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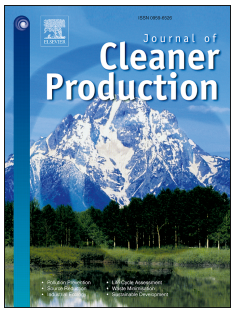

Evaluation of ultrafiltration and conventional water treatment systems for sustainable development: An industrial – scale case study

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Evaluation of ultrafiltration and conventional water treatment systems for sustainable development: An industrial – scale case study

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Abstract

Sustainable developments in water treatment systems are challenges in the 21st century. More industrial – scale drinking water treatment plants are using ultrafiltration (UF) membrane systems. Conventional media filtration is the mainstream treatment process for these plants especially in developing countries. Evaluations of both industrial – scale UF and conventional drinking water treatment systems have been carried out in this study. These treatment systems are evaluated based on 5 aspects which are capital expenditure, operational expenditure, maintenance cost, treated water quality and water losses. A case study water treatment plant in Malaysia which encompassed both the UF and conventional media filtration systems are used to elucidate this comparison study. River water source is fed as surface raw water to both systems. The UF system has exhibited consistent filtrate quality regardless of the fluctuation of raw water quality. Sludge discharged from the UF backwash remains the same characteristics as the feed water except with higher concentration of solids content. However, sludge from the conventional system contains high concentration of Aluminium residual originating from the coagulant. The UF system caused higher water losses compared to the conventional system. As for operation and maintenance expenditures, the conventional systems are more economical. Sensitivity analyses have been carried out on the capital expenditure and operational expenditure. Precaution measures have been taken to ensure all data collected are relevant and accurate. More than 12 months of treatment systems operational data are collected, compiled and analysed to substantiate the results. This study intends to highlight the commercial and environmental sustainability of both systems. The major contribution and novelty of this work is that it provides useful reference to the decision makers and stakeholders on the selection of treatment process for industrial – scale drinking water facilities to accommodate their current and future requirements.

Keywords: *ultrafiltration, drinking water, media filtration, sustainable development*

1.0 Introduction

Drinking water sources primarily come from freshwater inflow such as surface river water (Davies and Mazumder, 2003). Most drinking water treatment plants use conventional media filtration process to physically remove particles as final polishing (Zouboulis et al., 2007). Water treatment technology advancement has allowed more effective alternative processes in large – scale. However, the main drawbacks of these alternative treatment processes compared with the conventional system is the differing infrastructure and operational costs that require further evaluation (Emelko et al., 2011).

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