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IIT-M develops injectable hydrogel to replace weeks of daily medication for fibrosis patients

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Patented technology uses biodegradable biomaterials for targeted, sustained drug delivery



Indian Institute of Technology Madras (IIT-M) has developed an injectable hydrogel that could transform the treatment of fibrosis and other chronic degenerative conditions by replacing weeks of repeated medication with a single localised dose.

The researchers estimate that treatment could possibly reduce therapy costs from approximately \$2,000–3,000 per course to around \$300, potentially making advanced fibrosis care more affordable and accessible.

Developed at the Tissue Engineering and Biomaterials Laboratory, Department of Biotechnology, IIT Madras, the innovation is designed to deliver antifibrotic and anti-inflammatory drugs directly at the affected site in a sustained and controlled manner.

A key differentiator of this patented technology is its use of combination of naturally derived biomaterials obtained from silk cocoons and seaweed. These materials are biodegradable, biocompatible, and aligned with India's strengths in sericulture and its emerging seaweed-based bioeconomy.

The hydrogel combines therapeutic delivery with tissue healing support, creating a favourable environment for healthy cell growth while reducing inflammation and fibrosis. The hydrogel also responds to disease-related inflammation, releasing higher doses when needed while gradually degrading without leaving any harmful residue.

Furthermore, the research team has performed a first-of-its-kind omics study to prove that these smart-tuned hydrogels inhibit the progression of fibrosis by regulating the mechanical properties and metabolism of the cells.

Elaborating on the need for such research, Prof. Vignesh Muthuvijayan, Department of Biotechnology, IIT Madras, said, *"Fibroproliferative diseases, including pulmonary, liver, kidney and muscle fibrosis, are linked to nearly 45% of deaths globally. Existing treatments often require prolonged drug administration, can cause significant side effects and are frequently unable to stop disease progression effectively at the targeted site."*

Follow-up studies conducted in collaboration with the University of California, San Diego have also demonstrated efficacy across multiple disease models, particularly in aged muscle tissue. The preliminary study shows that hydrogel has potential in treating sarcopenia, an age-related loss of muscle mass and strength that affects an estimated 10 to 16 per cent of the global elderly population and currently has no approved pharmacological treatment.