**Supporting Information**

**Developing an antibacterial super-hydrophilic barrier between bacteria and membrane to mitigate the severe impacts of biofouling**

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To optimize the appropriate distribution amount of TiO2 NPs on the membrane surface, different amounts of NPs were immobilized on the membrane. The used distribution amounts included 3.04 g m-2, 7.71 g m-2, 15.4 g m-2, and 30.86 g m-2. The selection of appropriate amount was made by analyzing the internal resistance of the membranes, which was calculated using equation given below:

$$R\_{m}=\frac{∆P}{µJ\_{w}} (1)$$

where *Rm* is internal resistance of the membrane, *∆P* is applied pressure (0.1 MPa), *µ* is the viscosity of water, and *Jw* represents pure water flux.



**Figure S1:** Optimization of distribution amount of TiO2 NPs on the membrane surface

Figure S1 presented the results of the internal resistance of the membranes when different amounts of NPs were immobilized on the membrane surface. It was found that the internal resistance of the membranes decreased about a half comparing to the membrane without TiO2 NPs, which indicates more water passing through the membrane. However, no significant differences were found among the internal resistance of membranes with different distribution amount of TiO2 NPs on the surface. Based on the obtained results, least amount of TiO2 NPs was selected as an appropriate distribution amount on the membrane surface.

1. **Confirmation of TiO2 NPs on the membrane surface**

To confirm the presence of TiO2 NPs on the membrane surface, energy dispersive X-ray spectroscopy (EDS, X-Max 80, AZtec) was used. The membrane samples were air dried before testing. The presence of elemental Ti was mapped on the surface to express the presence of TiO2 NPs.



**Figure S2:** Presence of elemental Ti (green dots) on the membrane surface by EDS mapping.

Figure S2 presented the elemental Ti analysis of surface of the SaT-PPT membrane using EDS mapping. The presence of elemental Ti (green dots) on the whole surface indicated that the surface of membrane was completely covered by TiO2 NPs. The presence of TiO2 NPs was also expressed using membrane surface characterization (low contact angle and more negative zeta potential). However, EDS mapping ascertained that the changes in membrane surface characterization were the impact of presence of TiO2 NPs on the surface.

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