



Contents lists available at ScienceDirect

Chemical Engineering Journal

journal homepage: www.elsevier.com/locate/cej

Enhanced piezocatalytic degradation of cationic dyes using graphene oxide and magnetic beads Nanomaterials: Synthesis, Characterization, and mechanistic insights

Drashya Gautam^a, Laishram Saya^{a,b}, Geetu Gambhir^c, Sunita Hooda^{a,*}

^a Polymer Research Laboratory, Department of Chemistry, Acharya Narendra Dev College (University of Delhi), Govindpuri, Kalkaji, New Delhi 110019, India

^b Department of Chemistry, Sri Venkateswara College, (University of Delhi), Delhi, 110021, India

^c Department of Chemistry, Acharya Narendra Dev College (University of Delhi), Govindpuri, Kalkaji, New Delhi 110019, India

ARTICLE INFO

Keywords:

Piezocatalytic

Graphene Oxide

Chitin

Degradation

Hydroxyl and Superoxide radicals

ABSTRACT

Sequestration of organic pollutants by the method of degradation is one of the safest ways to completely remove them from water bodies, without generating harmful by-products. Piezocatalytic degradation for this approach has been gaining much research attention, in recent times, due to its high efficiency. The present work reports synthesis of four types of Graphene Oxide-Chitin-Magnetic Iron Oxide Beads Nanomaterials, each with a different ratio of Graphene oxide (GO) and Chitin (CH). Among these, GO-CH-MIOBs NM-4 showed a superior Piezocatalytic degradation capacity towards methylene blue (MB), crystal violet (CV) and Rhodamine 6G (R6G) dyes. Various parameters influencing the piezocatalytic performance of the material such as kinetic factors, initial dye concentration, strength of ultrasonic vibration etc., have been analyzed thoroughly. Degradation rate constant (K) values of 63.4, 59.34 and 48.36 /min were obtained for MB, CV and R6G Dyes respectively. Moreover, cycling tests for all three dyes reflected significant stability of these materials as evident from the high degradation efficiencies of 99.80, 99.24 and 99.12 % within 60 min being retained for MB, CV and Rh6G dyes even after the 5th cycle. These nanomaterials can be a good addition in the list of high efficiency piezocatalysts for water purification with no secondary wastes being produced. Comparison of the XPS spectra before and after sonication gave insight into the mechanism of piezocatalytic degradation which highlighted hydroxyl and superoxide radicals as the main attacking species which are responsible for the degradation process.