



“Gheorghe Asachi” Technical University of Iasi, Romania



COMBINED ULTRASONIC IRRADIATION AND AEROBIC BIODEGRADATION TREATMENT FOR OLIVE MILLS WASTEWATERS

Zakaria Al-Qodah^{1,2}, Abeer Al-Bsoul³, Eman Assirey⁴, Mohammad Al-Shannag^{5*}

¹Taibah University, Department of Chemical Engineering, Madinah, KSA

²Al-Balqa Applied University, Department of Chemical Engineering, Amman, Jordan

³Al-Balqa Applied University, Al-Huson University College, Department of Chemical Engineering, Jordan

⁴Taibah University, Department of Chemistry, Madinah, KSA

⁵The University of Jordan, Faculty of Engineering and Technology, Chemical Engineering Department, 11942 Amman, Jordan

Abstract

In this study, the reduction of phenolic compounds and other organic pollutants from greenish black (GB) and dark brown (DB) olive mill wastewater (OMW) was investigated. Ultrasonic irradiation in combination with aerobic biodegradation was adopted as the treatment technique. Operational parameters such as the duration of ultrasonic irradiation, ultrasonic power intensity and ultrasonic frequency were tested to determine their effects on phenol, BOD, and COD degradations. It was found that a time interval of 90 minutes of continuous exposure of OMW to ultrasonic field lead up to 81% degradation of the total phenol at 25°C. In addition, the results showed that ultrasonic field affects significantly BOD of OMW. In contrast, there was no significant dependency between COD degradation and ultrasound intensity. It was demonstrated that phenol degradation can be modelled adequately according to first-order kinetics model with rate constant, k , of around 0.0083 and 0.0077 min^{-1} for (GB) and (DB) OMW samples, respectively. In the aerobic degradation step, the COD was consumed according to Grau kinetic model. The order of COD degradation rate, is about $n=1.13$ and 1.27, whereas, the Grau kinetic constant, $K=0.0218$ and 0.0149 h^{-1} for GB and DB OMW, respectively. The maximum COD removal efficiency achieved was about 80%. It can be concluded that sonication energy plays a significant role on enhancement the efficiency of the biodegradation of OMW by contributing positively in the reduction of the toxic phenolic compounds.

Key words: biodegradation, olive mills wastewater, phenols, ultrasound irradiation

Received: June, 2014; *Revised final:* July, 2014; *Accepted:* July, 2014

* Author to whom all correspondence should be addressed: e-mail: Mohammad_al_shannag@hotmail.com; m.shannag@ju.edu.jo