiefly influences the barrier properties to form an irrefutable food environment. Before reaching the end-consumer, food commodities are packaged and hygienically transported to protect and preserve them from any unacceptable alteration in quality.



Presently, the modern consumers of competitive economies demand natural quality food, assured safety, minimal processing, extended shelf-life, and a ready-to-eat concept. The dawn of nanotechnology has further opened up new avenues and technological advancement possibilities in food packaging.

Innovative packaging systems ascertain transit preservation and effective distribution and facilitate communication at the consumer levels. The technological advances in food packaging in the twenty-first century are mainly chaired by nanotechnology, the science of nanomaterials.

Novel nano-packaging systems (Improved/Active/Intelligent packaging) can serve as an essential tool to overcome existing packaging challenges with consumer and industrialist satisfaction.

The third webinar that we conducted was on "Next-generation smart delivery systems for agrochemicals on 27th September 2021.

In recent years, nanotechnology has extended its relevance in plant science and agriculture. The advancement of nanotechnology has improved ways for large-scale production of nanoparticles of physiologically essential metals that can improve fertilizer formulations.

Nanotechnology is on the horizon to transform present industries, including food, pharmaceuticals, agriculture, medical and other related areas. Research on nanotechnology

applications in agriculture, particularly in the production of crops, has received much attention, with the fundamental aim of attaining a more reasonable utilization of resources via the development of sensors or delivery systems for agrochemicals.



This delivery system can increase nutrient use efficiency through targeted delivery and slow or controlled release of agrochemicals. Besides, such delivery systems could precisely release their active ingredients in response to environmental triggers and biological demands. With all the promise of nanotechnology, we must mention that the development of the smart delivery system is primarily available at a bench-top scale. Commercialization of such nanomaterials for agricultural applications requires large-scale production, testing priorities, risk assessment and regulatory guidance at the global level.



MESSAGE FROM
**MS RAVNEET
PAWHA,**
DEPUTY VICE PRESIDENT
(GLOBAL) AND CEO
DEAKIN SOUTH ASIA

Pandemic has had a life altering implications on all of us, but it has also been an opportunity to reimagine our world and collective lives. It has emphasised the critical contribution of technologies in attaining a 'new normal'.

Un Gen Secretary António Guterres, aptly puts it -

As the world fights the deadly COVID-19 pandemic – the most challenging crisis we have faced since the Second World

War... This is a time for science and solidarity.

COVID has also drawn attention to the power of collaboration and doing things collectively for not just individual but also for greater common good.

Deakin has always been committed to ideals of **Advancing society and culture; Building safe and secure communities; Enabling a sustainable world; Improving health and wellbeing; and creating smarter technologies.** Its collaboration with

TERI to create TDNBC in 2011 was a part of its larger vision to combat issues of food security, climate change and its impact of agriculture and water through deployment of nano technology, product chemistry, data science and artificial intelligence.

These issues are pressing concerns for India and Australia, even though the magnitude is different and points of intervention into the problem vary in both countries. The teleological aim, however, for both India and Australia, is to create sustainable solutions to the problems posed to us by the changing times and human activities.

The DBT –TDNBC – DEAKIN – Research Network across continents for learning and innovation (DTD-RNA), is another step in this direction. Deakin's belief

in collaborative efforts to create sustainable solutions to problems underpins the formation of this network. We strongly support it and envision this network as a driving force in bringing the policy and regulatory perspective, academic insights, and practical issues from industry together in a common platform. I am happy to be a part of it and to witness collaborative efforts deliver positive results in attaining sustainable solutions to problems of food and water security through transdisciplinary translational research.

As **MS Swaminathan** had once said "If agriculture goes wrong, nothing will have a chance to go right".

Keeping this in mind, the network is dedicated to enhancing research outcomes across continents in through interdisciplinary research collaborations. It is also an excellent platform for students and early career professionals to conceive and deploy nanotechnology solutions for solving problems of agriculture and environment at industrial scale.

Challenges of our times are huge but nano technology offers huge possibilities to deal with them. I am optimistic that together we will create a difference.

WEBINAR ON: INTERNATIONAL TEST GUIDELINES AND METHODS FOR NANO SAFETY

Novel products with nanotechnology intervention are projected to revolutionize the healthcare practice, agriculture, and food sectors in future. The emphasis is on creating technologies that have high commercial and societal impact. However, the scientific understanding related to evaluation of nanoproducts

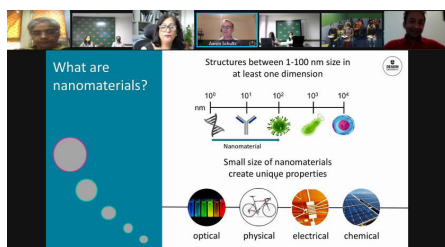


for efficacy and risk to human health and environment is a critical gap concerning their successful commercialization. The novel multifunctional nanomaterial-based products require cautious selection of the available tests as well as additional new tests for quality, safety, and efficacy assessment. In regard to this, TERI-Deakin Nanobiotechnology Centre (TD-NBC) through DBT-TDNBC-DEAKIN-Research Network Across continents for learning and innovation (DTD-RNA) network along with support from DIPAS, DRDO and CSIR, Govt. of INDIA, organized a webinar on 'International Test Guidelines and Methods for Nano Safety' on 22nd -23rd July 2021.

