



PRESS RELEASE

IIT Mandi Researchers Develop Biodegradable Polymeric Microgels for Sustainable Agriculture

Video Byte:

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MANDI, 18th April 2024: A research team from the [Indian Institute of Technology Mandi](#) has achieved a significant breakthrough in sustainable agriculture with the development of natural polymer-based multifunctional smart microgels. These microgels are engineered for the slow release of nitrogen (N) and phosphorus (P) fertilizers over an extended period, presenting a promising solution to enhance crop nutrition while minimizing environmental impact.

As global populations surge towards an estimated 10 billion by 2050, ensuring food security becomes increasingly critical. Agriculture plays a pivotal role in meeting this demand, with fertilizers playing a significant role in boosting crop productivity. However, the inefficiency of traditional nitrogen (N) and phosphorus (P) fertilizers, with absorption rates as low as 30% to 50% and 10% to 25%, respectively, poses challenges in optimizing agricultural output while minimizing environmental impact.

Modern agriculture heavily relies on fertilizer applications to meet the escalating food demand of a growing population. While fertilizers are essential for providing nutrients to plants and improving crop yields, their effectiveness is often compromised by factors such as gaseous volatilization and leaching. Consequently, excessive fertilizer application not only leads to high costs but also has adverse effects on the environment, including groundwater and soil contamination, as well as human health hazards. Therefore, developing technological alternatives that prolong fertilizer release is imperative to facilitate a shift towards sustainable agriculture practices.

The findings of this comprehensive research have been published in the prestigious journal ACS Applied Materials & Interfaces from American Chemical Society. The research work was led by Dr. Garima Agrawal along with her team including Ms. Ankita Dhiman, Mr. Piyush Thaper and Ms. Dimpny Bhardwaj from School of Chemical Sciences, IIT Mandi. The research was funded by the Science and Engineering Research Board, Government of India and the Department of Science & Technology, Government of India.

Explaining the motive of the study, Dr. Garima Agrawal, Assistant Professor, School of Chemical Sciences, IIT Mandi, said, “We have developed natural polymer-based multifunctional smart microgels for the slow release of urea over longer period. These



microgels also act as a potential source of phosphorus for plants and are cost effective, biodegradable and environment friendly.”

Further Dr. Agrawal added, “The microgel formulation is eco-friendly and biodegradable, as it is made with natural polymers. It can be applied by mixing it into the soil or by spraying it on plant leaves. Recent studies with maize plants have shown that our formulation greatly improves maize seed germination and overall plant growth compared to pure urea fertilizer. This sustained release of nitrogen and phosphorus fertilizers helps crops thrive while cutting down on fertilizer use.”

These findings pave the way for sustainable agriculture, offering a promising solution to optimize nutrient supply, enhance crop yields, and mitigate environmental challenges associated with traditional fertilizers.

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About [IIT Mandi](#)

IIT Mandi has nine Academic Schools and five major Research Centers. The Schools are the School of Biosciences and Bioengineering (SBBE), School of Chemical Sciences (SCS), School of Mathematical and Statistical Sciences (SMSS), School of Physical Sciences (SPS), School of Mechanical and Materials Engineering (SMME), School of Civil and Environmental Engineering (SCENE), School of Computing and Electrical Engineering (SCEE), School of Humanities and Social Sciences (SHSS), and School of Management (SOM). The Centers are Advanced Materials Research Centre (AMRC), Centre for Design and Fabrication of Electrical Devices (C4DFED), BioX Centre, Indian Knowledge System and Mental Health Applications Centre (IKSMHA Centre) and Centre for Artificial Intelligence and Robotics.

The Institute offers B.Tech. programs in seven different streams, one M.A. program, ten M.Tech. programs, nine Ph.D. programs, and one iPh.D. program. The unique, project-oriented B.Tech. curriculum is centered around its 4-year long Design and Innovation stream. Since the inception of the Institute, IIT Mandi faculty have been involved in over 275 Research and Development (R&D) projects worth more than Rs. 120 crores.

IIT Mandi established the IIT Mandi iHub and HCI Foundation (iHub; a section-8 company) on its campus at Kamand with significant funding of INR 110 crores from the Department of Science and Technology (DST), Government of India. The iHub is planned to fuel research and technology development, skill development, startup and innovation, and collaborations in the HCI and allied AI/ML areas in India. IIT Mandi is the only second-generation IIT to be featured at rank 7 in the Atal Ranking of Institutions on Innovation Achievements of the Innovation Cell, Ministry of Education, Govt. of India.

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