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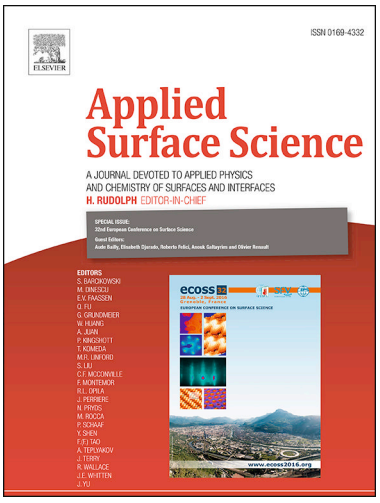

Full Length Article

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Optimization of synthesis parameters and characterization of coal fly ash derived microporous zeolite X

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Abstract

The present work focused on synthesis of microporous zeolite X (mZX) from Indian coal fly ash (CFA) by modified hydrothermal method. Response surface methodology, namely Box-Behnken design were accounted to optimize the synthesis parameters - NaOH/CFA ratio, crystallization temperature, and crystallization time to maximize crystallinity percentage and yield percentage for mZX. Both CFA and mZX were characterized by various techniques such as XRD, FESEM, TEM, XRF, BET, FTIR and TGA-DTA. XRD pattern are matching uniformly with commercial zeolite X at the optimum conditions of 1.25 weight ratio NaOH/CFA, 100 ^{o}C of crystallization temperature and 10 h of crystallization time. FESEM of mZX showed the formation of microporous zeolite. The maximum crystallinity was achieved 76% with 88% mZX yield. A total surface area of 648.42 m^2/g, micropore area of 578.64 m^2/g, micropore volume of 0.218 cm^3/g and average pore size 9.048 Å were obtained. The optimized average crystal size was calculated as 22.55 nm from XRD and crystal size was observed in the range of 17.43-35.07 nm from TEM. A maximum adsorption for Crystal Violet (CV) were found as 99.62% for mZX in comparison to 82.42% for CFA and 96.23% for commercial zeolite X.

Keywords: Microporous zeolite X; coal fly ash; modified hydrothermal treatment; crystal violet dye; Box-Behnken Design.

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