

# Combination of adsorption and heterogeneous photo-Fenton processes for the treatment of a winery wastewater

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**Acknowledgements** - The authors thank to the NORTE 2020

**1. Introduction** – The production of winery wastewater (WW) constitute a serious environmental problem due to their high organic content and low pH conditions. Nowadays, there are several treatment processes available. However, the main challenge in this field is to develop a more efficient process, in order to achieve more easily the legal discharge limits, and reduce the financial costs involved in the conventional treatment processes [1, 2].

In the present work, it was proposed the combination of both adsorption and heterogeneous photo-Fenton processes, for the treatment of a real WW, where different operational conditions were taken into account. A Portuguese Ca-smectite (Ca-Sm) was applied in both processes, however, with different purposes: (1) as an adsorbent, which reveals great capacity to retain organic acids, and (2) as catalyst support for the production of an iron based catalyst (Fe-Sm).

**2. Results and Discussion** - The results show that the adsorption data was successfully described by Jovanovich isothermal model ( $R^2 = 0.990$ ), which predicted a maximum adsorption capacity of 161 mg C/g. The adsorption process was enhanced at pH 4.0 ( $\text{TOC}_{\text{rem.}} = 51\%$ ) due to the increase positively charged compounds from WW (flavylium species), which can be adsorbed on the internal surface of Ca-Sm. Regarding to the heterogeneous photo-Fenton process, the higher TOC removal percentage obtained (78.7% - 240 min) was also achieved at pH 4.0, with a  $\text{H}_2\text{O}_2$  concentration of 98 mM and a catalyst dosage (S:L) corresponding to 6.00 g/L (UV-C). As a result, the combination of both treatment processes, using the optimized conditions, allowed a total TOC removal of 90%, where the initial  $\text{TOC}_0$  value (825 mg C/L) was reduced by 54%, through the adsorption process, and by 36% by means of heterogeneous photo-Fenton process [ $\text{TOC}_0 = 825$  mg C/L (1) –  $\text{TOC}_{\text{f-ads}} = 380$  mg C/L (2) –  $\text{TOC}_{\text{f-pF}} = 81$  mg C/L (3)].

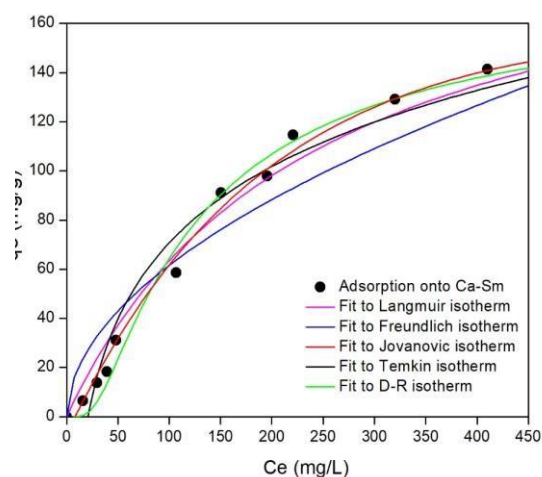


Fig. 1. Fit of different isothermal models to the adsorption data.

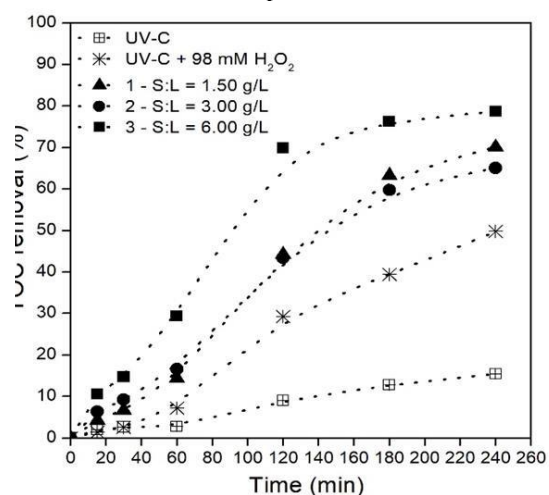


Fig. 2. Heterogeneous photo-Fenton experiments, using different catalyst dosages.

Program and to the European funding for regional development, the financial support to the project INNOVINE&WINE (BPD/UTAD/INNOVINE&WINE/WINEMAKING/754/2016).