**Title:**

**Antimicrobial surfactant-incorporated antibiofouling thin film composite membranes**

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**Abstract:**

Polyamide (PA) thin film composite (TFC) membranes are widely used in desalination and water treatment owing to their high permselectivity and easy scalability. However, PA TFC membranes critically suffer from biofouling, surface accumulation of microorganisms, which significantly reduces separation efficiency and thus increases process costs.

PA TFC membranes are typically fabricated via interfacial polymerization (IP) of multifunctional amine and acyl chloride monomers on a porous support. Various antifouling additives have been added to reaction media during the IP process to endow the fabricated membrane with antibiofouling function. Unfortunately, the use of additives often resulted in the performance deterioration of the fabricated membrane.

In this study, we propose a facile strategy to enhance the biofouling resistance of the PA TFC membrane even with improving its separation performance. We simply added a cationic antimicrobial surfactant, benzalkonium chloride (BAC), to an amine aqueous solution during the IP process. The optimal addition of BAC resulted in the formation of a more permselective PA layer than that prepared without BAC, thus improving separation performance. This benefit was attributed to the role of BAC as a surfactant that can improve support wettability and facilitate the IP reaction. Importantly, BAC, as an antimicrobial additive, was strongly incorporated into the PA network, which imparted the membrane with antibiofouling and antibacterial performance. The enhanced separation and antibiofouling performance of the BAC-assisted TFC membrane remained unchanged during long-term operation, demonstrating the robust implantation of BAC. Our proposed strategy provides a new and facile platform to fabricate functional membranes that can be used in various applications.