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Development of carbon nanotube-mycosorbent for effective Congo red removal: optimization, isotherm and kinetic studies

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ABSTRACT

Nano-biocomposites with high adsorption surface and various functional groups are considered as efficient sorbents for remediation of azo dyes. In this study, two bio-nanocomposites were made using *Mucor circinelloides*, a previously confirmed potent azo dye biosorbent, with Fe_2O_3 and carbon nanotube. The efficacy of Congo red removal was 67% for the fungal biomass but it was 72% and 85% for the Fe_2O_3-biocomposite and carbon nanotube biocomposites, respectively. The sorption capacity in the free biomass and carbon nanotube biocomposite were 67.1 and 127.2 mg dye/g adsorbent, respectively, showing a 100% increase in sorption capacity of the carbon nanotube biocomposite when compared with the free fungal adsorbent. Also, the SEM images showed precipitation of dye particles on the nano-bioadsorbent surface. The adsorption isotherms showed that the biosorption process is in agreement with the Langmuir isotherm model and the kinetics adsorption results showed that the biosorption process followed the pseudo-second-order kinetics model. Acetone showed the most efficient dye desorption performance which was about 50% for carbon nanotube-biocomposite. In addition, evaluating the removal efficiency of the construct in real wastewater confirmed its high potential for use in wastewater treatment. The values of BOD and COD in treated wastewater decrease for 6259 and 16690 mg/L, respectively.

Keywords: Congo red; Nano-biosorbent; Isotherm; Kinetic; *Mucor circinelloides*

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