



PRESS RELEASE

IIT Mandi researchers develop an anti-bacterial, self-cleaning material for Face Masks and PPE Equipment

The developed nanomaterial can clean the mask by simply keeping it in bright sunlight and make it ready to wear again

Video file of Dr. Amit Jaiswal explaining his research is available at this link:

<https://fromsmash.com/d.t1MjOZhg-dt?e=a2FqYWwueWFkYXZAZm9vdHByaW50Z2xvYmFsLmNvbQ%3D%3D>

MANDI, 19th April 2021: Indian Institute of Technology Mandi researchers have developed a virus-filtering, self-cleaning and antibacterial material that can be used to make face masks and other PPE equipment. This path breaking development of Dr. Amit Jaiswal, Assistant Professor, School of Basic Sciences, IIT Mandi, along with his research scholars, Mr. Praveen Kumar, Mr. Shounak Roy, and Ms. Ankita Sarkar comes at a time in which it has become imperative to develop techniques to stop the second wave of the COVID-19 pandemic in the country.

Results of this work have recently been published in the prestigious journal of the American Chemical Society - Applied Materials & Interfaces.

Facemasks have (or must) become a default piece of apparel to be worn in public in these pandemic times. They are largely designed to act as a physical barrier between the wearer and the external environment, but in reality, must also act as anti-microbial agents to inhibit or kill pathogens. This is especially important in the case of reusable masks, which are a necessary alternative to single use masks that add to littering and pollution issues, and secondary infections.

“Keeping the urgency of the pandemic situation and cost-effectiveness in mind, we have developed a strategy to repurpose existing PPEs, especially face masks, by providing an antimicrobial coating to these protective clothing/textiles,” **said Dr. Jaiswal.** For this, the research team has used such materials that are a hundred thousand times smaller than the width of the human hair to confer antimicrobial properties to polycotton fabric

Dr. Jaiswal and his team has incorporated nanometre sized sheets of molybdenum sulphide, MoS₂, the sharp edges, and corners of which act as tiny knives that pierce bacterial and viral membranes, thus killing them. *“The ‘nanoknife’-modified fabrics demonstrated excellent antibacterial activity even after 60 cycles of washing,”* **said the lead researcher,** which makes this an excellent way to reuse masks and reduce biological waste generation.



Dr. Jaiswal reminds us that improperly disposed off PPEs are a serious secondary source of transmission, and having reusable antimicrobial masks can help circumvent this risk. The reusability of the fabric will also enable it to be integrated with homemade masks.

In addition to puncturing the microbial membranes, the nanosheets of molybdenum sulfide enable disinfection when exposed to light. Molybdenum sulphide exhibits photothermal properties, i.e., it absorbs solar light and converts it into heat, which kills the microbes. *“Within 5 min of solar irradiation, all the MoS₂-modified fabrics showed 100% killing of both E. coli and S. aureus,”* **wrote the authors in their recently published paper.** Thus, merely hanging out the masks in bright sunlight can clean the mask and make it ready to wear again.

The researchers have developed prototypes of a 4-layered face mask using the MoS₂ modified fabric. They report that these masks, in addition to killing microbes and being light-cleanable, can also filter >96% of particles that are in the size range of the COVID Virus (120 nanometres), without compromising on the breathability of the fabric, and could thus be a powerful tool to prevent the spread of coronavirus and other microbial infections.

“We expect that the impact of this innovation on society will be immense and immediate, considering the current situation of global COVID-19 pandemic,” **said Dr. Jaiswal.** The proposed materials can also be used to fabricate screens/sheets for creation of makeshift isolation wards, containment cells and quarantines for holding individuals who come in contact with pathogens.

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About IIT Mandi

Since the first batch of 97 students joined in July 2009, IIT Mandi has grown to currently host 125 faculty and 1,833 students who are enrolled in various programmes of studies in undergraduate, postgraduate and research programmes, and 1516 alumni. IIT Mandi is a fully residential campus with 1.4 lakh sq. m. buildings completed. It has a guest house with 88 rooms, a 750-seater Auditorium, campus school, sports complex and hospital.

IIT Mandi has four Academic Schools and three major Research Centers. The Schools are: School of Computing and Electrical Engineering, School of Basic Sciences, School of Engineering, and School of Humanities and Social Sciences. The Centers are: Advanced Materials Research Centre (AMRC; set up with an investment of Rs. 60 crores), Centre for Design and Fabrication of Electrical Devices (C4DFED; has Rs. 50 crores worth of fabrication tools), and BioX Centre (has acquired research equipment worth Rs. 15 crores). In 2017, the Department of Biotechnology, Government of India, selected IIT Mandi to lead the prestigious Rs. 10 crore FarmerZone® Project.

To cater to the growing and changing needs of the Indian industry and the aspirations of students, IIT Mandi has introduced 7 B.Tech., 7 M.Tech., 5 M.Sc., 4 Ph.D., 1 I-Ph.D and 1 M.A



programmes in the past 10 years. The unique, project-oriented B.Tech. curriculum is centred around its 4-year long Design and Innovation stream. From August 2019, IIT Mandi started 3 new and unique B. Tech. programmes in Data Science and Engineering, Engineering Physics, and Dual Degree in Bioengineering.

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 crore. In the past 10 years, the Institute has signed a Memorandum of Understanding (MoU) with as many as 11 international and 12 national universities.

IIT Mandi Catalyst, the first Technology Business Incubator in Himachal Pradesh, has helped over 75 startups since 2017 and is changing both the industry profile and entrepreneurial mindset in the state. So far, Catalyst has secured external funding of Rs. 24 crores from various funding agencies. Enabling Women of Kamand Valley (EWOK) is another innovative programme run by IIT Mandi, which focuses on imparting skills training to rural women to enable them to start village-scale businesses.

IIT Mandi has been ranked no. 31 in the Engineering Institutions Category in the [India Rankings 2020](#) released by National Institutional Ranking Framework, Ministry of Education, Govt. of India. Apart from this, IIT Mandi is the only second-generation IIT to be featured at rank no. 7 in the Atal Ranking of Institutions on Innovation Achievements, of the Innovation Cell, Ministry of Education, Govt. of India.

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