



Synthesis and Adsorptive Study of Carbon Quantum Dots based Magnetic Composites derived from Plastic and Agricultural Wastes: Waste to Valuable Product

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INTRODUCTION

- ❖ The novel and hybrid adsorbents Fe_3O_4 /Activated carbon/ graphene oxide (MAG) and Fe_3O_4 /Activated carbon/Carbon Quantum dots (MAC) were prepared by co-precipitation method.
- ❖ Graphene oxide is prepared from the plastic waste.
- ❖ Carbon Quantum dots and activated carbon is prepared from the banana peel. The novelty of this work is the recycling of plastic and agricultural waste that is major cause of water pollution

OBJECTIVES

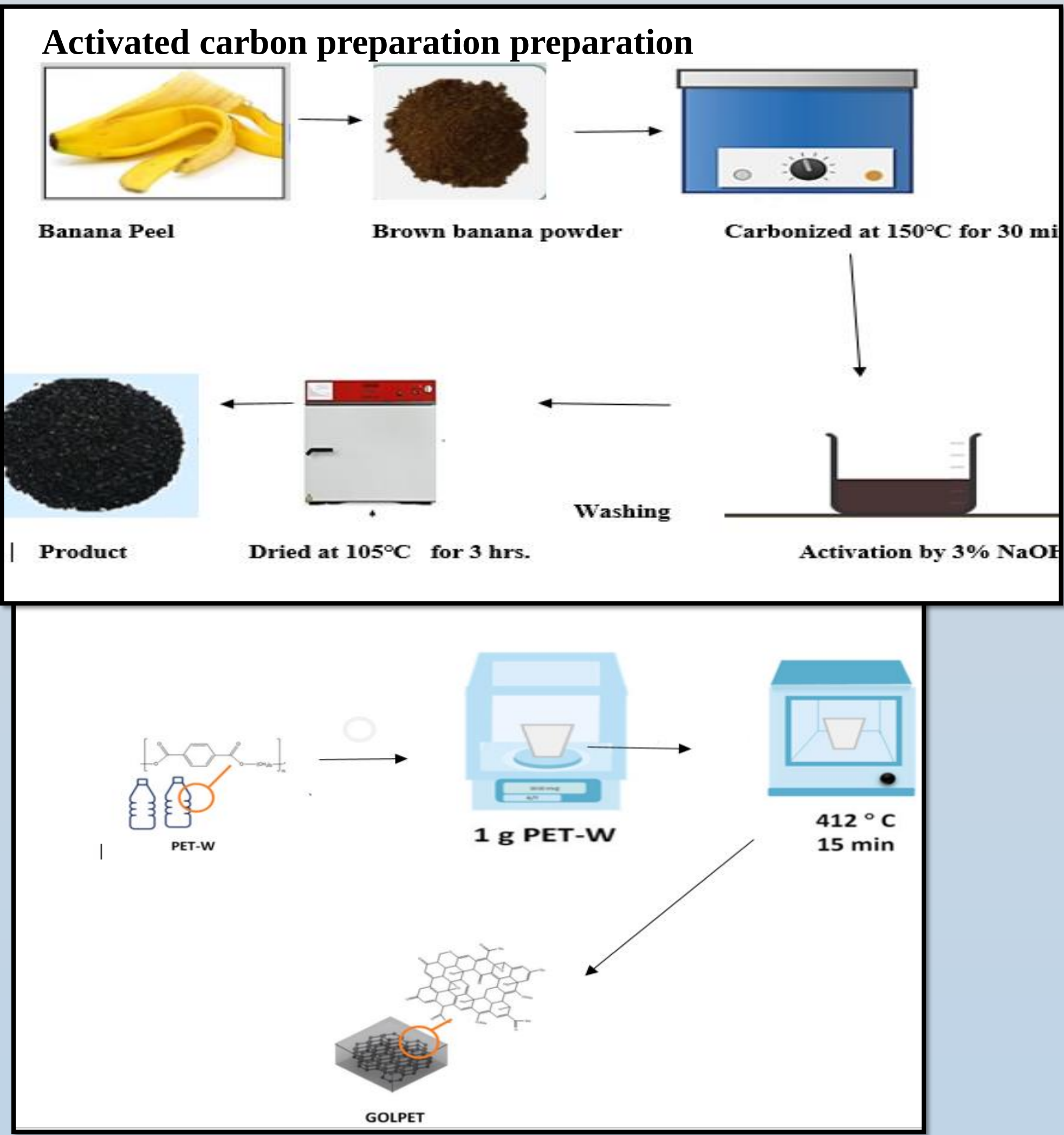
- The nanocomposites, **Fe_3O_4 /Activated Carbon/Graphene Oxide (MAG)** and **Fe_3O_4 /Activated Carbon/Carbon Quantum Dots (MAC)**, prepared from banana peel and PET plastic waste, for the removal of methylene blue dye from wastewater.
- To develop sustainable magnetic adsorbents from agricultural and plastic waste
- To synthesize and compare the adsorption performance of two magnetic composites

