

# Natural treatment of wastewater in rural communities

**I. Di Termini<sup>1\*</sup>, A. Prassone<sup>1</sup> and M. Rovatti<sup>1</sup>**

<sup>1</sup>Department of Civil, Chemical and Environmental Engineering, University of Genoa, Via All'Opera Pia, 15  
16145 Italy

\*Corresponding author: E-mail: [ilaria.ditermini@unige.it](mailto:ilaria.ditermini@unige.it), Tel +390103532913, Fax: +39010 3532586

## Abstract

This work describes the results obtained in the framework of the E.U. project LIFE08 ENV/IT/000390 "ECOsustainable Management of Water and wastewater in Rural communities" on the additional treatment by microalgae of the effluent from a wastewater treatment plant and on the wastewater treatment of a hamlet by facultative lagoons.

The experiment was carried out in Varese Ligure rural community of Northern Italy, (Lat. 44° 22' 38.28"; Long. 09° 35' 42.72 "). The system of micro phytodepuration (**MFB**) is fed with only a portion of the effluent from the municipal biological wastewater treatment plant in the village of San Pietro Vara (500 IE). The facultative lagoon (**FL**) is fed with the whole flow of sewage arising from the hamlet of Le Pezze (10 IE).

The **MFB** synthetically consists of: a photobioreactor composed by 40 vertical plexiglass tubes (internal diameter 44mm, external diameter 50mm, height 2000mm) fed in parallel; a recycling vessel with a volume of 500 l; a recycling centrifugal pump; a submerged centrifugal feed pump; a discharge vessel with a volume of 500 l. The **FL** briefly consists of: a grease and oil interceptor tank and a Imhoff tank where the sewage coming from the small hamlet of Le Pezze is pretreated; two rectangular fibreglass tanks connected in series, the size of each tank is: width 1 m, length 4.2 m, height 0.5 m, total volume 4.2 mc; a recycling pump from the second tank to the first one; two photovoltaic panels to provide energy to the recycling pump. The main results obtained from the tests on the **MFB** are: the algal species dominating the system are *Chlorophyceae* (90%) mainly autotrophic with a growth coefficient  $\mu$  in the range 0.012-0.220 d<sup>-1</sup> and a biomass productivity  $P_v$  from 16.67 to 133.32 g<sub>biomass</sub>/m<sup>3</sup>d. The range of abatement obtained are: 35-50% for COD; 82-90% for N; 60-80% for P. The average elemental composition of biomass was: C = 40.52 %, H = 5.70 %, N = 5.39 %, P = 2%, K = 1.1 % and S = 0.20 %.

The tests on the **FL** were carried out in two phases: the first phase was performed with synthetic wastewater in order to assess, at hydraulic and composition steady state, the reaction coefficient K for the demolition of the biodegradable COD and nutrients; the second phase was carried out with the real pretreated sewage and allowed to detect deviations from the above "ideal conditions". The main results obtained from the tests are: the algal species dominating the pond are the *Cyanophyceae*, mainly heterotrophic; the range of abatement obtained are: 30-50% for COD; 50-70% for N; 20-50% for P; the decrease of the reaction coefficient K during the coldest months (January-February). This decrease could be counterbalanced partially by the recirculation flowrate from the second tank to the first one.

*Keywords: microalgae, photobioreactor, facultative lagoon.*