

## Recent achievements of CSIR-IITR, Lucknow (Year: 2023)

### **[1] Prestigious MoU/MoA:**

CSIR-IITR, Lucknow entered into research collaboration agreement with MARICO LIMITED, Mumbai on March 2, 2023. The broad purpose of this MoU is to engage extensively in R&D on various innovations. The MoU was signed and exchanged at CSIR-IITR, Lucknow in the august presence of Dr N Kalaiselvi, Director General, CSIR.



CSIR-IITR entered into a knowledge-sharing MoU with the Indian Centre for Plastics in the Environment (ICPE), Mumbai on September 9, 2023. The agreement was signed by Dr Bhaskar Narayan, Director-CSIR-IITR in the presence of Dr S.K. Ray, Hon. Secretary, ICPE, and Dr. T.K. Bandopadhyay, Technical Director, ICPE. Under this MoU, CSIR-IITR and ICPE shall work together for scientifically addressing the concerns of the society on plastics, assessing the safety of their constituent chemicals & additives and reaching out to the regulators and policymakers with valid data.



CSIR-IITR and the State Pollution Control Board, Odisha have joined hands to foster collaboration and execute joint research programmes towards the advancement of scientific and technological knowledge for the benefit of society at large. The MoU to this effect was signed on November 4, 2023 at CSIR-IITR, Lucknow in the presence of Dr. K. Murugesan, (IFS) Member Secretary, SPCB, Odisha.



CSIR-IITR, Lucknow and the National Institute of Pharmaceutical Education and research (NIPER), Raebareli (under the Min. of Chemicals & Fertilizers, Govt. of India) have decided to establish a stronger relationship for collaboration and cooperation in areas like pharmacology, nanomaterial toxicology, animal experimental studies, regulatory and environmental toxicology etc. The MoU towards



this academic collaboration was signed on October 12, 2023.

## **[2] CSIR-IITR at the service of Industry:**

- (1) CSIR-IITR, Lucknow and Farelabs Private Limited, Gurugram have joined hands to collaborate on the Development of Certified Reference Materials (CRM) as per ISO 1734:2016 for multi element solution in water matrix. The duration of this project is 2 years and the industry's commitment in the project is Rs. 33.79 lakhs to the Institute (exclusive of GST).
- (2) CSIR-IITR is undertaking the safety assessment of a beverage product developed by Tata Consumer Products Limited (TCPL), Bangalore through GLP mode. This study is for a duration of 14 months and the funding support from TCPL is for Rs. 14.00 lakhs (exclusive of GST).
- (3) CSIR-IITR is executing the pre-clinical safety study of nano-fertilizers for Rashtriya Chemicals and Fertilizers Limited (RCFL), Mumbai. This project, initiated in February 2023, is for a duration of two years and the project charges are Rs. 1.96 crores (exclusive of GST).
- (4) CSIR-IITR is working for the Sivakasi Fireworks Manufacturers Association & Sivakasi Sparklers Manufacturers Association to undertake studies on firework emissions and establish the permissible concentration of Barium Oxide in ambient air. This study has a sponsorship support of Rs. 41.3 lakhs (exclusive of GST) and is for a duration of 12 months.

## **[3] Collaboration with line Ministries & Government Departments:**

- (1) CSIR-IITR has established close collaboration with the **Ministry of AYUSH** to evaluate the pre-clinical safety/toxicity of test formulations. These include:
  - (a) Execution of collaborative project on "Toxicity profile of Mrityunjana Rasa in experimental animals" with Regional Ayurveda Research Institute, Gwalior [*Period: 3 years; Project Value: Rs. 1.05 cr*]
  - (b) Execution of collaborative project on "Toxicity profile of Tribhuvana Kirti Rasa in experimental animals" with CSMCARI, Chennai [*Period: 3 years; Project Value: Rs. 1.12 cr*]
  - (c) Execution of collaborative project on "Toxicity profile of Swaskuthar Rasa in experimental animals" with National Ayurveda Research Institute for Panchkarma, Thrissur, Kerala [*Period: 3 years; Project Value: Rs. 1.02 cr*]
  - (d) Execution of collaborative project on "Toxicity profile of Rasamanikya Rasa in experimental animals" with CARI, Kolkata, West Bengal [*Period: 3 years; Project Value: Rs. 85.60 lakhs*]
- (2) CSIR-IITR has initiated a research project on "Safety assessment of Diethyl phthalate (DEP), an important ingredient in incense stick

(agarbatti) under the exposure of UVR/sunlight” for the **Khadi & Village Industries Commission (KVIC), Ministry of MSME, Govt of India**. The agreement for execution of this project was signed on May 2, 2023.  
*[Period: 18 months; Project Value: Rs. 14.95 lakhs]*

- (3) CSIR-IITR is one of the partners working on the **GEF-United Nations Environmental Programme** (GEF-UNEP) sponsored project on “Screening and budgeting of POPs (PFAS and its related compounds in different industrial sectors, products and environmental matrices from India). The project is for a duration of three years and is being executed in collaboration with CSIR-NEERI, Nagpur. In this project CSIR-IITR has a funding support of Rs. 96.43 lakhs.

