



Combination of an anaerobic process with O₃, UV and O₃/UV for cellulose pulp bleaching effluent treatment

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ABSTRACT

Recent studies have shown that partial oxidation by advanced oxidation processes (AOP) is able to transform hard-to-degrade compounds and increase their biodegradability. In this work, anaerobic treatment was followed by ozonation, UV radiation and ozonation in the presence of UV radiation, to treat bleaching effluents from a cellulose kraft pulp plant. The anaerobic reactor (horizontal anaerobic immobilized sludge bed, HAISB) was used as a pretreatment to reduce the effluent organic load before applying AOP. The ozone treatments were applied in three different pH environments (3, 8 and 10) with retention times of 10, 30, 45 and 60 min. COD and adsorbable organic halogens (AOX) removal efficiencies at the HAISB were approximately 50%, while the BOD removal efficiency reached 80%. Ozonation promoted further removal of AOX and COD so that the combined efficiency reached 96% for AOX and 70% for COD. In the oxidation process, BOD was either removed in small quantities or actually increased, as intended, so that a second biological treatment would be able to complete the treatment. The maximum increase in the BOD₅/COD ratio (biodegradability indicator) occurred at pH 8, reaching 104% for ozonation at a dosage of 1540 mgO₃·L⁻¹. Applying UV radiation alone resulted in lower values: a 34% increase in the BOD₅/COD ratio and a 76% AOX removal efficiency. These results indicate that the combination of anaerobic treatment with ozonation or ozonation/UV radiation improves the treatability of cellulose pulp bleaching effluents and that the resulting wastewater is suitable for further biological treatment under aerobic conditions with a low level of toxic compounds from the halogenated family.

Keywords: Advanced oxidation processes; Ozonation; UV; Bleaching effluent; Anaerobic treatment; Combined wastewater treatment; AOP

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