

Poster

Heterogeneous catalysis based on photo-Fenton reaction for olive oil mill wastewater treatment



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ABSTRACT

Motivation: The production of olive oil generates high volume of olive-oil mill wastewater (OMW), which is normally deposited at large build-evaporation ponds. This OMW are characterized by acidic pH, high organic load and phenolic compounds. The accumulation of this polluted wastewater does not represent an adequate solution becoming an important environmental issue. Advanced oxidation processes (POAs) are known for their efficiency in removing contaminants. The photo-Fenton process is one of the best known and is based on the combination of Fenton reaction ($\text{Fe}/\text{H}_2\text{O}_2$) with the presence of ultraviolet light. The photo-Fenton system can be carried out in homogeneous phase (liquid) as in heterogeneous phase (liquid-solid). The use of solid catalysts has its advantages, especially in the easy recovery and reduction in its consumption. In this work has been evaluated the use of iron oxide (III), HFeO_2 , as solid catalyst in the photooxidation ($\text{UV}/\text{HFeO}_2/\text{H}_2\text{O}_2$) of OMW.

Methods: All experiments were performed in a 1L reactor and common operating conditions were: initial COD = 16586 g O_2/L , pH = 3, T = 20°C, agitation rate = 700 rpm and UV-light. Different catalyst concentrations (HFeO_2) were assayed 0.038; 0.263; 0.758; 5; 10; 20; 30 and 50 g/L. In addition, control experiments have been developed only with air, UV, H_2O_2 and the combined system of $\text{UV}/\text{H}_2\text{O}_2$.

Results: The removal percentages values recorded for the range of catalyst concentrations tested were: 46.8-62.8% and 76.4-88.8% of COD and total phenolic compounds 'TPCs', respectively. The removal percentages in control experiments registered in the case of air (%CODremoval = 11,1% and TPCs = 50,0%), UV (%CODremoval = 37,8% and TPCs = 56,97%), H_2O_2 (%CODremoval = 43,1% and TPCs = 70,4%) and $\text{UV}/\text{H}_2\text{O}_2$ system (%CODremoval = 46,7% and TPCs = 78,0%).

Conclusions: The photo-Fenton oxidation has high efficiency in organic pollutant reduction. Catalyst concentration increase improves the oxidation capacity of $\text{UV}/\text{H}_2\text{O}_2/\text{HFeO}_2$ system in the OMW treatment. The industrial application of this photooxidation system is depending to the final destination of the treated water and the quality requisite. Another operation units can be added if the final water quality requires it. On the other hand, for future it's interesting indicate the importance of the evaluation of catalytic capacity of recuperated HFeO_2 .

REFERENCES

- Paraskeva, P., & Diamadopoulos, E. (2006). Technologies for olive mill wastewater (OMW) treatment: a review. *Journal of Chemical Technology and Biotechnology*, 81(9), 1475-1485. doi:10.1002/jctb.1553.
- Hodaifa, G., Agabo, C., Moya, A.J., Pacheco, R., & Mateo, S. (2015). Treatment of Olive Oil Mill Wastewater by UV-Light and $\text{UV}/\text{H}_2\text{O}_2$. *International Journal of Green Technology*, (1), 46-53.
- Borja, R., Raposo, F., & Rincón, B. (2006). Treatment technologies of liquid and solid wastes from two-phase olive oil mills. *Grasas y aceites*, 57(1), 32-46. doi:10.3989/gya.2006.v57.i1.20.