# ABSTRACT

Constructed wetlands are an attempt of reproducing the depuration qualities of natural wetlands. Over the last 25 years, many studies have been realized with the aim of improving the design of constructed wetlands. Even this way, their internal operation is only slightly known, due to the great number of processes that occur inside them and the interaction among themselves.

This study is part of an investigation project carried out by the Universitat Politècnica de Catalunya (UPC) and the Centro Superior de Investigaciones Científicas (CSIC), that aims the objective of contributing to the knowledge of the internal mechanisms of wetlands. To this end, a pilot plant has been developed, consisting in 8 subsurface wetlands with different sizes, depths and landfills.

This study is about the evolution of particle size distribution in two of the wetlands previously described. Its motivation is the fact that many of parameters commonly used in environmental engineering are lumped parameters. These parameters include many different chemical species which can be submitted to totally different processes. This happens to parameters as common as the ones that measure the organic matter content (COT, $DBO_5$), or the amount of suspended solids. This study tries to verify the dependence between particle sizes and the way in which they are eliminated inside wetlands.

For this purpose, four sampling campaigns have been carried out in different months during 2003. Samples were taken in two wetlands, with different sizes and depths, in five points of each one of them. Then, a particle account of each of the samples was done, as well as a statistician study of the predominant evolution. Likewise, kinetical evolution of particles was modelled. This was done according to particles sizes in order to obtain a trustworthy prediction model for this evolution.

It has been verified that in subsurface flow wetlands, particle elimination for the most part occurs during the first meters. Average particle elimination in the first quarter of the way was around 80 % in both of the wetlands. This reduction was around 95 % at the effluent. There were no significant differences between both of the wetlands, for what we conclude that wetland size relationship does not affect to the elimination.

It can be verified that 95 % of the particles in affluents, belong to a size range between 0,7 and 2 µm, and that their elimination is of the same kind and order than the one experimented by the total number of particles. Organic matter elimination is analogous to particle elimination, but elimination percentages are always lower. This is due to the fact that approximately 50% of organic matter in domestic wastewater is dissolved. Hereby, this percentage of organic matter does not remain retained at the beginning of the wetland with largest particles. The analysis of organic matter composition reveals that in spite of the fact that TOC does not diminish significantly after filtration phenomena, wetlands manage to degrade organic matter into more assimilable forms for the natural way.

The main way of elimination of particles is filtration. A great fraction of particles coming inside the wetland remains retained in the initial meters due to physical phenomena. In this zone, big amounts of pollutants are accumulated. When retained particles hydrolyse and decompose, resultant smaller particles continue their course along the wetland. This way, a continuous source of organic matter and other pollutants is created. To avoid this phenomenon it would be advisable to implant at wetlands entry a pretreatment system which eliminates particles between 0,7 and 2 µm.

Kinetical modelling revealed that particles whose sizes are bigger than 1 µm are removed following zero order models. It is concluded that smaller particles best adjustment is reached by biparameter one order models. For plug flow with retardation model, best results were obtained with elimination constants around 1,5 $d^{-1}$ and retardation coefficients of about 3,5 $d^{-1}$. For the model based on tanks in series with an initial plug flow reactor, best results were reached by elimination constants around -0,05 $d^{-1}$ and $t_{delay}$ of 45 and 20 hours respectively for wetlands C2 and D2.