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Impact of hydraulic pressure and pH on organic fouling in pressure retarded osmosis (PRO) process

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ABSTRACT

Pressure retarded osmosis (PRO) is a promising membrane-based process for producing clean and renewable energy. Since the major driving force is the salinity gradient between the feed and draw solutions, PRO can operate without a large environmental footprint. However, the performance of PRO can be severely limited by fouling, with organic fouling commonly deemed the main factor influencing PRO performance, since even a small amount of organic foulants can cause a significant flux decline. In spite of its importance, however, few studies have focused on PRO fouling. Therefore, the objectives of this study were to investigate the effect of hydraulic pressure as an influencing factor and to adjust the feed solution pH in order to alleviate fouling in the PRO process. Alginate was chosen as the model foulant due to its common existence in feed water. Based on our results, a higher hydraulic pressure caused an increase in the reverse solute flux, such that organic fouling became aggravated. In addition, the potential for fouling control by changing the feed solution pH was confirmed. As such, it is expected that this study would provide insight into PRO development in terms of the reduction of fouling.

Keywords: Pressure retarded osmosis (PRO); Organic fouling; Reverse solute flux; Feed solution pH; Hydraulic pressure

1. Introduction

Due to rapid population growth and industrial development, people in many countries suffer from a lack of energy resources. To overcome this shortage, resources that can sustainably produce clean energy, such as wind, hydro, solar, biomass, biofuel, and geothermal systems have received global attention [1–3]. Among these technologies, pressure retarded osmosis (PRO) is a promising membrane-based process that can generate power without causing environmental problems. In PRO, fresh water moves from a

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