



# IIT MADRAS

Indian Institute of Technology Madras

Technology Transfer Office  
TTO - IPM Cell



## Industrial Consultancy & Sponsored Research (IC&SR)

### DRUG LOADED PLASMONIC CORE-SHELL ELECTROSPUN NANOFIBRES FOR LASER MEDIATED INTRACELLULAR DELIVERY

**IITM Technology Available for Licensing**

#### PROBLEM STATEMENT

- Generally, it is noted that control over cell behaviors & cellular fates helps in various biomedical fields such as treating cancers, cell-based therapies, and tissue engineering.
- Electrospun nanofibre has been proven & in order to increase the functionality of the nanofiber scaffolds, core-shell nanofibres are being developed.
- Core-shell nanofibres constitute a biphasic scaffold with distinct inner core and the outer shell. The variation in core & shell chemical, & physical properties provides **higher degree of functionalization to target drug/gene/biomolecule delivery.**
- Further a few patent literature has discussed, however unable to provide solution as discussed in the present invention.

#### INTELLECTUAL PROPERTY

**IITM IDF Ref. 2262; Patent No: 409682**

#### TECHNOLOGY CATEGORY/ MARKET

**Technology: Nanofibres;**

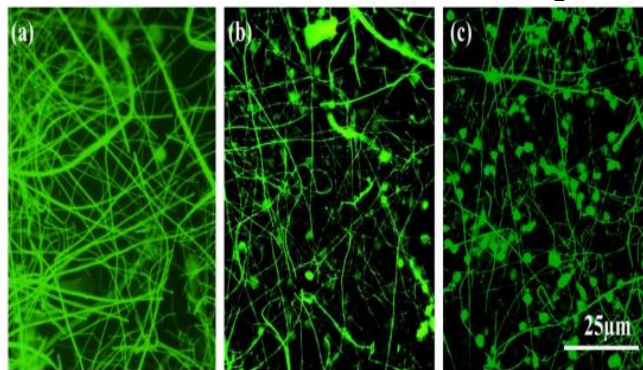
**Industry:** Pharmaceutical; **Applications:** Pharmaceutical & Drugs, Bio-medical Engineering;

**Market:** The global nanofibers market is projected to grow at a **CAGR of 24%** during 2021 to **2025**;

#### TECHNOLOGY ALONG WITH IMAGE

- The present invention describes a **core-shell nanofiber**. Said core-shell nanofiber comprising: **an inner core, & an outer shell.**
- Said **inner core** comprises **hydrophilic polymer and an active ingredient.**
- Further, the outer shell comprises a **hydrophobic polymer and plasmonic nanoparticles.**

- Moreover, present invention describes a **method of preparing a core-shell nanofibre**, & a **method to deliver the active ingredient to cells on-demand by laser mediated drug delivery technique.**
- Discussed a method for preparing **core-shell nanofibres** composed of hydrophilic core with **an active substance (drug) reinforcement** and **hydrophobic shell with plasmonic nanoparticles**, by dual syringe system based electrospinning. (Refer Figure)
- Subject matter includes the fabrication of **core shell electrospun nanofibers** composed of hydrophilic polyvinyl alcohol (PVA) core with curcumin drug reinforcement & hydrophobic polycaprolactone(PCL) shell with **gold nanoparticles.**
- The **core-shell electrospun nanofibres** mediated laser based optoporation for drug delivery has performed on the neurons cell shown in figure.1



#### TRL (TECHNOLOGY READINESS LEVEL)

**TRL- 4**, Proof of Concept ready, validated

#### RESEARCH LAB

**Prof. Tuhin Subhra Santra**  
Dept. of Engineering Design

#### CONTACT US

**Dr. Dara Ajay, Head**  
Technology Transfer Office,  
IPM Cell- IC&SR, IIT Madras

**IITM TTO Website:**  
<https://ipm.icsr.in/ipm/>

Email: [smipm-icsr@icsrpis.iitm.ac.in](mailto:smipm-icsr@icsrpis.iitm.ac.in)  
[sm-marketing@imail.iitm.ac.in](mailto:sm-marketing@imail.iitm.ac.in)  
Phone: +91-44-2257 9756/ 9719

