



Experimental investigation and modeling hybrid nano-porous membrane process for industrial oily wastewater treatment

Mohammad Vahid Sarfaraz^a, Ehsan Ahmadpour^a, Abdolhamid Salahi^{b,*}, Fatemeh Rekabdar^c, Behrooz Mirza^b

^a Department of Gas & Chemical Engineering, Petroleum University of Technology (PUT), Ahwaz, Iran

^b Department of Applied Chemistry, Faculty of Science, East Tehran Branch, Islamic Azad University, Tehran, Iran

^c Polymer Science and Technology Division, Research Institute of Petroleum Industry (RIPI), West Blvd., Near Azadi Sports Complex, Tehran, Iran

A B S T R A C T

The aims of this work are to construct a pilot scale purification set-up using membrane process for Tehran Oil Refining Company desalter plant wastewater. The investigation was shown that the high amount of impurities in the feed was the main reason of low permeation flux. The nano-porous membrane-powdered activated carbon (NPM-PAC) was employed to settle this problem. Results demonstrated NPM alone was ineffective in removing TSS, COD, and TOC. In the NPM process the removal of COD and TOC are around 62.5 and 75.1%, respectively, and the steady permeation flux (SPF) is around 78.7 L/(m² h). Optimum PAC dosage, which leads to less deposit layer with high porosity on the membrane surface, could increase permeation flux up to 133.8 L/(m² h), the removal of COD and TOC, 78.1% and 90.4%, respectively, and also decreased steady fouling resistance (SFR) around 46.1%. Hermia's models were employed to investigate mechanism of preventing membrane fouling. After coagulation, the kinetic constants, K_b , K_i , K_s , and K_c , showed lower amounts when NPM filtration used alone. Thus, a NPM-PAC hybrid membrane system has the potential to be an effective method to improve NPM removal efficiency in high percentages as well as to improve membrane fouling and permeation flux in desalter plant.

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1. Introduction

Industrial oily wastewaters (oil-in-water emulsions) are serious pollutants that have been involved in a wide variety of chemical industries. In wastewater treatment plant, many traditional techniques are used for separation of oily wastewater (Shokrkar et al., 2011). Among these techniques, industries have paid increasing attention for membrane filtration (Xu et al., 1999). The first and foremost problem membrane technology faces is membrane fouling. Usually, polymeric membrane with organic materials is the dominating type of membrane that has been widely used in water.

Pretreatment such as coagulation, adsorption and ozonation before membranes has been used as a means of

preventing fouling. The coagulation process is widely used in the wastewater treatment. Adsorption and coagulation is more used due to low cost. The efficiency of coagulation-filtration process largely depends on the role of coagulant/adsorbent. The effectiveness of organics removal of oily waste water in a microfiltration (MF) system by different coagulant was also investigated by Cañizares (2008, 2009).

In recent years, powdered activated carbon (PAC) has been widely used to alleviate the fouling problem in membrane in various membrane processes such as microfiltration (MF), ultrafiltration (UF), nanofiltration (NF) and electrodialysis (ED). Some relevant studies are summarized in Table 1. According to this table, it can be concluded that:

* Corresponding author. Tel.: +98 21 33580330; fax: +98 21 33580330.

E-mail address: hamidsalahieng@gmail.com (A. Salahi).

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