#### **[4] Major societal outcomes of the R&D activities taken at CSIR-IITR:**

- (1) **Assessment of air pollution in Lucknow city:** CSIR-IITR has been regularly monitoring Lucknow’s air pollution and giving suggestions for the improvement of air quality. CSIR-IITR has studied air quality status of Lucknow city for each pre-monsoon and post-monsoon seasons since the year 1997 and has been assessing pollutants like PM10, PM2.5, SO<sub>2</sub>, NO<sub>2</sub> and noise levels in ten representative locations grouped in three categories (residential, commercial and industrial). It has been observed that despite all the efforts of the State Government and its agencies the city has seen gradual increase in air pollution levels. The CSIR-IITR studies have attributed this increase to the rapid urban development and massive growth in population. There has been increase in the fine inhalable particulates that aggravate cardiovascular, respiratory and other diseases along with other physiological damages. It was interesting to record that during the COVID19 pandemic, irrespective of locations, the average values of PM10, PM2.5 decreased exponentially.
- (2) **Water quality indexing of Uttar Pradesh:** CSIR-IITR has contributed immensely in various mission mode programs related to water quality analysis of major rivers and their basins. The institute has performed pre- and post-monsoon analysis of groundwater quality in major river basins like Hindon, Ghaghara, Central Ganga, Ramganga and Yamuna in Uttar Pradesh. The Institute has rendered its expertise in studying the water quality of rivers Ganga and Gomti. The NMGC had commissioned CSIR-IITR during Kumbh 2019 for inspection and monitoring of treatment plants to maintain water quality of the river for outdoor bathing. CSIR-IITR was involved in a month-long river rafting expedition “Ganga Amantaran Abhiyan” organized from Devprayag in Uttarakhand to Ganga Sagar in West Bengal. The team was involved in cleaning the ghats and creating awareness about conservation of river and its biodiversity.
- (3) **Detection of SARS-CoV-2:** CSIR-IITR implemented the project “Detection of SARS-CoV-2 in human nasal and pharyngeal samples by RT-PCR method”. The lab for COVID testing was operational since May

4, 2020 and resulted in testing more than 4.2 lakh samples (till August 2021). In addition, CSIR-IITR prepared and distributed more than 4500 litres of hand sanitizer to personnel involved in essential services in the state of Uttar Pradesh.

- (4) **Detection of SARS CoV-2 virus in river Ganga:** During the COVID pandemic CSIR-IITR was entrusted with the arduous job of detection of SARS CoV-2 virus in the river Ganga. The reports of episodic incidents of disposal and burial of dead bodies in the river Ganga in some parts of Uttar Pradesh and Bihar during the second wave of the pandemic had become a National issue and to substantiate the possibility of SARS CoV-2 contamination in river water CSIR-IITR did sampling on the banks of the river Ganga in several locations where dead bodies were reported (like Kannauj, Unnao, Prayagraj, Varanasi, Ghazipur, Ballia, Patna, Bhojpur etc.). The reports found water quality as acceptable and the virus was not detected in the river.

#### [5] Knowhow/Technologies transferred:

CSIR-IITR has transferred the knowhow entitled “SenzHb: Rapid Haemoglobin Test Kit” to M/s Techno Surge Industries Private Limited, Amravati, Maharashtra on September 26, 2023. The knowhow transfer agreement as signed on the 82<sup>nd</sup> Foundation Day of CSIR at New Delhi at Bharat Mandapam in the reverend presence of Dr N Kalaiselvi, Director General, CSIR.

This kit is meant for the estimation of haemoglobin in blood samples. This easy-to-use paper-based colorimetric strip type sensor will be of immense use for point-of-care testing by the health-care workers, where sophisticated instruments are not available and also as a Do-it-yourself (DIY) at home kit.



#### [6] Knowhow/Technologies developed:

(a) **FluoriPCR©: A platform device integrating thermocycler with fluorimeter** (Ready for commercialization)

FluoriPCR©, an advanced DNA-based fluorimeter-embedded device integrates a thermo-cycler with tunable fluorimeter for nucleotide amplification assays and spectroscopy for robust and accurate molecular testing in a compact, stand-alone instrument suitable for both laboratory and field-based applications. The device is equipped with a





thermocycler, UV-Visible LED based interface for applications in PCR, RT-PCR, Fluorescence spectroscopy and UV-Vis Spectrophotometry. The compact instrumentation with result ready technology/portability will enable national regulatory agencies, retailers and consumers, testing laboratories, academic and research institutions to test random samples in the field with high accuracy.

