

# Efficient Synthesis of Fluorinated Nanochannels for Water Desalination Technology

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## Summary

One of the Sustainable Development Goals (SDGs) adopted at the UN Summit in 2015 was the development of technologies to obtain safe water. This is due to the explosive population growth in developing countries in recent years and the dramatic changes in lifestyles associated with economic development, which have led to a rapid increase in the demand for drinkable water on a global scale. It is estimated that about 4 billion people on the planet are currently facing serious drinking water shortages, and this situation is expected to worsen in the future. However, the current desalination efficiency is far from sufficient to solve the global shortage of drinkable water, and the development of an innovative technology for selective and rapid water filtration is strongly desired.

We were inspired by the high-water repellency of polytetrafluoroethylene, a fluorinated polymer, and developed "fluorinated nanotubes," whose inner walls are densely covered with fluorine atoms to filter water at an extremely high speed. The fluorinated nanotubes, formed by one-dimensional assembly of macrocyclic fluorinated nanorings, exhibited a water permeability that is 4500 times higher than that of aquaporins, natural water channel proteins. However, the synthetic yield of the fluorinated nanorings was only about 0.0055%, which is too low for mass production at this time. In this study, we developed a new synthetic method based on peptide solid-phase synthesis for highly efficient synthesis of fluorinated nanotubes.

We focused on the structure of natural amphiphilic helical peptides and replaced some of their amino acid residues with artificial amino acids containing fluorine atoms. We succeeded in synthesizing the desired molecule by repeating the deprotection and coupling reactions on a solid-phase support using various amino acids protected with Fmoc groups. The final isolated yield after 47 steps was 2%, which was 364 times higher than that of the conventional method.