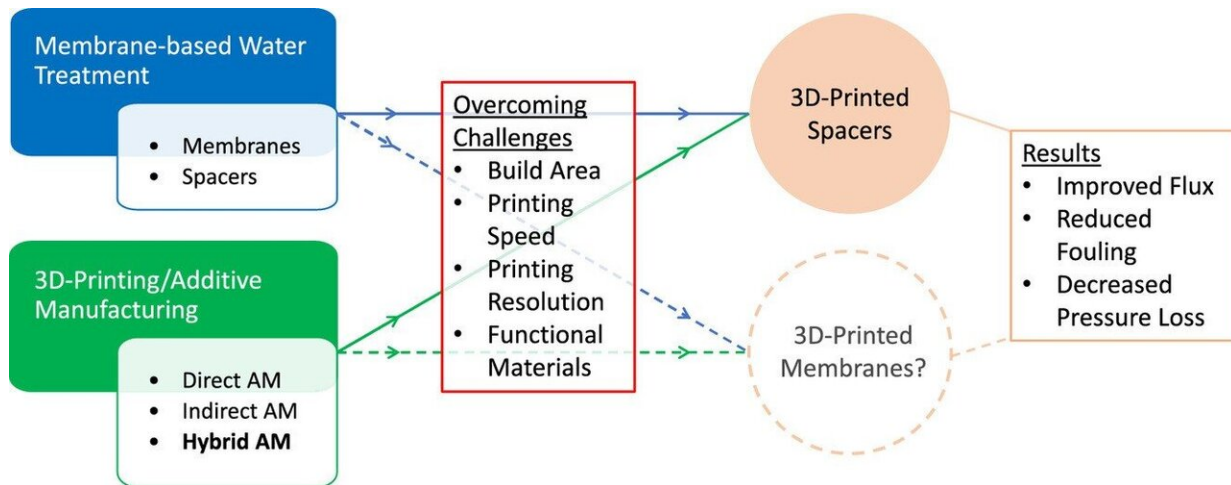


New insights into 3-D printing of spacers and membranes for water treatment

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Overview of the relationship between 3D printing and membrane-based water treatment industry. Credit: SUTD

3-D printing has seen great advancements in various aspects over the past few decades, and many industries have witnessed innovative breakthroughs in their respective fields. Amongst them, the water treatment industry in particular has reaped the benefits of 3-D printing. High performance spacers and membranes can be fabricated by 3-D printing technologies, and they help increase production while minimizing energy consumption in purification processes.

Researchers from Nanyang Technological University (NTU) and the

Singapore University of Technology and Design (SUTD) reviewed the recent efforts and shortcomings as well as the conflicting reports of 3-D [printing](#) in [membrane](#)-based water treatment. Their [research paper](#) entitled "A review on spacers and membranes: Conventional or hybrid additive manufacturing?" has been published in *Water Research*.

In the paper, they discussed the potential of 3-D printed spacers. The great freedom of design in 3-D printing enables the fabrication of complex and innovative spacers, which was previously impossible with conventional heat extrusion methods. These spacers were able to reduce the number of dead zones within flow channels, and help mitigate detrimental membrane fouling problems. Some [spacer](#) designs such as the helical spacer, turbospacer, and column spacer were even able to reduce energy consumption.

An interesting perspective was also presented in the paper regarding the feasibility of 3-D printed membranes. Microfiltration membranes (MF) with pore sizes

In an attempt to resolve this confusion, the paper critically analyzes these 3-D printed membranes, especially with regard to 3-D printing's role in the overall fabrication process. Hybrid additive manufacturing, a process where 3-D printing is used in conjunction with other established fabrication methods, is also introduced in the paper. It shows how 3-D printing can still be a powerful tool in the fabrication of membranes when used together with other established processes despite its inadequate printing resolution.

"3-D printing is gradually evolving from a single-standalone process to a multi-integrated process. The application continues to grow in the [water treatment](#) industry, especially the membrane-based technologies. Future focus is expected to shift from lab scale prototyping to large scale manufacturing," said principal investigator Associate Professor Chong

Tzyy Haur from NTU.

"It will be a challenge to overcome upscaling and material limitations, but consistent research efforts are already evident today. Potentially, 4-D printing can even be a possibility in the future to fabricate smart spacers and membranes that adapt to their surrounding environment," explained co-author Professor Chua Chee Kai from SUTD.

More information: Jing Wee Koo et al, A review on spacers and membranes: Conventional or hybrid additive manufacturing?, *Water Research* (2020). [DOI: 10.1016/j.watres.2020.116497](https://doi.org/10.1016/j.watres.2020.116497)

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