Preparation and characterization of hybrid materials based on graphene oxide and enzymes

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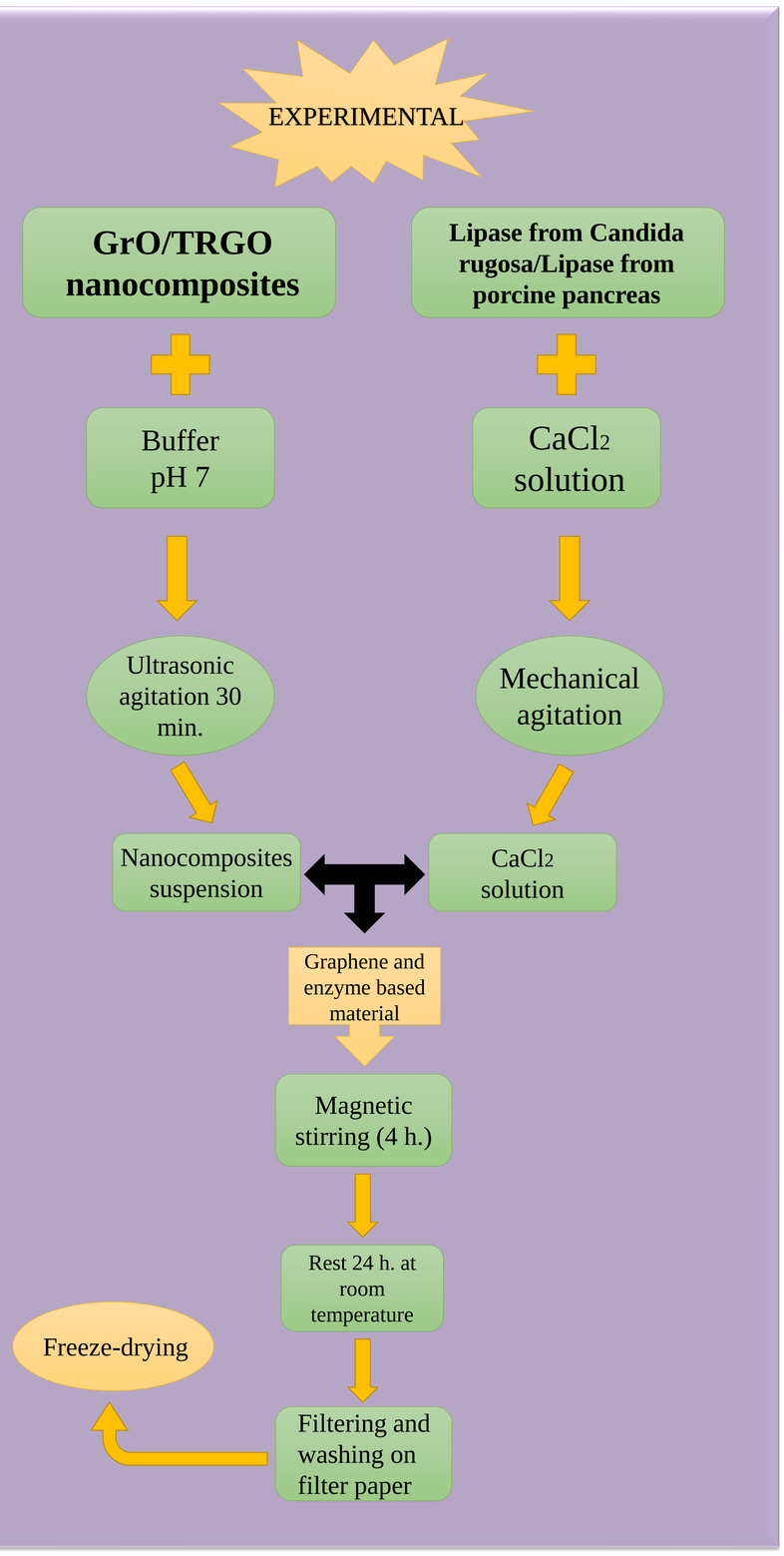
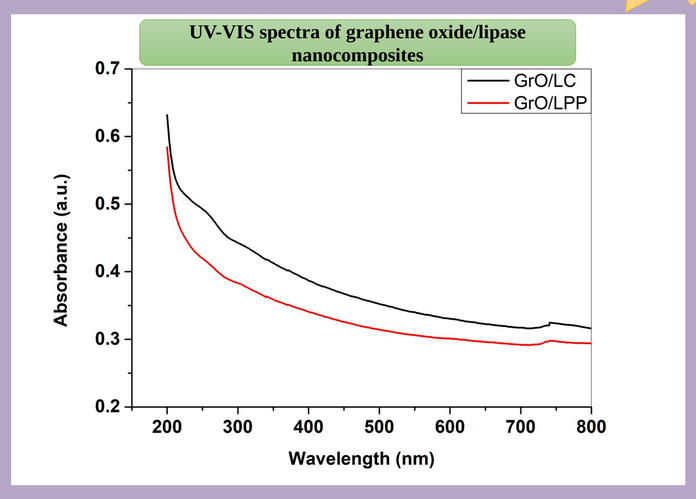
INTRODUCTION

