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Biofiltration Odour Removal at Wastewater Treatment Plant Using Natural Materials: Pilot Scale Studies

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Abstract : Deodorization is nowadays a need in wastewater treatment plants. Nitrogen and sulphur compounds, volatile fatty acids, aldehydes and ketones are responsible for the unpleasant odours, being ammonia, hydrogen sulphide and mercaptans the most common pollutants. Although chemical treatments of the air extracted are efficient, these are more expensive than biological treatments, namely due the use of chemical reagents (commonly sulphuric acid, sodium hypochlorite and sodium hydroxide). Biofiltration offers the advantage of avoiding the use of reagents (only in some cases, nutrients are added in order to increase the treatment efficiency) and can be considered a sustainable process when the packing medium used is of natural origin. In this work the application of some natural materials locally available was studied both at laboratory and pilot scale, in a real wastewater treatment plant. The materials selected for this study were indigenous Portuguese forest materials derived from eucalyptus and pinewood, such as woodchips and bark, and coconut fiber was also used for comparison purposes. Their physico-chemical characterization was performed: density, moisture, pH, buffer and water retention capacity. Laboratory studies involved batch adsorption studies for ammonia and hydrogen sulphide removal and evaluation of microbiological activity. Four pilot-scale biofilters (1 cubic meter volume) were installed at a local wastewater treatment plant treating odours from the effluent receiving chamber. Each biofilter contained a different packing material consisting of mixtures of eucalyptus bark, pine woodchips and coconut fiber, with added buffering agents and nutrients. The odour treatment efficiency was monitored over time, as well as other operating parameters. The operation at pilot scale suggested that between the processes involved in biofiltration - adsorption, absorption and biodegradation - the first dominates at the beginning, while the biofilm is developing. When the biofilm is completely established, and the adsorption capacity of the material is reached, biodegradation becomes the most relevant odour removal mechanism. High odour and hydrogen sulphide removal efficiencies were achieved throughout the testing period (over 6 months), confirming the suitability of the materials selected, and mixtures thereof prepared, for biofiltration applications.

Keywords : ammonia hydrogen sulphide and removal, biofiltration, natural materials, odour control in wastewater treatment plants
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