The webinar brought together leading academic researchers, technocrats, and

industries along with representatives from regulatory bodies to exchange and share their experiences on the scope and use of the OECD/international test guidelines for toxicity assessment of the nanomaterials using a variety of terrestrial and aquatic model species and mammalian cell lines.

The webinar commenced with the welcome address by the Dr. Vibha Dhawan, Director General, TERI. This was followed by two days with multiple sessions, each having presentations by senior speakers from academia and young researchers who presented videos from lab. The sessions were moderated by Dr Pushplata Singh TDNBC, TERI on the Day 1 and by Dr. Palash Manna, TDNBC TERI on the Day 2.



A detailed discussion took place between the speakers, invited panelist from various renowned institutes and industries; on the first day they discussed about the in vivo assessment of Nano-safety using Zebrafish, fruitfly. Similarly on the second day, they discussed about the assessment of nanotoxicity using ex vivo & in vivo model systems and in silico tools.

The following were the speakers and senior academia discussants:

1. Dr Aaron Schultz, Deakin University, Australia
2. Dr Ekta Kohli from DIPAS, New Delhi
3. Dr Parthasarathi Ramakrishnan CSIR-IITR, Lucknow
4. Dr Pushplata Singh, TDNBC, TERI, New Delhi
5. Dr Rita Choudhary, TDNBC, TERI, New Delhi
6. Dr Sreemoyee Chatterjee, IIS University
7. Dr Sanchaita Lala, University of Calcutta
8. Dr Naresh Prasad, Chambal fertilizers and Chemicals Limited
9. Dr Mandira Kochar, TDNBC, TERI, New Delhi
10. Dr Jagmohan Saini, Chambal fertilizers and Chemicals Limited

After every session, an interactive Q&A session was held with representatives from academia, industries, and regulatory bodies.

This webinar was attended by more than 65 participants across the globe.

WEBINAR ON: NANOSTRUCTURED MATERIALS (NSMS) IN FOOD PACKAGING, PRESERVATION AND DIAGNOSTICS

Several nanomaterials are expected to reach the application and commercial stages globally. Commercial applications of nanomaterials will continue to impact the food industry because of their unique and novel properties. In particular, food packaging, preservation, and diagnostics industries are expected to be revolutionized by the advent of nanotechnology. In this regard, TERI-Deakin Nanobiotechnology Centre (TDNBC), Gurugram, India and Deakin University, Australia, in association with Department of Biotechnology, Govt. of India under "DBT-TDNBC-DEAKIN-Research Network" across continents for learning and innovation (DTD-RNA) project organized an international webinar on "Nanostructured Materials (NSMs) in Food Packaging, Preservation and Diagnostics" on 26th August, 2021.

The program aimed to spread advanced knowledge on the practical applicability

of using various nanomaterials and nano-formulations for rapid detection (nano-diagnostics) nano-packaging and nano-preservation. The webinar had participations from national and international leading scientists, graduate students, and technocrats to share their knowledge.

The webinar began with the welcome address by Dr. Vibha Dhawan, Director General, TERI followed by introductory virtual tour of TDNBC nano research facilities. A virtual tour of the international "Nano Fabrication and Nano Sensor Laboratory" established at Inha University, South Korea was also broadcasted. The sessions were moderated by Dr. Pushplata Singh, Dr. Shruti Shukla and Dr. Palash Kumar Manna, TDNBC, TERI.

Eminent speakers and invited panelists from various renowned national and international

institutes discussed about the food safety issues and how nanomaterials can help in improving the issues of biodegradable, smart & active nano-packaging, nano-fortification in various edible oils, and development of various portable sensing systems.

The following were the speakers and senior academia discussants:

1. Dr. Vimal Katiyar, Indian Institute of Technology, Guwahati (IIT-G), Guwahati, India
2. Prof. Yun Suk Huh, Inha University, Incheon, South Korea
3. Prof. Rajni Chopra, National Institute of Food Technology Entrepreneurship and Management (NIFTEM), Sonapat, India
4. Dr. Sonu Gandhi, National Institute of Animal Biotechnology (NIAB), Hyderabad, India
5. Prof. Ashutosh Upadhyay, National Institute of Food Technology Entrepreneurship and Management (NIFTEM), Sonapat, India
6. Dr. Rahul Kumar Anurag, ICAR – Central Institute of Post-Harvest Engineering & Technology, Ludhiana, Punjab, India
7. Dr. Anurag Singh, National Institute of Food Technology Entrepreneurship and Management (NIFTEM), India
8. Dr. Ashutosh Bahuguna, Department of Food Science and Technology, Yeungnam University, South Korea

