



Enhanced MBR by internal micro-electrolysis for degradation of anthraquinone dye wastewater

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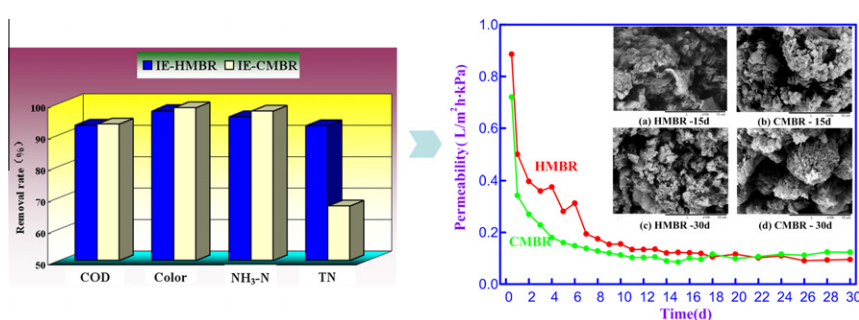
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HIGHLIGHTS

- ▶ Enhanced MBR by IE was first used to treat anthraquinone dye wastewater.
- ▶ Membrane fouling was reduced by iron fed but aggravated by excess iron accumulation.
- ▶ The mean particle size experienced a transition from large to small in enhanced MBR.
- ▶ The binding between iron ions and bound EPS improved membrane permeability.

GRAPHICAL ABSTRACT



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ABSTRACT

Anthraquinone dyes are very common and refractory pollutants in a wide variety of textile wastewaters and the treatments of these wastewaters have attracted much attention up to now. In this study, a novel enhanced membrane bioreactor (MBR) by internal micro-electrolysis (IE) was successfully applied for treatment of reactive brilliant blue X-BR dye wastewater owing to its high organic matter and nitrogen removal. The main interests were taken in exploring the effect of iron ions released from the IE on properties of biomass and membrane filtration. A hybrid MBR (HMBR) with iron ions fed and an iron controlled MBR (CMBR) were operated in parallel. The biomasses in various MBRs were characterized by sludge volume index (SVI), particle size distributions, concentration of the bound extracellular polymeric substance (EPS), and microscopic structure of the sludge flocs. The results demonstrated that alleviation of membrane fouling in HMBR for a long time was mainly caused by the improvement of settleability and compactability of flocs, as well as the increase in the particle size. As a skeleton frame of aggregations, bound EPS effectively enhanced the bioflocculation of small particles, which was beneficial in controlling membrane biofouling. However, in the last phase, membrane permeability in HMBR continued to drop and tended to be lower than that in CMBR, which mostly attributed to the severely inorganic fouling besides the negative impact of EPS on membrane filterability. Therefore, iron ions control was critical in operation of the enhanced IE/MBR system.

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1. Introduction

The treatment of dye wastewater has been one of the most bothersome issues to be solved due to its high color, heavy toxicity,

and non-biodegradable characteristics even at very low concentration [1–3]. Anthraquinone dyes, as the second largest class of textile dyes after azo dyes, are extensively used in the textile industry. However, a lower rate and a lesser extent of decolorization of anthraquinone dyes have been observed as compared to azo dyes [4]. This is ascribed to their higher water solubility and greater stability of chromogenic groups. Thus, anthraquinone dye removal from the wastewater has been a subject of major importance.

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