KINETICS

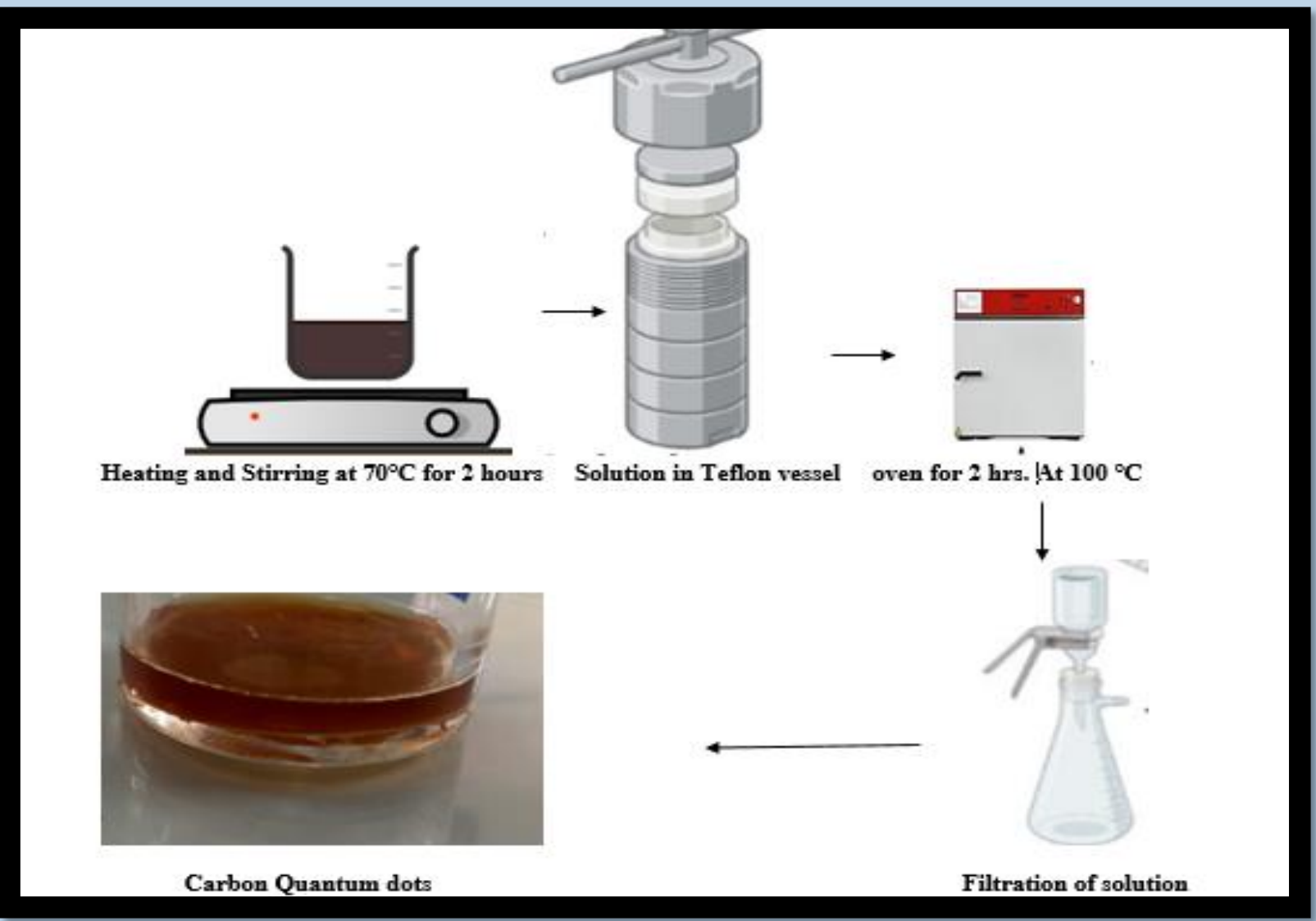
The **pseudo second order rate equation** (PSORE) effectively characterised the absorption kinetic data for both MAC and MAG composites, with R^2 values of 0.971 and 0.953, respectively.

