Abstract

Comparison of the efficiency by Sono-fenton and Sono-persulphate Processes removal of Humic Acid from aqueous solutions by Response Surface Methodology (RSM) base on Box-Behnken design (BBD) in 1397

Abstract

Background and Objectives:Today, the supply of safe water has faced many challenges due to the increase in water consumption due to the growing population and the entry of various pollutants into water.Among these, natural organic matters (NOM_S) are one of the most important factors in reducing the quality of surface water. Natural organic matters (NOM_S) not only affects the color, odor, and taste of water, but also causes wide range of problems such as increasing the demand for disinfectants, corrosion, and bacterial growth in the distribution system and drinking water treatment processes. Humic substances (humic acid and folic acid) are the most important part of natural organic matters in water. The presence of humic compounds in the water, in addition to increasing the use of disinfectants, leads to the formation of disinfectant by-products such as Trihalomethanes and Halo acetic Acids, which are mainly toxic and carcinogenic. this study was the optimization of the HA removal in the sono-persulfate and sono-fenton process using the response surface methodology based on the box-Behnken model combined.

Materials and Methods: This study was an experimental study and was conducted on a laboratory scale to removal humic acid by sonopressulfate and sonofenton processes and the effect of important operational parameters such as solution pH, persulfate concentration, ferrous ions, hydrogen peroxide concentration and reaction time at three levels (+1, 0 and -1) was studied using a constant intensity of ultrasonic waves of 37 kHz and the initial concentration of HA at 25 mg/L. Optimization and analysis of the results were performed by Design Expert 10 and Statgraphics 18 software, and the residual-humic acid was measured using a spectrophotometer.

Results: The results showed that the quadratic model was suitable for the data ($P_{value}<0.0001$) and the proposed model was confirmed with a high correlation coefficient (($0.9966 = R^2$) and ($0.9932 = R^2_{Adj}$)). Under the optimal conditions for the process (pH = 3, optimal persulfate concentration of 0.514 mg/L and reaction time of 39.29 min), the observed elimination efficiency was about 87.59%. The synergetic degradation of the sono-persulfate process and COD removal in optimal conditions was 42.63% and 81.2%, respectively.

Also in the sonofenton process, like the sonopressulfate method, the proposed model (Quadratic) was confirmed with a correlation coefficient (($R^2 = 0.9856$) and (R^2Adj = 0.9729)).Under the optimal conditions for the sonofenton process (PH = 3, optimal concentration of hydrogen peroxide 49.5 mg / l, concentration of ferro ions 9.63 mg / l and reaction time 60 minutes) the observed removal efficiency was about 100% and the COD removal was 89.65%.

Conclusion: According to the results of this study, efficiency of sonofenton process in removing humic acid from sonopresulfate process was higher and also the box design was determined. Bacon can also be used as a suitable tool to optimize process conditions in the removal of humic acid.

Keywords: Advanced Oxidation Process, Ultrasonic - Persulfate, Fenton, Humic Acid, Response surface methodology