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Preparation of imprinted chitosan nanoparticles for the selective removal of some organic pollutants

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Abstract

Herein, new molecular imprinted polymers (MIPs) based on chitosan-TiO_2 nanocomposite (CTNC) was prepared for the selective and quantitative removal of Congo red (CR) and Rose bengal (RB) dyes, as model organic pollutants, from industrial waste water. The physicochemical features of the prepared MIPs have been investigated using XRD, FTIR, N_2-adsorption-desorption isotherm, SEM and HRTEM. The results have pointed out the existence of high surface area MIP nanoparticles 95 m^2/g and 184.9 m^2/g for RB and CR. respectively, with wide mesoporous channels that are very accessible to attract the dye molecules. Exceptional uptake of dye was registered as (q_m=79.3651) mg/g for RB and (q_m=138 mg/g) for CRreflecting the high selectivity of MIP in attracting the dye molecules compared to that of pure chitosan. The mechanism of adsorption was investigated using Freundlich, Langmuir, Dubinin Radushkevich and Temkin models. However, the kinetics of the

removal was explored by pseudo-first, pseudo second order and Weber-Morris models. The Experimental data fit well into pseudo-second order kinetic model, and much well with the Langmuir isotherm confirming the formation of monolayer of dye molecules. The enthalpy of adsorption was 62.279 kj/mol and 67.79kj/mol for RB and CR respevively, showing strong interaction of MIP with the dyes. The prepared MIPs exhibits good reproducibility and satbility. Subsequently, the novel CTNC-MIP nanoparticles were successfully applied for selective and quantitative removal of RB and CR dyes from textile wastewaters.

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List of Abbreviations

AOP'S	Advanced Oxidation processes
CR	Congo red
CTNC	Chitosan-Titanium nanocomposite
DLLME	Dispersive Liquid-Liquid Micro extraction
FTIR	Fourier transform infrared spectroscopy
HRTEM	High Resolution Transmission electron microscope
LMIP	Leached Molecularly Imprinted Polymer
MIP	Molecularly Imprinted Polymer
MIT	Molecularly Imprinted Technique
MO	methyl Orange
NF	Nanofilteration
NIP	Non Imprinted Polymer
pH	The negative Logarithm of hydrogen ion
RB	Rose Bengal
RO	Reverse Osmosis
SEM	Scanning Electron Microscopy
TiO_2	Titanium dioxide

CHAPTER ONE

INTRODUCTIONAND LITERATURE REVIEW