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Application of the combined ultrafiltration and reverse osmosis for refinery wastewater reuse in Sinopec Yanshan Plant

Daxin Wang[a*], Flora Tong[a], Peter Aerts[b]

[a] *F8 Xueyuan International Tower, 1 Zhichun Road Haidian District, Beijing, 10083, China*
The Dow Chemical (China) Company Limited, 24/F Aurora Plaza, 99 Fu Cheng Road , Shanghai 200120, China
Tel. +86 (21) 38511671; Fax +86 (21) 58954597; email: FTONG@dow.com
[b] *The Dow Chemical Company, DOW Water Solutions, Larkin Laboratory 120-3, 1691 N Swede Rd., Midland, MI 48674, USA*

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ABSTRACT

The refinery wastewater reuse system of Sinopec Yanshan Plant in Beijing (China) has been in operation for more than four years. The water reuse system combines biological treatment, media filtration with a combination of ultrafiltration (UF) and reverse osmosis (RO). After more than 30 times of chemical cleaning, the current RO system salt rejection is still above 97% at 80% system recovery. The normalized permeate flow of the three RO trains vary with the operation time but after chemical cleaning, they recover to above the design flow of 100 m^3/h. The data presented in this study indicate the fouling nature of the RO feed water on the 1st stage RO. However, according to the experience of Sinopec Yanshan Plant the output water quality meets the customer requirements. This is one of the first publications which show that the combination of UF and RO technology can be applied to reuse the refinery wastewater. The TOC rejection of the UF process is determined at 34%, which is highly dependent on the molecular weight of the organics. Low molecular weight organics could pass the UF unit and foul the RO membrane surface, causing serious organic fouling. Furthermore, the periodic pressure drop increase of the 1st stage RO system showed that there was serious bio-fouling. Therefore, addition of other pretreatment technology before UF, such as activated carbon cartridge filter and dosing non-oxidized biocides, are proposed alternatives that could help to increase the life-span of UF and RO elements.

Keywords: Refinery wastewater; Water reuse; Membranes; Ultrafiltration; Reverse osmosis

* Corresponding author.