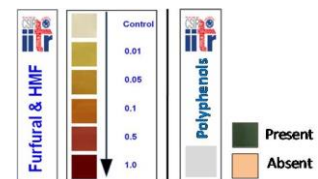
**(b) Milk adulteration detection kit and test-strips** *(Ready for commercialization)*

CSIR-IITR has developed a sensitive strip-type sensor and kit to detect multiple adulterants in milk. The colorimetric response from the strips and kit indicates the presence of specific adulterants. The colour chart provided along with the strips can be used to access the presence of urea, boric acid, detergent, ammonia/ammonium compounds and nitrate/nitrites in milk.



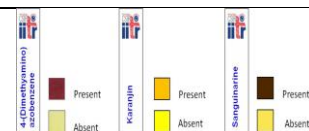
**(c) Test-strips for detection of spoilage in fruit juices** *(Ready for commercialization)*

Storage and transport conditions can have a deteriorative impact on fruit juice and other beverages. Spoilage in fruit juices and beverages manifests in the form of off-flavour and odour resulting from the degradation of the volatile flavour compounds present in juices. Assessing their quantity in packaged juices and beverages can help in identifying the quality of the product. Paper-based sensors and kit has been developed for furfural, hydroxymethylfurfural (HMF) and polyphenols for assessing quality of fruit juices.



**(d) Test-strips for detection of adulteration in edible oils** *(Ready for commercialization)*

High demand and consumption of mustard oil has resulted in increased instances of edible oil adulteration. Adulteration of oil with low quality, toxic oils such as karanja, argemone and dyes such as butter yellow has been known to cause hypertension, dropsy, glaucoma, etc., Strip-type, colorimetric sensors to detect their presence in



edible oils and fats provide a quick and effortless method for ensuring food safety. The strip-type sensor is based on a visual assessment technique and changes colour in the presence of the said adulterants.

**(e) Lignin bioabsorbent gel for wastewater treatment, water conservation and agrochemical applications**

The hydrogel has been prepared by polymerization and simultaneous cross-linking of technical lignin and polyvinyl alcohol. The resultant hydrogel is biodegradable, non-toxic and can be used to treat waste water. Lignin being inexpensive and sustainable can be used for water remediation as the polyphenolic structure and swelling properties of lignin is capable of absorbing heavy metal ions (Cr(III), Cr(IV), Ni(II), As(II), Cd(II), Hg(II), Pb(II), etc. It can also be used for absorption of organic pollutants like dyes.

**[7] Spectrum of major outreach, HRD and training endeavours:**

Under the Jigyasa programme a summer camp was organized at CSIR-Indian Institute of Toxicology Research (CSIR-IITR), Lucknow, from 11-12th and 15-17th May 2023. This was organized as part of the National Technology Week 2023 wherein students learned about different sectors of innovation in the field of toxicology, and techniques used for toxicity assessment from element level to exposome and the role of CSIR-IITR in ensuring the health and environmental safety.



A 5-day DST/SERB sponsored Workshop - KARYASHALA titled "Hands-on Training Course on Toxicology and Pathological Tools and Techniques for Pre-clinical Regulatory Toxicity Studies in Laboratory Animals" was conducted at the CRK Campus of CSIR-IITR from 23 May 2023. This workshop aimed to improve the research productivity of promising PG and Ph.D. students in pre-clinical safety testing toxicology and pathology.



As part of the “AKAM-Rashtriya Boudhik Sampada Mahotsav/ National Intellectual Property Festival” initiative, CSIR-IITR organized an Intellectual Property Rights awareness training session entitled “Nurturing Ideas to Innovation” on July 14, 2023. The program aimed to give insights on identifying and protecting intellectual property, crafting successful strategies for management, commercialization and monetization of IP and legal aspects involved in IPR.



CSIR-IITR conducted the Workshop on Genotoxicity on 14.07.2023 with 44 participants from all over the Country. Knowledge regarding Chromosomal aberrations, Micronucleus assay, Comet assay, and Ames test, was imparted.



CSIR-IITR conducted a workshop on "Microbial Water Safety: Sampling and Testing for Safety Management" from 21.08.2023 to 01.09.2023. The participants were taught basic principles of microbiology including media preparation, plating, plate-steaking, basic principles of working in a Laminar Flow, sampling, testing water samples, and basic statistics.



CSIR-IITR organized a 3-day workshop on “Environmental Pollution Predictions and Apportionment of Sources using Computational Modeling Techniques” from August 16-18, 2023 at its CRK Campus.



CSIR-IITR in collaboration with NABL conducted a three days technical training program on “Analysis of Pesticide residues and contaminants in meat samples using GC-MS/MS technique” from Oct. 4-6, 2023.



The 27th Professor Sibte Hasan Zaidi Oration was delivered on November 3, 2023 by Padma Shri Prof. S. Ayyappan, Former DG-ICAR & Secretary-DARE on the topic “Towards Climate Resilient Farming in India”.

