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Plasma polymerization of pyrrole and aniline on polyurethane foams for microorganism immobilization and wastewater treatment

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ABSTRACT

The development of new approaches for wastewater treatment is a current challenge for scientists and technologists. Microorganism immobilization onto supports for wastewater treatment is a powerful tool of low cost and highly efficient. Therefore, in this work pyrrole and aniline were copolymerized on the surface of polyurethane (PU) foams by the plasma polymerization method (changing the power input, atmosphere of reaction, and polymerization time) to obtain polyurethane/polypyrrole/polyaniline (PU/(PPy-*co*-PANI)) composites which were used as supports for microorganism immobilization and tested in municipal wastewater treatment in anaerobic batch and continuous packed-bed reactors. The supports were characterized by Fourier transform infrared (FTIR) spectroscopy, scanning electron microscopy (SEM) and thermogravimetric analysis (TGA); chemical oxygen demand (COD) removal efficiency, during the treatment of municipal wastewater, was determined. It was observed from SEM analysis that PPy-*co*-PANI deposited onto the PU surface can be a homogeneous sheet coating PU or spherical nanostructures with average diameters between 50 nm and 1 μm, depending on the plasma polymerization conditions. Batch wastewater treatment after 48 h showed COD removal efficiencies of 30%, 28%, 26%, 61% and 56% for the PU and PU/(PPy-*co*-PANI) composites obtained at 40 W and 55 min, 30 W and 45 min, 50 W and 30 min (air plasma first) and, 45 W and 40 min (acrylic acid plasma first), respectively; which was associated to the polymers morphology deposited onto the PU foam surface. The composite of PU/(PPy-*co*-PANI) obtained at 50 W and 30 min (air plasma first) was tested in the continuous wastewater treatment, observing that for 54 h of hydraulic retention time (HRT), 76% of COD removal can be achieved.

Keywords: Plasma polymerization; Conducting polymers; Immobilization, Biodegradation

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