



Characterization of fouling in immersed polyvinylidene fluoride hollow fibre membrane ultrafiltration by particles and natural organic matter

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ABSTRACT

Turbidity-causing particles and natural organic matter (NOM) in surface water are two major contributors to membrane fouling. This study focused on the effects of particles, NOM and particles-NOM contaminated raw water on membrane fouling in ultrafiltration (UF) and coagulation-UF process, respectively. The kaolinite solution and humic acid (HA) solution was used to simulate the particles and NOM contaminated raw water respectively in the laboratory experiments. It was found that pollutant constituents and concentration of raw water and pre-treatment process had an influence on membrane fouling. There was a linear relationship between the total organic carbon (TOC) concentration of raw water and that of effluent in UF when HA-contaminated raw water was tested. The transmembrane pressure increase rate was in exponential relationship with raw water TOC. HA mainly contributed to the irreversible fouling, while kaolinite mainly brought the reversible fouling. It was verified that coagulation pre-treatment could postpone membrane fouling development in the limited range of coagulant dosage. Additionally, it was also found that combined fouling effects of particles and NOM were not the simple addition of the individual's effect.

Keywords: Ultrafiltration; Membrane fouling; Humic acid; Particles; Coagulation

1. Introduction

As a new purification technology of micro-polluted raw water, ultrafiltration (UF) combined with other conventional treatment technologies have attracted more and more attention and become a hot topic in drinking water treatment. However, membrane fouling is a great obstacle which restricts UF in application [1–3]. Membrane fouling mechanisms depends on not only the characteristics of membrane including the type, material, pore size and structure, but also the characteristics

of raw water [4]. The interaction between membrane surface and dissolved substances in water plays an important role in UF membrane fouling [5]. Accordingly, it is helpful to improve the understanding of fouling phenomena to study the mutual influences between various foulants in raw water [6].

Turbidity-causing particles and natural organic matter (NOM) are two major concerns in surface water which can lead to the membrane fouling in UF process. Many researchers have shown that NOM, especially the humic substances is the major contributor to fouling during the UF process by NOM [7,8]. The fractions with higher molecular weight (MW) and more UV absorbing

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