### TECHNOLOGY IMAGES

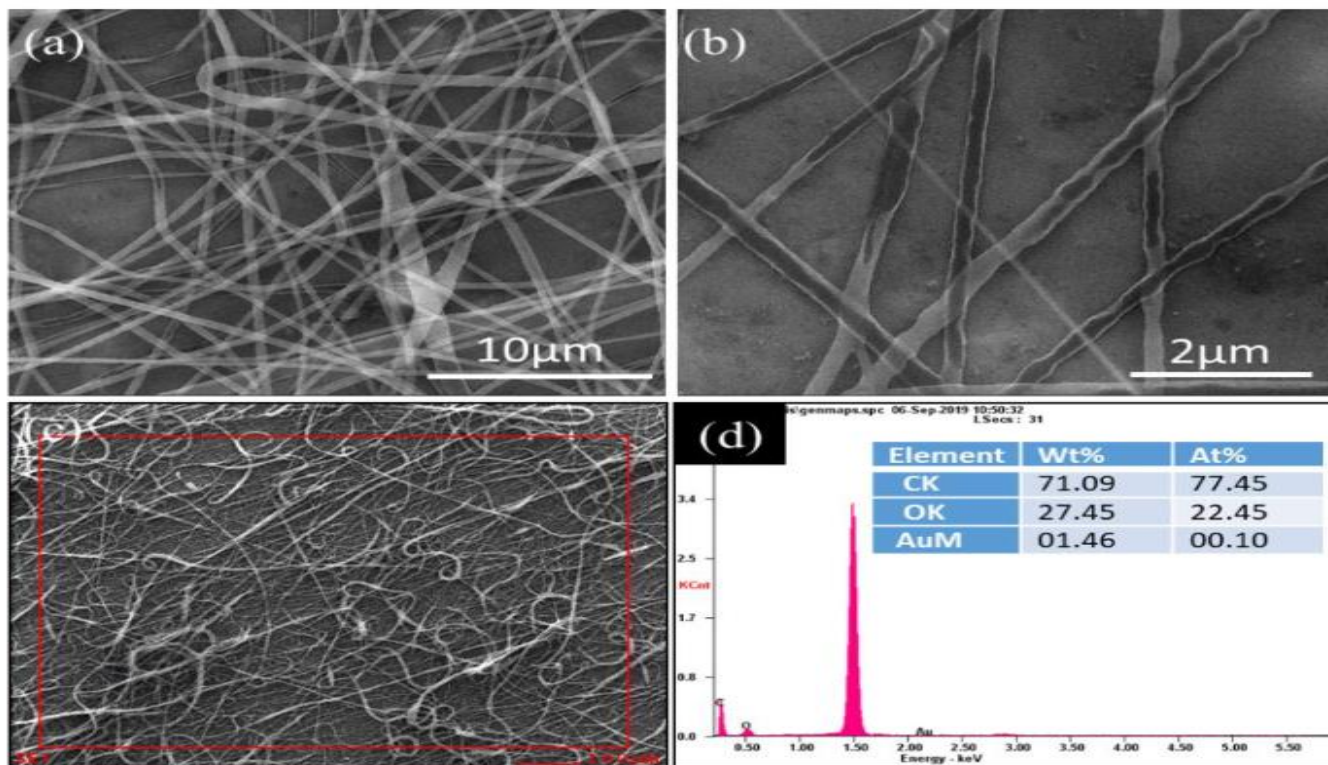


Figure 2: Illustrates scanning electron microscopy (SEM) images showing morphology of the core-shell nanofibers (a, b). Image (c) shows a representative area for which Energy Dispersive Analysis X-Ray (EDAX) was taken. Image (d) shows elemental analysis in EDAX graph for the selected area.

### KEY FEATURES / VALUE PROPOSITION

#### ❖ Technical Perspective:

1. Claimed invention provides a **method to deliver the active ingredient to the site of action without destruction of cells.**
2. The development of **core-shell nanofibre based laser assisted drug delivery process** is shown in the **flowchart.**

#### ❖ Industrial Perspective:

- The plasmonic nanoparticles are gold nanostar nanoparticles.
- the average diameter **of** core-shell structure of the nanofibers was found to be approximately 300 nm based on Fig. 2a,2b.

### Flow Charts - Preparing a Core-shell Nanofiber

**Dissolving hydrophilic polymer in distilled water and mixing it with an active ingredient to make a first mixture**



**Dissolving hydrophobic polymer in a polar solvent and mixing it with plasmonic nanoparticles to make a second mixture**



**Adding first mixture in syringe 1 and second mixture in syringe 2, and Electrospinning the mixtures**

### CONTACT US

**Dr. Dara Ajay, Head**  
Technology Transfer Office,  
IPM Cell- IC&SR, IIT Madras

**IITM TTO Website:**  
<https://ipm.icsr.in/ipm/>

Email: [smipm-icsr@icsrpis.iitm.ac.in](mailto:smipm-icsr@icsrpis.iitm.ac.in)  
[sm-marketing@imail.iitm.ac.in](mailto:sm-marketing@imail.iitm.ac.in)  
Phone: +91-44-2257 9756/ 9719