Chitosan/graphene oxide@montmorillonite composites for the adsorption of dyes from wastewaters

Anastasia D. Meretoudi[1], Ioannis Kalampogias[1], Konstantinos N. Maroulas[1], Sofia L. Kouvalakidou[1], Ramonna I. Kosheleva[1], Ioannis Georgiou[1], Despina A. Gkika[1], Athanasios Varoutoglou[1], Irene Moschou[1], Athanasia K. Tolkou[1], Pavlos Efthymiopoulos[1], George Z. Kyzas[1]

[1]Hephaestus Laboratory, Department of Chemistry, School of Science, Democritus University of Thrace, Kavala, GR-654 04, Greece
Keywords: Chitosan, montmorillonite, GO
Presenting author email: tolkatha@chem.ihu.gr

It is known that human activity is strongly engaged with dyeing industry. More than 800 thousand tons of synthetic dyes are produced globally per year. A value of 18% ends up in water, which pose a threat to flora and fauna of this world, due to the high toxicity of these compounds (T. Islam, et al, 2022). Many processes are capable of avoiding these unwanted results. One of the most efficient, is adsorption due to its simplicity and low-cost need compared to others. Environmental awareness is included to the agendas of every country and decentralized agency.

Chitosan is a bioactive polymer with a wide variety of applications due to its functional properties such as antibacterial activity, non-toxicity, ease of modification, and biodegradability (A. Muxika, et al, 2017). In chitosan structure there are amino and hydroxyl groups where the dyes can be docked and be removed from water solutions. It has to be mentioned in addition, that in its native form, chitosan is characterised by pH sensitivity at low values, and instability. Hence, chitosan derrivatives are more effective adsorption materials. Crosslinkers and grafting agents, compounds that reacts with chitosan, attach higher adsorption capacity and stability.

Graphene oxide (GO) can be a material connected with chitosan, as it meets all the properties that chitosan does not have (N. Politaeva et al, 2022). Many papers and reviews have been published at the last decade for such an operation of this composite material. But when it comes to the scaling up process, except from an efficient result, a low-cost method must be taken into account.

Montmorillonite (Mon), a mineral clay, owes unique characteristics like high surface area, high cation exchange capacity and swelling properties (K. Rosli,2023). Especially the last one, could be the innovative point of using such a composite material in big industrial adsorption beds. The combination of these three chitosan/graphene oxide@montmorillonite, aiming at a greener adsorption method than the one is used nowadays, without losing adsorption runs with the same material, achieving even lower cost.

All of materials are characterised via FT-IR, SEM, XRD and BET. Furthermore, experiment under continuous flow carried out for determination of optimal condition of pH, temperature and contact time. All of this result is very important to study and isothermal kinetics for the adsorption evaluation. To sum up, Chitosan/Montmorillonite/Graphene oxide can use in industries or public organization for dye removal of wastewater.

Acknowledgment

We acknowledge support of this work by the project "Advanced Nanostructured Materials for Sustainable Growth: Green Energy Production/Storage, Energy Saving and Environmental Remediation" (TAEDR-0535821) which is implemented under the action "Flagship actions in interdisciplinary scientific fields with a special focus on the productive fabric" (ID 16618), Greece 2.0 – National Recovery and Resilience Fund and funded by European Union NextGenerationEU.

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