

## Treatment of olive mill wastewater by $K_2S_2O_8$ in pressurized hot water/subcritical water

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### Abstract

The production of olive oil is one of the most important economic proceeds of Mediterranean countries. Nevertheless, the production of olive oil also causes a large amount of waste which is known as olive mill wastewater (OMW). OMW is a dark red to black colored, malodorous and blurred by-product which is produced during the fabrication of olive oil. OMW contains high levels organic matter like phenolic compounds which is harmful to the nature. The removal of OMW has been faced as a very important issue for many countries. OMW cannot be purified as enough as desired by conventional treatment methods. Thus, a great effort has been made to develop new methods for the treatment of OMW in the last decades.

Advanced oxidation processes (AOPs), which are based on the formation of OH radicals that attack to organic molecules non-selectively, are effectively used for treatment of OMW. Subcritical water oxidation (SWO) which is a member of AOPs, is an environmentally friendly method and applied to wastewater containing pollutants in a wide range. SWO is used for converting persistent organic molecules to simple, harmless organic molecules and ultimately to carbon dioxide and water. When water heated between 373 and 647 K and pressurized high enough to be kept it in the liquid state, it is called subcritical water. In addition, oxidising agents like  $H_2O_2$ ,  $K_2S_2O_8$  and  $KIO_3$  are commonly used to improving the efficiency of degradation capacity of SWO.

In present work, SWO method and pressurized hot water oxidation method were used to mineralize OMW. Degradation experiments were carried out using a homemade stainless steel reaction cell system. The reaction cell was filled with 200 ml of OMW and the pressure of the reaction cell was fixed to 30 bar with  $N_2$  for each degradation experiments. Degradation experiments were carried out at three different temperatures ranging from 323K to 373 K, three different treatment time ranging from 60 to 120 minutes and three different oxidant concentration ranging 50 to 150 mM.  $K_2S_2O_8$  (PS) was used as oxidising agent. The effect of experimental parameters (temperature, concentration of oxidising agent and treatment time) that are affecting OMW treatment were determined by taking the advantage of response surface methodology (RSM) which is known as a statistical and mathematical modelling technique. RSM has been commonly used to characterize and optimize the experimental factors. The effectiveness of the treatment method is measured as removal percentage of chemical oxygen demand (COD). The results were evaluated using ANOVA tests and 3D plots. In addition, the results show that the maximum and minimum COD removal were obtained as 70.87 % and 9.75 % respectively.

**Keywords:** Olive mill wastewater, Response Surface Method, Subcritical water oxidation, Pressurized hot water oxidation.

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