The sorption isotherm for both composites were well represented by the Freundlich isotherm, with R^2 values of 0.97 for MAG and 0.9685 for MAC nanocomposite.

Both composites were prepared by using precipitation method.



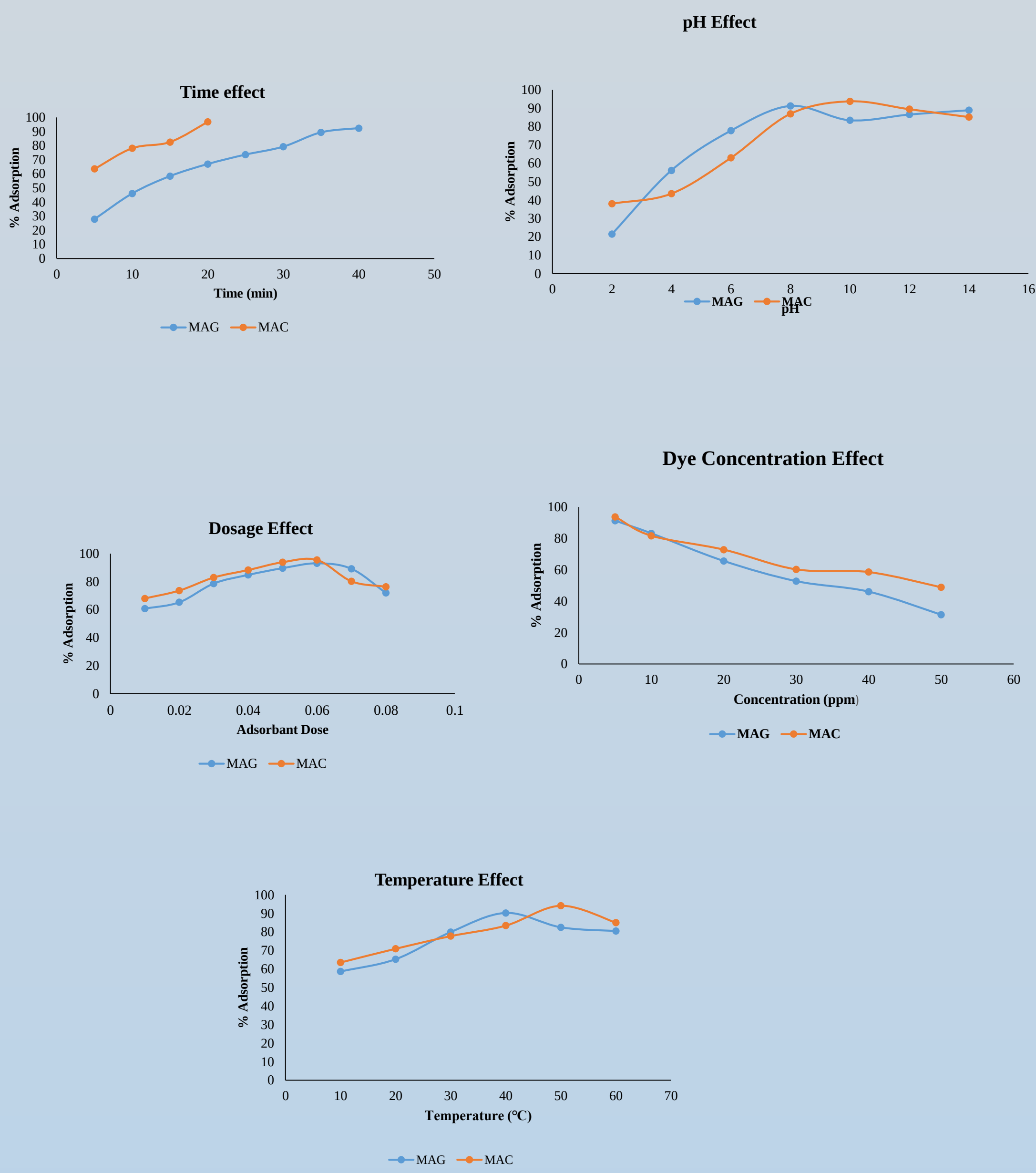
Graphene oxide from PET bottles



Carbon quantum dots synthesis

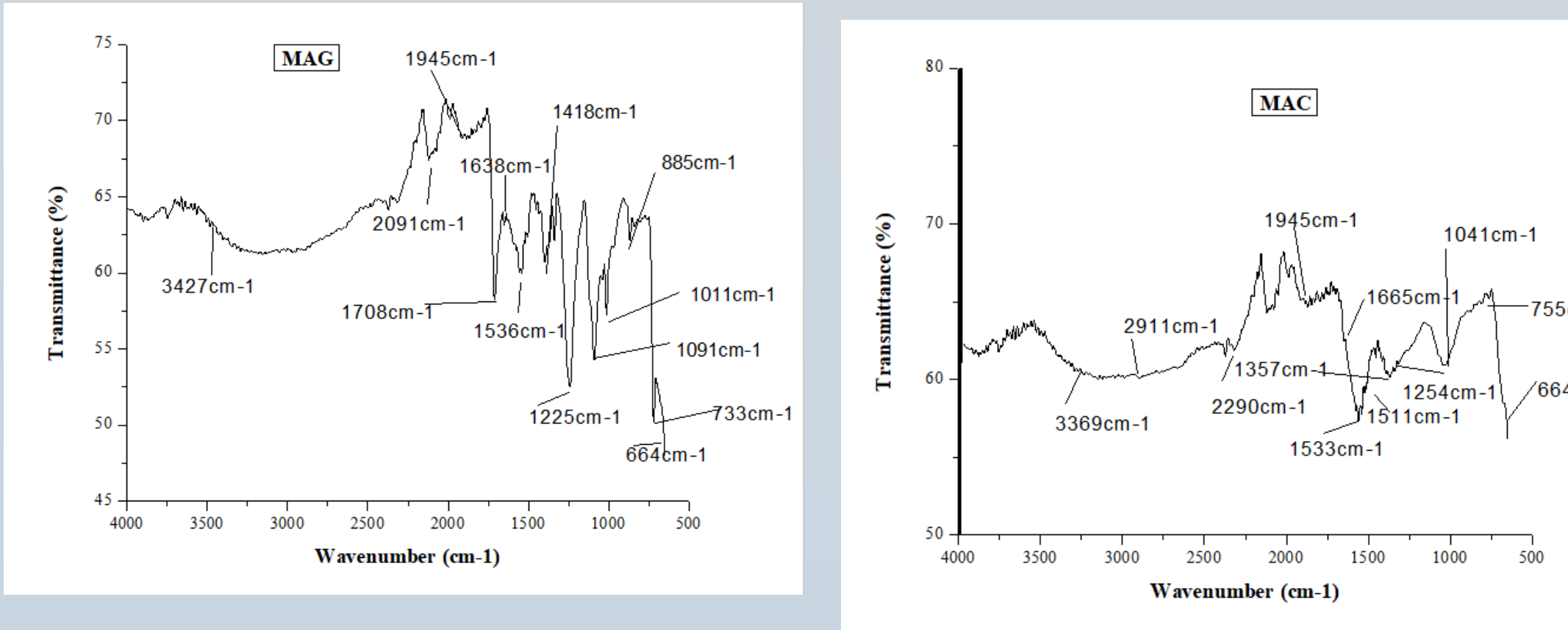
RESULT

Adsorption

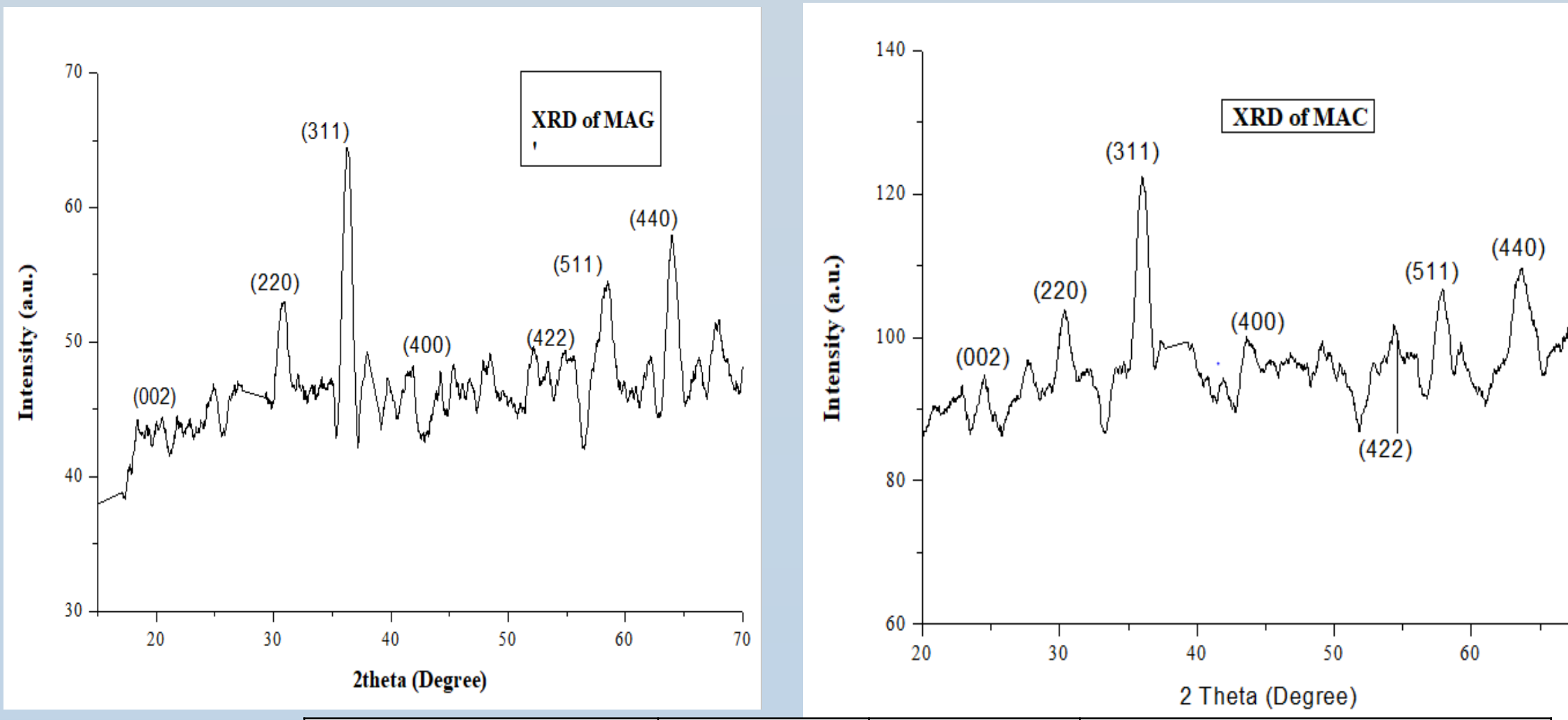


CHARACTERZATION

FTIR



XRD



XRD DATA	MAG	MAC	INTERPRETATION
Fe_3O_4 characteristic peaks (220, 311, 400, 422, 511, 440)	Present	Present	Confirms Fe_3O_4 formation in both composites
Most intense peak (311)	Strong	Stronger and sharper	MAC shows relatively higher crystallinity and/or Fe_3O_4 loading
Background noise	Slightly higher	Lower	MAG contains more amorphous contribution (carbon matrix effect)
Carbon hump (002) ~20–25°	Broad and weak	Broad and weak	Activated carbon is mostly amorphous in both
Presence of GO (001) peak ~10–12°	Slightly appear		Exfoliation of GO layers, overlap with amorphous carbon, and domination of strong Fe_3O_4 peaks.
Presence of (100), (102)		Slight peaks appear	CQD PEAKS

CONCLUSION

Both the banana peel derived activated carbon and carbon quantum dots , graphene oxide like from PET bottles when combined with the magnetic iron oxide nanoparticles showed astonishing results for removing methylene blue dye.

It is very effective research which involve recycling of plastic waste.

Agricultural waste may be reduced more by converting into the useful products which help in the water treatment

. The dye degraded upto 99 % when the time increases,

It Showed excellent result at basic pH and at high concentration of adsorbent dose .

The maximal dye removal reached **95.8%** at the optimal adsorbent dosage of 0.06 g for both composites.

The highest degradation of dye, reaching **95.5%** for both MAG and MAC at the optimal temperature of **40°C**. The effectiveness of dye removal decreases as temperature increases.

Both composite shows excellent adsorption