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## INNOVATIVE COMBINED PROCESS FOR THE BIOLOGICAL EXPLOITATION OF OLIVE MILL WASTEWATER

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### Abstract

Olive mill wastewater (OMW) is the liquid byproduct of olive oil extraction. Due to its high organic load and phenolic compounds concentration, OMW is considered one of the most toxic waste in the agro-industrial field. Therefore, it is crucial to assess a feasible treatment both on an economical and ecological point of view.

In the present work, the employed OMW underwent a first dephenolization treatment followed by an anaerobic acidogenic digestion, where OMW organic matter was bioconverted in volatile acids (VAs). The purple bacteria *Rhodospseudomonas palustris* (*Rp. p.*) is able to use VAs as carbon source for growth and the concomitant photobiological evolution of hydrogen.

The dephenolized and digested OMW had COD and VAs concentrations of 29 and 18 g/L respectively. Different OMW dilution in water (6%, 12.5%, 25%, 50% and 75%, v:v) was used as the sole substrate for the biological growth and hydrogen production using *Rp. p.*, 42OL. In addition, 3 different initial bacteriochlorophyll (Bchl) concentrations (3, 6 and 9 mg/L) have been used to evaluate their incidence on the bacterial growth and the VAs consumption. The final amounts of both biomass dry weight and Bchl together with the organic contents (COD and VAs) were determined in the three conditions, in order to determine the optimal dilution able to support the bacterial growth, while exploiting the residual organic load of OMW.

Irrespective of the initial culture concentration, diluted OMW (25%, v:v) resulted the best condition for bacterial growth; over 30 mg/l of final Bchl was reached. On the contrary, diluted OMW (6%, v:v) carried to the highest COD and VAs consumption (73% and 96% respectively).

Diluted OMW (75%, v:v) carried neither to a biological activity nor a decrease in the organic load, most likely because of the persisting dark color of the waste.

Cumulative H<sub>2</sub> produced during the experiments was also evaluated: 25% v/v was the optimal dilution among the tested ones, with a final volume of about 1000 mL/L of H<sub>2</sub>.

These results show that an integrated biotechnological system represents an important approach towards a feasible OMW exploitation, with a valid contribution to the production of green energy.

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