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Evaluation of Natural Waste Materials for Ammonia Removal in Biofilters

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Abstract : Odours are generated in municipal solid wastes management plants as a result of decomposition of organic matter, especially when anaerobic degradation occurs. Information was collected about the substances and respective concentration in the surrounding atmosphere of some management plants. The main components which are associated with these unpleasant odours were identified: ammonia, hydrogen sulfide and mercaptans. The first is the most common and the one that presents the highest concentrations, reaching values of 700 mg/m3. Biofiltration, which involves simultaneously biodegradation, absorption and adsorption processes, is a sustainable technology for the treatment of these odour emissions when a natural packing material is used. The packing material should ideally be cheap, durable, and allow the maximum microbiological activity and adsorption/absorption. The presence of nutrients and water is required for biodegradation processes. Adsorption and absorption are enhanced by high specific surface area, high porosity and low density. The main purpose of this work is the exploitation of natural waste materials, locally available, as packing media: heather (Erica lusitanica), chestnut bur (from Castanea sativa), peach pits (from Prunus persica) and eucalyptus bark (from Eucalyptus globulus). Preliminary batch tests of ammonia removal were performed in order to select the most interesting materials for biofiltration, which were then characterized. The following physical and chemical parameters were evaluated: density, moisture, pH, buffer and water retention capacity. The determination of equilibrium isotherms and the adjustment to Langmuir and Freundlich models was also performed. Both models can fit the experimental results. Based both in the material performance as adsorbent and in its physical and chemical characteristics, eucalyptus bark was considered the best material. It presents a maximum adsorption capacity of 0.78±0.45 mol/kg for ammonia. The results from its characterization are: 121 kg/m3 density, 9.8% moisture, pH equal to 5.7, buffer capacity of 0.370 mmol H+/kg of dry matter and water retention capacity of 1.4 g H2O/g of dry matter. The application of natural materials locally available, with little processing, in biofiltration is an economic and sustainable alternative that should be explored.

Keywords : ammonia removal, biofiltration, natural materials, odour control
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