Coupling anaerobic digestion and electrooxidation for biogas and nutrients recovery from animal by-products

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Organic wastes generated by numerous agro-industrial enterprises represent an important resource for the production of energy (biogas) via anaerobic digestion and the recovery of nutrients. Electrochemical processes can provide a treatment supplement to oxidize recalcitrant organics and disinfect the anaerobic effluent from pathogenic microorganisms, and recover the nutrients present therein. In this work we applied electrochemical treatment on the effluent from an anaerobic digester treating animal by-products. The latter was characterized by high COD concentration 180 000 mg/L consisting of 70% animal fat and 30% protein. The anaerobic digester was operated at organic loading rate of 5-10 g COD/ L d and achieved a COD removal efficiency of 95-97% with a final effluent having COD = 2500 mg/L, NH_4-N = 2000 mg/L and a salinity = 16 mS/cm. The subsequent electrooxidation treatment of the digestate was conducted with a BDD anode at room temperature, current density of 60 mA/cm^2 and electroprocessing time of 3 h, and resulted in further removal of residual organics (> 90%), giving a final effluent COD of 250 mg/L and negligible total suspended solids, colour and turbidity (Figure 1). The electrochemical effluent also retained 50% of the digester nitrogen mainly in the form of ammonia and nitrates, enabling possible reuse in agriculture.

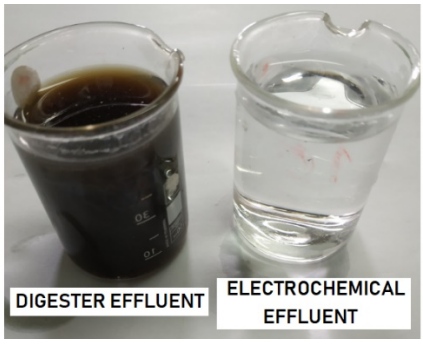

Figure 1. Schematic representation of the digester effluent and the electrochemical effluent.