Defence Seminar

Seminar Title	: Barium ferrite based magnetic adsorbents for methyl blue dye removal from aqueous solution.
Speaker	: Kousik Polley (Rollno : 515cr1011)
Supervisor	: Prof. Japes Bera
Venue	: Seminar Room, Ceramic Engineering Department
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Abstract

: $BaFe_{12}O_{19}$ (BaM) is a multifunctional material which is used in various applications like electromagnetic interference shielding, high frequency antenna substrate, permanent magnets, drug delivery, adsorbents and catalyst to remove pollutants etc. Ferrite and ferrite based composite adsorbents are important choice for water purification applications, which requires good adsorption capacity, they are easy to recover and reuse. Here in this current research BaM powder, and BaM-chitosan, BaM-chitosan-activated charcoal based different adsorbent have been evaluated for methyl blue dye removal application. In this work, pure hexagonal BaM ferrite has been synthesized through solid-state, sol-gel combustion and co-precipitation route. Because of the advantage of lower calcination temperature and good textural properties, coprecipitated BaM powder has been used for the methyl blue (MB) dye removal application. 900 oC calcined BaM powder (CP-BaM-900) showed BET surface area of 8.22 m2 g-1, band gap of ~ 2.9 eV, saturation magnetism of 67.7 emu g-1 and used for the adsorptive removal of MB dye. The adsorption process followed the pseudo-second-order model and Langmuir isotherm model. BaM powder showed a maximum Langmuir saturation adsorption capacity of 223.86 mg/g at room temperature. Adsorption process was exothermic and spontaneous. After the adsorption equilibrium the BaM-900 powder was further used for the solar light driven photocatalytic degradation of MB dye and showed 73% degradation efficiency for MB dye under sunlight irradiation for 3h. Activated charcoal modified BaM powder (SG-BaM-C) showed BET surface area of 5.93 m2 g-1 with saturation magnetism of 56.8 emu g-1. SG-BaM-C powder showed MB adsorption capacity of 150.2 mg g-1.Adsorption process followed pseudo-second-order kinetics and sips adsorption isotherm. MB adsorption was spontaneous and endothermic in nature. Chitosan modified BaM beads (BaM-CS) showed BET surface area of 2.237 m2 g-1. BaM-CS beads showed maximum sips adsorption capacity of 123.9 mg g-1 at 323K and 6.0 of pH. BaM powder, chitosan, activated charcoal based beads (BaM-CS-AC-B) and powder (BaM-CS-AC-P) showed BET surface area of 152.99 m2 g-1 and 41.5 m2 g-1 respectively. The MB absorption by BaM-CS-AC-B was optimized through the design of experiments using Box Behnken design of response surface methodology. For MB dye removal applications, BaM-CS-AC-B beads showed adsorption capacity of 371.6 mg g-1 at pH=6.0 and 323K temperature. BaM-CS-AC-P composite powder showed MB adsorption capacity of 254.58 mg g-1 in similar conditions. Both samples followed pseudo-second-order kinetics with sips isotherm model and spontaneous and endothermic MB adsorption. The scale-up calculations and cost benefit analysis were also carried out and found suitable for the MB adsorption through BaM-CS-AC-B composite. These results indicates that BaM based composites can be a good material for MB dye contaminated water treatment applications.