

Pfibrolizer: A new paradigm for large scale electrospinning from lessons learnt from Malaysian kitchen

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INTRODUCTION

Electrospinning is a fiber production method, in which a liquid droplet is electrified to generate a jet, followed by stretching and elongation to generate fibers. Electrospinning setup mainly consists of 3 parts, a spinneret, high voltage source and a collector. The currently available electrospinning spinneret in markets has several drawbacks which limits its efficiency. Inspired from the Malaysian kitchen, we have designed a simple electrospinning spinneret head which is beneficial for large scale nanofiber production. This design also allows the user to easily modify the spinneret according to the requirements of morphology and number of fibers.



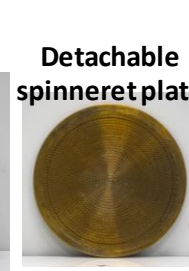
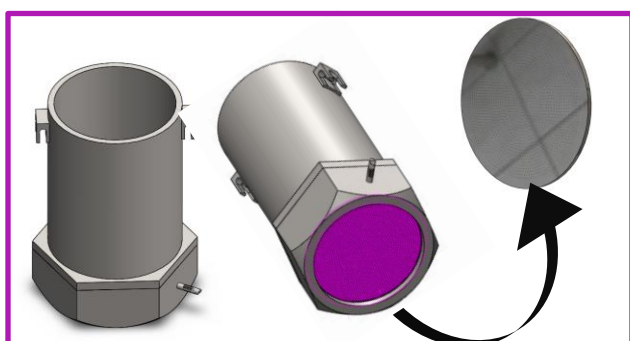
MARKET VALUE & SCOPE

- The Global Nanofibers Market projected to grow at a CAGR of 26.6% from USD 490.1 million in 2019 to USD 3.10 billion in 2027.
- The demand for large scale production of nanofibers have rapidly increased since the SARS- COVID19 pandemic.
- The forthcoming smart textile industry would elevate the market value of nanofibers and the need for upscaling the nanofiber production.

DESIGN & PROTOTYPE



Inspired from the Puttu mayam making protocol, a design for a pfibrolizer was developed to upscale the production of nanofibers from its current standards. The design of the prototype was generated using Solid works software. The pfibrolizer is intricately designed to address the demands of a spinneret head upon upscaling production, such as, high yield, low wastage, simplicity in design, ease of maintenance, adaptability according to the requirements. The pfibrolizer houses a cylindrical reservoir, spinneret plate and a cap. The spinneret plate is easily detachable by removing the cap and can be replaced with a spinneret plate suiting the application requirement.



Specifications

- 100 mm diameter x 150 mm height.
- 1020 holes with 0.4 mm diameter.
- 1.5L reservoir capacity.

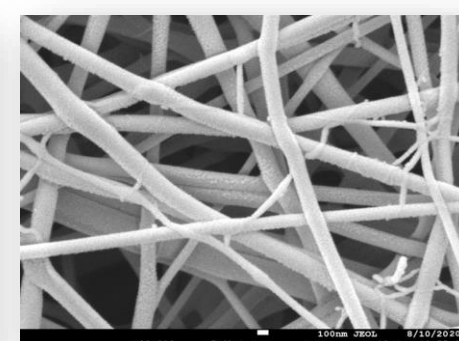
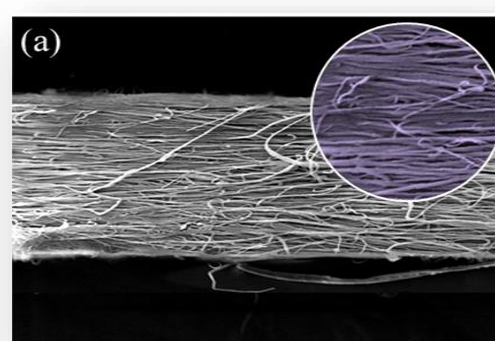
RESULTS



Pfibrolizer installed setup



As spun PVDF fibre



SEM images of the as-spun fiber at different magnifications. The fibre produced are highly uniform

ENVIRONMENTAL IMPACT

The design of the pfibrolizer relies on hydrostatic pressure which completely eliminates the requirement of conventional solution injection system. This reduces the energy consumption.

The Pfibrolizer has a unique design that reduces the wastage of polymeric solution.

BENEFITS

- Simple design
- High throughput
- Uniform fibre production
- Adaptable design that suits various requirements of fibre production
- Ease of maintenance
- Continuous operation

RESEARCH INFORMATION

- This project is supported by UMP PRECOM GRANT UIC 190302

The prototype of the pfibrolizer has been designed, fabricated and tested successfully. Synthesis of charge storage yarns are for smart textile are on-going.

A patent protection for this innovation is planned for submission.