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Development of Cobalt Doped Alumina Hybrids for Adsorption of Textile Effluents

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Abstract : The discharge volume and composition of Textile effluents gains scientific concern due to its hazards and biotoxcity of azo dyes. Azo dyes are non-biodegradable due to its complex molecular structure and recalcitrant nature. Serious attempts have been made to synthesize and develop new materials to combat the environmental problems. The present study is designed for removal of a range of azo dyes (Methyl orange, Congo red and Basic fuchsine) from synthetic aqueous solutions and real textile effluents. For this purpose, Metal (cobalt) doped alumina hybrids are synthesized and applied as adsorbents in the batch experiment. Two different aluminium precursor (aluminium nitrate and spent aluminium foil) and glucose are mixed following sol gel method to get hybrids. The synthesized materials are characterized for surface and bulk properties using FTIR, SEM-EDX and XRD techniques. The characterization of materials under FTIR revealed that –OH (3487-3504 cm-1), C-H (2935-2985 cm-1), Al-O (~ 800 cm-1), Al-O-C (~1380 cm-1), Al-O-Al (659-669 cm-1) groups participates in the binding of dyes onto the surface of hybrids. Amorphous shaped particles and elemental composition of carbon (23%-44%), aluminium (29%-395%), and oxygen (11%-20%) is demonstrated in SEM-EDX micrograph. Time-dependent batch-experiments under identical experimental parameters showed 74% congo red, 68% methyl orange and 85% maximum removal of basic fuchsine onto the surface of cobalt doped alumina hybrids probably through the ion-exchange mechanism. The experimental data when treated with adsorption models is found to have good agreement with pseudo second order kinetic and freundlich isotherm for adsorption process. The present study concludes the successful synthesis of novel and efficient cobalt doped alumina hybrids providing environmental friendly and economical alternative to the commercial adsorbents for the treatment of industrial effluents.

Keywords : alumina hybrid, adsorption, dopant, isotherm, kinetic
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