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Efficiency of nitrification and organics removal from municipal landfill leachate in the rotating biological contactor (RBC)

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ABSTRACT

The usability of moving beds both to ammonia oxidation and removal of refractory organic compounds from municipal landfill leachate was investigated. Organics and ammonia concentrations in the leachate were 1154 mg COD/L and 834 mg $N\text{-}NH_4$/L, respectively, whereas BOD_5/COD – 0.08. The humic substances expressed by UV_{254} and UV_{280} indexes were 10.04 and 8.0, respectively. The investigations have revealed that at ammonium load of 1.92 g $N\text{-}NH_4/m^2 \cdot d$ (experiment 1), complete and stable nitrification (99%) was obtained and the single stage RBC may be sufficient in practical application, while at load 3.58 g $N\text{-}NH_4/m^2 \cdot d$ (experiment 2), there was a necessity of two-stage system working (nitrification efficiency was 70% at 1st stage). At ammonium load of 4.79 g $N\text{-}NH_4/m^2 \cdot d$ (experiment 3), the nitrification effectiveness was 59.7% in the 1st stage, but in whole system — 74.4 %. Simultaneously with nitrification, organics removal was observed. The efficiency of COD removal changed from 42.9% (experiment 1) to 32.6% (experiment 3). The efficiency of humic substances removal, based on UV_{254} and UV_{280} indexes, exceeded 30% and 20%, respectively. High concentrations of extracellular polymeric substances EPS (90.9-68.8 mg/g d.w.) in both stages of RBC and low biodegradability of organics in leachate (BOD_5/COD) allow to consider biosorption as a main process responsible for refractory compounds removal.

Keywords: Landfill leachate; Nitrification; Organics; Rotating biological contactor (RBC); EPS

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