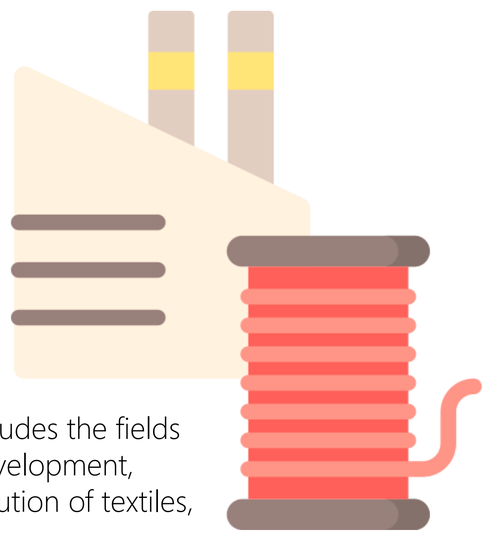
Synthesis of AC/Ag Nanocomposites as Potential Nanophotocatalyst for the Removal of Thiazine Dyes under UV Light Irradiation

Phoebe Marie V. Matulin*, Angeline M. Atacador, and Rey Marc T. Cumba

Department of Physics, Caraga State University – Main Campus
KM 7 NH1, Ampayon, 8600 Butuan City, Philippines

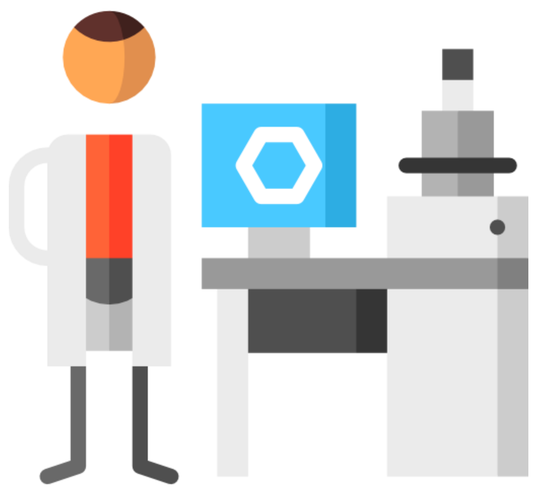
ABSTRACT. Dye-contaminated water from the textile, dyeing, carpet making, pulp and paper industries needs to be adequately treated before it can be released into the environment. The removal of dye-contaminated wastewater can be undertaken through conventional methods such as adsorption, electrodialysis, and membrane filtration but this process is costly and requires complex process. Nanotechnology will offer solution to the problem of the conventional processes. In this proposed study, silver (Ag) nanoparticles were synthesized and impregnated on activated carbon (AC) derived from water hyacinth stems to form AC/Ag nanocomposites for the degradation of methylene blue (MB) aqueous solution under UV light irradiation. UV-Vis analysis initially confirmed the formation of Ag nanoparticles at threshold absorbance peak of 397 nm. Results on the photocatalytic activity indicated that the synthesized AC/Ag nanocomposites showed faster degradation under UV light with an efficiency of 95.27% after 60 mins of light irradiation. Hence, this study is a straightforward synthesis of AC/Ag nanocomposites which is a potential photocatalyst for the removal of thiazine dyes in wastewater.

INTRODUCTION



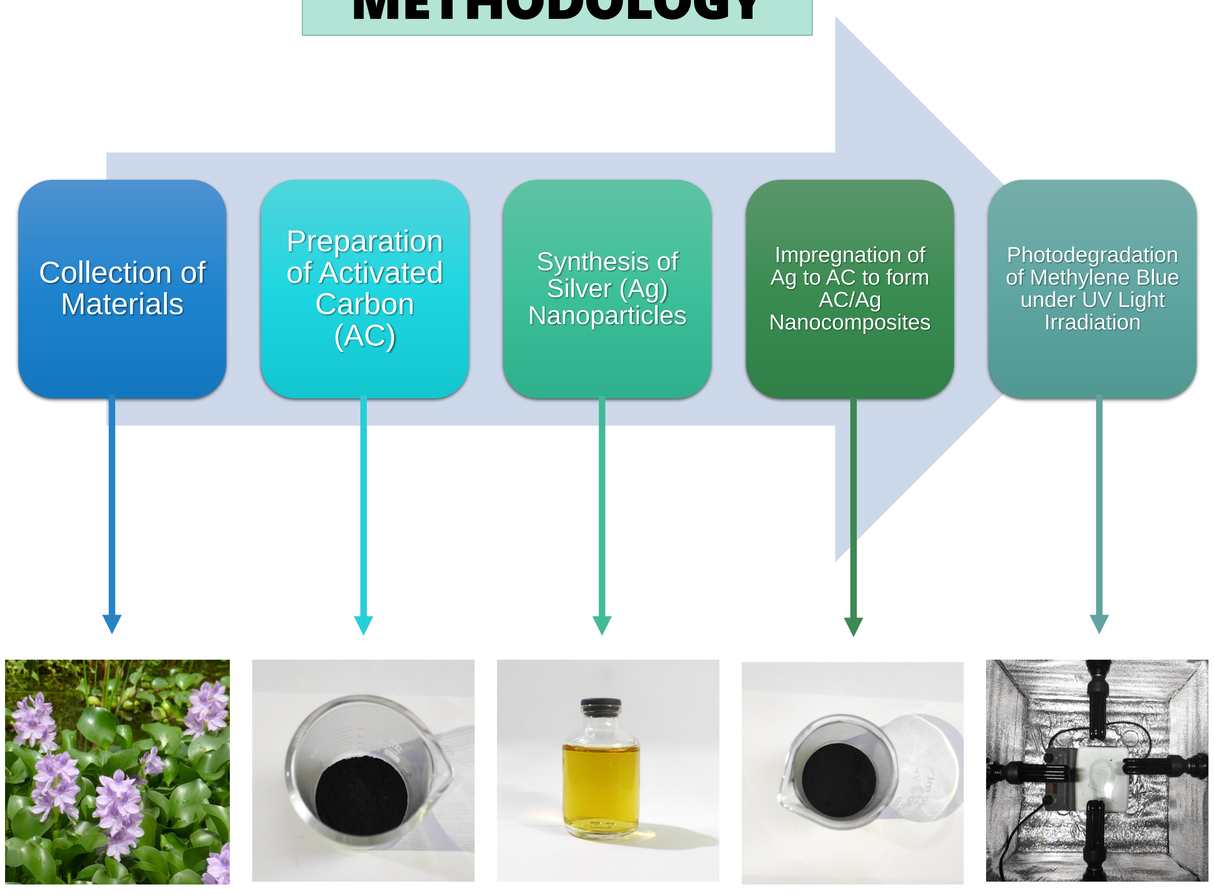
The textile industry includes the fields of research, design, development, production, and distribution of textiles, fabrics, and apparel [1].

