UTILIZATION OF ADVANCED OXIDATION PROCESSES FOR ADVANCED MEMBRANE SEPARATION OF OIL CONTAMINATED WATERS

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Abstract

Water source protection is a major challenge of the 21st century [1], therefore continuous developments of available wastewater treatments are necessary. Hazardous oily contaminants can be effectively purified by the available membrane separation techniques, such as microfiltration [2, 3] and ultrafiltration [2, 3], however the accumulation of hydrophobic contaminants on the membrane surface leads to membrane fouling and significant flux reduction, which often limits the economic utilization. Promising fouling mitigation solutions can be classified into two main groups: (1) utilization of photocatalytic and/or hydrophilic nanomaterials to develop antifouling and/or self-cleaning membranes [4, 5] and (2) investigation of suitable pre-treatments (such as destabilization, ion exchange, gas injection, oxidation), which are able to reduce the accumulation of the contaminants on the surface [6, 7]. In the present study the available advantages were discussed, when different photocatalytic nanomaterial (TiO_2 or TiO_2/CNT nanocomposite) modified membranes or pre-ozonation were used during the membrane filtration of oil-in-water emulsions. Available fluxes, different filtration resistances (i.e. membrane-, reversible- and irreversible resistances), flux recoveries, fouling mechanisms were discussed in detail.

Key words: membrane filtration, advanced oxidation processes, oil-in-water emulsion, fouling mitigation

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References:

[1] W. J. Cosgrove, D. P. Loucks, Water Resour. Res. 51 (2015) 4823-4839.
[2] H. Shokrkar, A. Salahi, N. Kasiri, T. Mohammadi, Chem. Eng. Res. Des. 90 (2012) 846-853.
[3] K. Masoudnia, A. Raisi, A. Aroujalian, M. Fathizadeh, Desalin. Water Treat. 55 (2014) 901-912.
[4] S. Kertész, J. Cakl, H. Jiránková, Desalination 343 (2014) 106-112.
[5] K. Wang, D. Hou, J. Wang, Z. Wang, B. Tian, P. Liang, Appl. Surf. Sci. 450 (2018) 57-65.
[6] D. Metcalfe, P. Jarvis, C. Rockey, S. Judd, Sep. Purif. Technol. 163 (2016) 173-180.
[7] A. Zouboulis, D. Zamboulis, K. Szymanska, Sep. Purif. Technol. 137 (2014) 43-52.