Regeneration of exhausted granular activated carbon by low frequency ultrasound in batch reactor

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ABSTRACT

The aim of the present work is to investigate the use of low frequency ultrasound (20 kHz) for the desorption of 4-chlorophenol (4-CP) from granular activated carbon (GAC) in batch reactor. The influence of experimental conditions such as amount of adsorbent, acoustic power, pulsed ultrasound, temperature, concentrations of NaOH, ethyl alcohol, and salt and saturating gases on the desorption was examined. The obtained results show that continuous wave ultrasound was more effective than pulsed modulation. The desorption was enhanced with the rise in temperature from 15 to 45°C and was reduced in the presence of salt (NaCl) and saturating gases such as argon and nitrogen. The regeneration of GAC was increased with increasing the concentration of NaOH from 0.01 to 0.1 M and decreased afterward. The desorption increased with increasing the ethanol percentage. Using different mixtures of ethanol and NaOH at various concentrations, it has been shown that these regenerating mixtures improve the desorption of 4-CP. A mixture of 30% ethanol and 0.1 M NaOH produces a synergistic effect and a significant intensification of desorption. The findings revealed the potential to regenerate exhausted GAC by ultrasonic irradiation.

Keywords: Regeneration; Granular activated carbon; Ultrasound; Batch reactor

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