

Dual Membrane - Adsorption Hybrid System as a Sustainable Water Reuse System

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ABSTRACT

Dual membrane hybrid systems are becoming emergent in the production of high-quality reclaimed water for reusable purpose where microfiltration (MF) followed by Reverse Osmosis (RO) is commonly used worldwide. However, the attention towards the detection of micro pollutants (pharmaceuticals and pesticides) are lacking and this results to several toxicological and mutagenetic effects when the organisms are exposed to the reclaimed water. Therefore, the feasibility to apply nano-filtration (NF) membranes and MF-GAC (Microfiltration-Granular Activated Carbon) hybrid system to reduce micro pollutants load from the reclaimed water was studied. The MF-GAC was found to remove majority of the micro pollutants from the reclaimed water and the micro pollutants having Log Kow >3 were generally shown more than 90% removals by GAC. However the removals depend on molecular size, charge, other physic-chemical interactions, GAC dosage, other competitors etc. NF (especially NTR729HF) also was effective in removing micro pollutants (70-90%) equally as good as MF-GAC. The removal mechanisms by NF are explained by electrostatic interactions and size exclusion mechanisms. The development of sustainable hybrid systems for the removal of all micro pollutants of different chemical and physical properties is the key for the water reclamation. This study suggested to send a portion of the MF permeate to either the MF-GAC hybrid system or NF membrane (NTR 729HF) before blending with the RO permeate to reduce the micro-pollutants in the reclaimed water. A proper monitoring mechanism should be developed to monitor the micro-pollutants levels in the reclaimed water at regular intervals to ensure environmental safety.

Keywords: adsorption, dual membrane, hybrid, micro pollutants, reuse

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