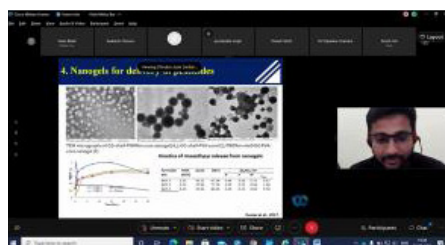
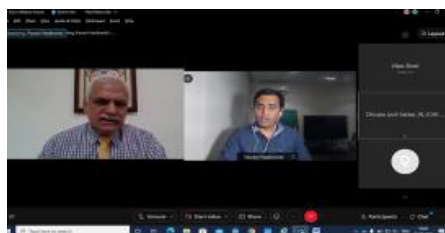
After each session, an interactive Q&A session was held.

The webinar was attended by more than 100 participants across the globe.



WEBINAR ON: NEXT GENERATION SMART DELIVERY SYSTEMS FOR AGROCHEMICALS

In recent years, nanotechnology is very much relevant in plant science and agriculture. Advancement of nanotechnology has improved the ways for large-scale production of physiologically important metallic nanoparticles that can be used to improve fertilizer formulations. Consequently, we can expect enhanced uptake of nano-fertilizers by plant cells leading to minuscule nutrient loss. Nanoparticles have high surface area, sorption capacity, and controlled-release kinetics to the targeted sites, thereby making them suitable for “smart delivery system.” This kind of delivery systems can improve the nutrient use efficiency through mechanisms such as targeted delivery, slow or controlled release of agrochemicals. In this regard, TERI-Deakin Nanobiotechnology Centre (TDNBC), Gurugram, India and Deakin University, Australia, in association with Department of



Biotechnology, Govt. of India under “Centre of Excellence for Advanced Research in Agricultural Nanotechnology” DBT-funded project organized an international webinar on “Next Generation Smart Delivery System for Agrochemicals” on 27th September, 2021.

The webinar aimed to shed light on the current status of smart delivery systems in agriculture, highlighting the challenges and drawbacks. The lectures from international and national speakers will cater to faculties, researchers, scientists, students and industries to understand various aspects of delivery systems using green nanotechnology that offers low cost, facile method, and controlled-release features. The webinar had participations from national and international leading scientists, graduate students, and technocrats to share their knowledge.

The webinar began with introductory virtual tour of TDNBC nano research facilities. The sessions were moderated by Dr. Rita Choudhary, Dr. Shruti Shukla, Dr. Palash Kumar Manna and Dr. Pushplata Singh, TDNBC, TERI. Eminent speakers and invited panellists from various renowned national and international institutes discussed about various aspects of delivery systems using green nanotechnology that offers low cost, facile method, and controlled-release.

The following were the speakers and senior academia discussants:

Guest of Honor: Prof. Rakesh Kumar Khandal, President R&D and Business Development, India Glycols Limited, India

1. Prof. Kamlesh Choure, Director, CRIISD and Head, Biotechnology, AKS University, Satna (MP)
2. Dr. Dhruva Jyoti Sarkar, Aquatic Environmental Biotechnology and Nanotechnology Division, ICAR-Central Inland Fisheries Research Institute
3. Dr. Francisco Jesús Carmona (Marie Skłodowska-Curie Action Fellow) (Department of Inorganic Chemistry, Universidad de Granada, Granada (Spain))
4. Dr. Pavani P Nadiminti, La Trobe Institute for Agriculture & Food (LIAF) Department of Animal, Plant and Soil Science

After each session, an interactive Q&A session was held. The webinar was attended by more than 160 participants across the globe.

DTD-RNA PARTNERS THAT HAVE JOINED DURING DECEMBER 2020-MARCH 2021

Network Partners



BioNanonet (BNN), Austria

Institute Partners



Developing Agriculture from the Ground Up

International Fertilizer
Development Centre (IFDC), USA

Industry Partners



- ▶ KLR Green Biologicals Pvt. Ltd (KLRGB), Nagarjuna Fertilizers & Chemicals Ltd., India
- ▶ DCM ShriRam Ltd, India
- ▶ Coromandel International Ltd, India
- ▶ Adventz Group (Zuari Agro Chemicals Ltd.), India
- ▶ Croda India Company Private Limited, India
- ▶ Nuziveedu Seeds Ltd and Global Agrigenetics, India
- ▶ Smart Farming Technologies, Netherlands

Upcoming events of DTD-RNA network during October–December 2021

Website: <https://www.teriin.org/projects/dtd-rna/events.php>

- ▶ October: Webinar on 'Waste-Derived Nano-materials: Status, Impact and Future Prospects
- ▶ October: Webinar Series on Waste-Derived Nanomaterials: Part-II - BIO2NANO: BioResources to Sustainable Nanoproducts- Interventions, Current Status & the Future Perspective
- ▶ December - NanoforAgri Conference flagship activity