

ABSTRACT

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Constructed wetlands are natural wastewater treatment systems. Even though the short period of experience in comparison to other conventional technologies, these systems are gaining importance as an attractive option for wastewater treatment of small urban communities. This is due to their low cost of operation and maintenance, the simplicity in terms of design and the reasonably good removal capacity of the organic matter and nutrients present in wastewater.

This research focuses in two main topics. The first one studies the biodegradability of the remaining organic matter in the effluent of a horizontal subsurface flow constructed wetland which is one of the eight common reed beds of a pilot scale wastewater treatment plant located in Les Franqueses del Vallès. The second part deals with the accumulated organic matter biodegradability in the inlet area of two common reed beds located in the wastewater treatment plants of Alfés and Verdú (Lleida).

The experiments carried out in both parts of the present research consist of anaerobic and aerobic degradability tests. For the anaerobic essays a spherical flask was used as a reactor altogether with a "minert" valve cap which ensured the airtight conditions. These reactors were fulfilled with gravel and water sampled in several sampling campaigns. Dairy gas samples were extracted from these reactors in order to know the amount of methane gas through chromatography technique.

For the aerobic experiments was necessary to construct two aerobic reactors made of plastic consisting on 40 cm height column and 20 cm diameter, where the studied samples were confined and submitted to a constant air flow. The sampling methodology in this type of essays was based on dairy volatile suspended solids measures (for the Alfés and Verdú's wastewater treatment plants samples) and COD measures (for the previous ones and the pilot scale treatment plant of Les Franqueses del Vallès).

The obtained results from the first topic of this research show that the remaining organic matter is biodegradable under anaerobic and aerobic conditions. In the first case a reduction of the initial COD of about 80% has been observed in a period of 25-30 days and in the second case reductions between 80 and 90% of the initial effluent organic matter have been obtained in a period between 8 and 13 days. The methane gas production due to the degradation of the remaining organic matter in the effluent follows an increasing behaviour at the beginning of the anaerobic essay until reaching a constant value which corresponds to the highest methane production, 1-1,5 mg CH₄ per litre of effluent confined in the reactor.

The experiments performed in order to determine the biodegradability of the organic matter accumulated in the inlet area of two common reed beds, located in Alfés and Verdú's wastewater treatment plants, showed that this organic matter is very slowly biodegradable either under anaerobic (at 5°C and 20°C) or aerobic (at 20°C) conditions. The obtained methane speed productions from the anaerobic reactors at 20°C are 0,001 and 0,0025 g COD_{CH₄}/g VSS·d in Alfés and Verdú respectively and correspond to the methanogenic activity resulting from a river sludge or fresh manure. Both types of sludge are very few biodegradable which lead us to conclude that the organic matter present in the reactors is also very slowly biodegradable under anaerobic conditions. In the aerobic essays, it has been observed how the COD and VSS evolution remains almost constant during the whole experiment. The behaviour obtained from the aerobic essays shows the very slowly biodegradable nature of the organic matter present in the analysed wetlands, which agrees with the results from the anaerobic essays.