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Progress and perspectives for synthesis of sustainable antifouling composite membranes containing *in situ* generated nanoparticles

Xin Li[a,b], Arcadio Sotto[c], Jiansheng Li[b*], Bart Van der Bruggen[a,d*]

[a]Department of Chemical Engineering, KU Leuven, Celestijnenlaan 200F, B-3001 Leuven, Belgium

[b]Key Laboratory of Jiangsu Province for Chemical Pollution Control and Resources Reuse, School of Environment and Biological Engineering, Nanjing University of Science and Technology, Nanjing 210094, China

[c]School of Experimental Science and Technology, ESCET, Rey Juan Carlos University, 28933 Móstoles, Madrid, Spain

[d]Faculty of Engineering and the Built Environment, Tshwane University of Technology, Private Bag X680, Pretoria 0001, South Africa

lijsh@mail.njust.edu.cn

Bart.VanderBruggen@kuleuven.be

[*]Corresponding author. Tel./Fax: +32 16 322340.

Abstract:

Polymeric membranes enhanced by nanoparticles have received great attention over the past decade due to their abilities to meet the growing demand in addressing the global scarcity and pollution of water resources. Many efforts have been devoted to improve the membrane performance using this strategy, and to develop novel applications via molecular-level design for nanoparticle-polymer systems. Recent advances in applying *in situ* preparative techniques in polymeric membrane can potentially lead to new classes of nano-enhanced membranes for advanced water purification. Considering the increasing interest in this field related to the potential for controlling the dispersion and stability of nanoparticles, we review the progress of *in situ* preparative techniques for water purification. Categories of *in situ* preparative techniques are elaborated in detail, primarily focusing on the mechanism of the sol-gel process and *in situ* chemical reduction, which are considered as the most common applications of *in situ* preparative techniques. We also describe the effect of binding styles of nanoparticles (*in situ*