



Press Release

IIT Mandi researchers use diesel soot to mop up oil and organic chemicals from water

MANDI, 6th February 2019: Researchers at Indian Institute of Technology Mandi have used the soot emitted by diesel engines to mop up oil and other organic pollutants from water. Their work has been recently published in the journal - Environmental Science and Pollution Research (<https://link.springer.com/article/10.1007%2Fs11356-018-4045-0>).

Although diesel engines are known to be superior to other internal combustion engines in terms of lower fuel consumption and better energy release efficiencies, they are associated with significant amounts of particulate emissions. The particulates largely comprise soot, which is formed in the fuel rich regions of the burning diesel jets. Increasing environmental concerns and stringent emission standards require development of both conventional and unconventional means for reducing soot. Studies in this area have focused on improving the engine design and incorporating special filters and treatment units at the exhaust end of the vehicle.

Dr. Rahul Vaish, Associate Professor, School of Engineering at IIT Mandi and his research students Vishvendra Pratap Singh and Moolchand Sharma have looked at this problem from a different perspective. They rationalized that while it is impossible to bring down soot emissions to zero, it is possible to find use for the soot produced.

"Carbon species such as carbon nanotubes, graphene, and candle soot have shown their potential in many fields", says Dr. Vaish, "so why not automobile soot?"

It is known that carbon species can adsorb various organic pollutants in water. Carbon nanotubes, filter paper, mesh films, and graphene have been used for removing oil from water. Given that the typical carbon content of soot is between 90 and 98%, the team explored the possibility of using this pollutant as an adsorbent of oil and organic contaminants in water. "There is a rapid increase in oil and chemical leakages from oil tankers or ships and industrial accidents with expansion in oil production and transportation in the last few decades", the authors write in their recently published paper, justifying the need for new materials to mop up oil and prevent catastrophic environmental outcomes.

In an earlier study, Dr. Vaish used candle soot to successfully remove two cationic dyes, rhodamine B and methylene blue from water, thereby showing the possibility of organic



chemical removal by soot. Extending this earlier work, the research team incorporated diesel exhaust soot into polymer sponges to study their capability to adsorb oil and other organic materials from water. This hydrophobic sponge showed high absorption capacity for various oils, without need for complex pretreatments. The researchers found that the highest oil absorption capacity was 39 g/g for engine oil. An interesting observation was that the sponges were recyclable and retained 95% efficiency even after 10 cycles.

The diesel soot impregnated sponge could also absorb pollutants like methylene blue, ciprofloxacin, and detergent from the water. This has practical implications.

"Apart from oil spills, organic pollutants such as traces of dyes and detergent coming from industries and households are a major contributor to water pollution", says Dr. Vaish. The soot impregnated sponge can help in developing cost-effective remediation processes for common domestic and industrial pollutants. Such a development would additionally serve to repurpose automobile waste.

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About IIT Mandi (<http://www.iitmandi.ac.in/>)

Nestled in Sivalik Range of the Himalayas, IIT Mandi is fast emerging as a leader in science and technology education, knowledge creation and innovation, in an India marching towards a just, inclusive and sustainable society. Since the first batch of students took place in July 2009, IIT Mandi has grown to host 1,276 students including 274 PhD, 46 MS and 17 I-Ph.D. research scholars, 104 Faculty, 150 staff, and attracted funding to the tune of over Rs.70 crore for Research Projects. A growing body of alumni, nearly 850 in number, will become the champions of this institute as they assume leadership positions in industry, academia and administration.

From 1,280 students in 2018, the Institute aims to grow to 5,000 B.Tech, M.Tech/M.Sc. and M.S./Ph.D. by 2029. Currently, the campus has completed about 80,000 sq.m. of construction. Another 1,50,000 sq.m. is currently under construction. IIT Mandi has a fully residential campus with all students and 95 percent of the faculty residing within it.

Since 2010, IIT Mandi's faculty has bagged nearly 180 projects worth more than Rs. 85 Crore. IIT Mandi, in just 9 years of its existence, has been able to develop several labs and facilities on its campus here at Kamand, creating an extraordinary research ambiance. The Advanced Materials Research Centre (AMRC), created with an investment of about Rs. 50 crore, houses advanced instruments for the characterization of materials with scope for drug delivery, electrical, electronics and biological applications. Since its inception in 2013, the AMRC has contributed to more than 200 research publications.

The institute has an Interdisciplinary Academic Culture which is Design-oriented. The B.Tech. curriculum focuses on Real-World team projects from the Year One to Four A strong humanities



component as well makes the IIT Mandi curriculum even more relevant to the society at large. There are many active MoUs with TU9 in Germany since May 2011.

Launched in 2016, IIT Mandi's very own technology-business incubator Catalyst is the first Technology Business Incubator (TBI) in Himachal Pradesh. It aims to incubate technology-based startups focused on economic and/or social impacts. EWOK (Enabling Women of Kamand Valley) is another very innovative program being run by IIT Mandi which focuses on Skills training village-scale businesses by village women using Internet and pervasive mobile network and Serving local and global customers.

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