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Decoloration of methylene blue hydrate by submerged plasma irradiation process

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ABSTRACT

In this study, a submerged plasma irradiation (SPI) process was attempted for the decoloration of methylene blue hydrate (MBH) in synthetic dye wastewater from aqueous solution. Several series of experiments were conducted to study the effects of electrode materials, oxidants, applied voltage, pH, and type of buffer solution by monitoring MBH removal efficiency in 50 mL of batch reactor. More than 80% of removal efficiency was achieved within 2 min of plasma irradiation at 800 V, with a pH of 7. Electrode materials in SPI process were found to affect the MBH removal efficiency. Tungsten electrode produced a higher decoloration rate constant ($0.38\,s^{-1}$) than those of iron ($0.28\,s^{-1}$) and aluminum ($0.33\,s^{-1}$) ones. Electrode length in plasma irradiation system also affected the MBH removal. Decolorization reaction of MBH was found to follow the pseudo-first-order laws. The rate constant (k) of MBH as a decoloration index increased with the increase in applied voltage, pH, DO, and conductivity.

Keywords: Submerged plasma irradiation; Methylene blue hydrate; Decolorization; Electrode

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