Methylene blue is the most widely used dye in the textile industry



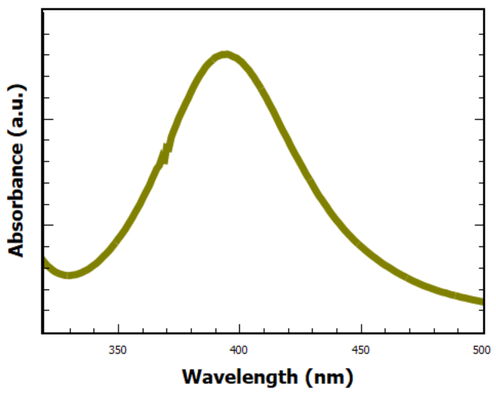
Nanotechnology for clean water is revolutionizing the corporate environment in both the developed and developing worlds when it comes to pollution, particularly water pollution [2].

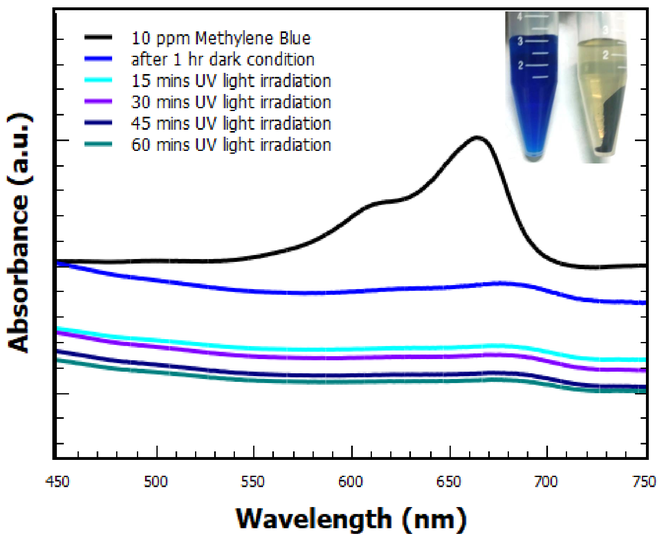
METHODOLOGY



RESULTS AND DISCUSSION

The characteristic absorbance band of Ag nanoparticles is found to be peaking at around **397 nm** which is consistent with previously reported literature for citrate-functionalized silver nanoparticles [3].





Results on the photocatalytic activity indicated that the synthesized AC/Ag nanocomposites showed faster degradation under UV light with an efficiency of 95.27% after 60 minutes of light irradiation.

SUMMARY AND RECOMMENDATION

This study is a straightforward synthesis of AC/Ag nanocomposites which is a potential photocatalyst for the removal of methylene blue in wastewater that has an efficiency of 95.27% after 60 minutes of UV light irradiation.

Material characterizations such as FTIR and DLS will be carried out to confirm the fabrication of AC and the threshold size diameter of the AC/Ag nanocomposites in this research work.

Further investigation of the parameters of photocatalytic activity including the amount of the catalyst, varying concentration of the dye, and photodegradation without light irradiation will be carried out.

ACKNOWLEDGMENT

The authors would like to thank CSU Center of Nanoscience & Technology for Research (CeNTRE) and Entrepreneurship and CSU Department of Chemistry for allowing us to use the laboratory chemicals and equipment in this research.

REFERENCES

[1] Slama, H.B.; ChenariBouket, A.; Pourhassan, Z.; Alenezi,F.N.; Silini, A.; Cherif-Silini, H.;Oszako, T.; Luptakova, L.; Golinska,P.; Belbahri, L. Diversity of SyntheticDyes from Textile Industries,Discharge Impacts and TreatmentMethods. Appl. Sci. 2021,11, 6255

[2] Tahir, M. B., Sohaib, M., Sagir, M., & Rafique, M. (2020). Role of Nanotechnology in Photocatalysis. Reference Module in Materials Science and Materials Engineering. https://doi.org/10.1016/B978-0-12-815732-9.00006-1

[3] Pan, N., Maji, T.K., Bandyopadhyay , S. et al. A Combined Spectroscopic and Theoretical Analysis of Plasmonic Silver Nanoparticle Sensor Towards Detailed Microscopic Understanding of Heavy Metal Detection. Plasmonics 17, 223–236 (2022). https://doi.org/10.1007/s11468-021-01514-6