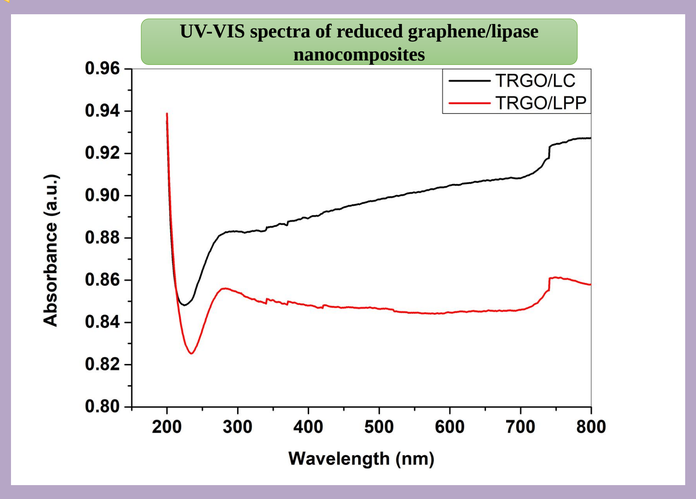
Enzymes are proteins that act as biocatalysts, having an important role on an industrial scale. The major disadvantage of enzymes is their facile denaturation. By obtaining hybrid materials based on immobilized enzymes on graphene oxide and reduced graphene oxide we target an increase in the stability and activity of enzymes. In this study we successfully prepared hybrid graphene oxide and reduced graphene oxide materials with immobilized porcine pancreatic lipase and candida rugosa lipase. We used the *non*-covalent immobilization method which involves the physical absorption of the enzyme on the substrate. The successful immobilization of three different lipase enzymes on graphene oxide was demonstrated by detail characterizations using X-ray diffraction, solid UV-VIS spectroscopy, liquid UV-VIS spectroscopy, TGA in air and argon.

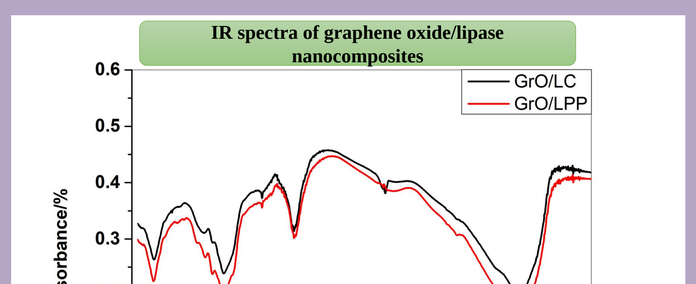
EXPERIMENTAL

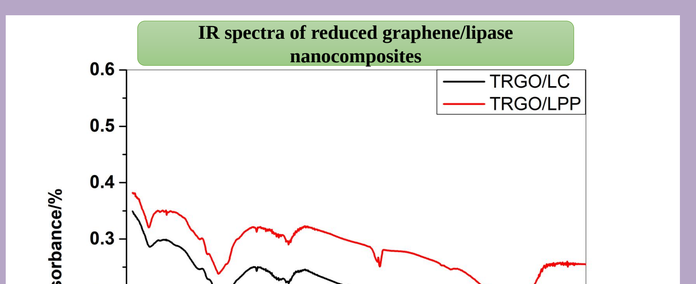


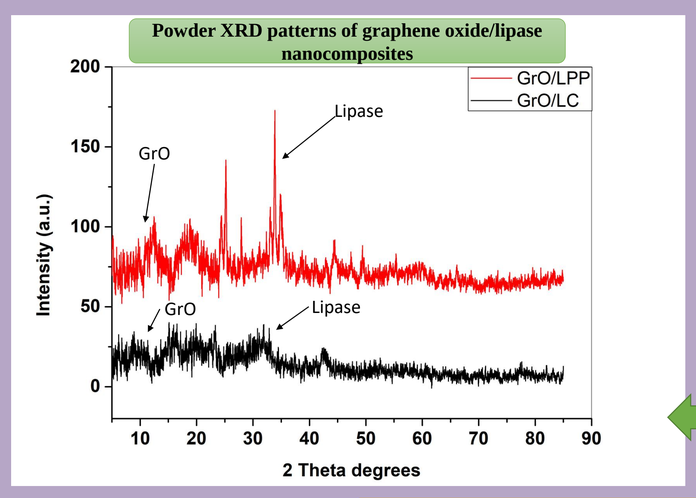
PHYSICAL CARACTERIZATION

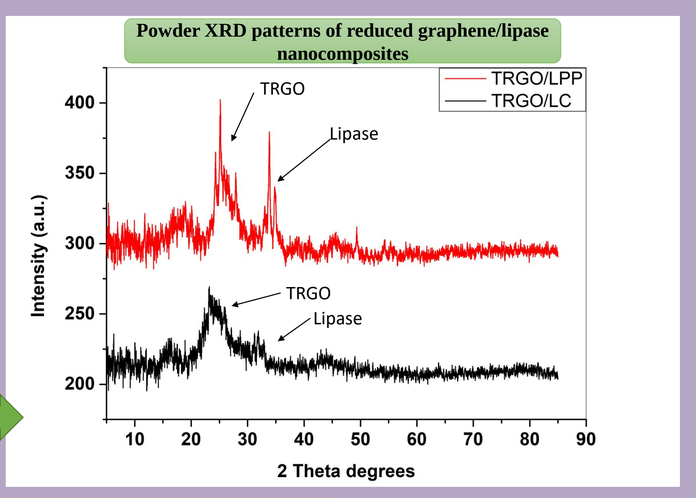




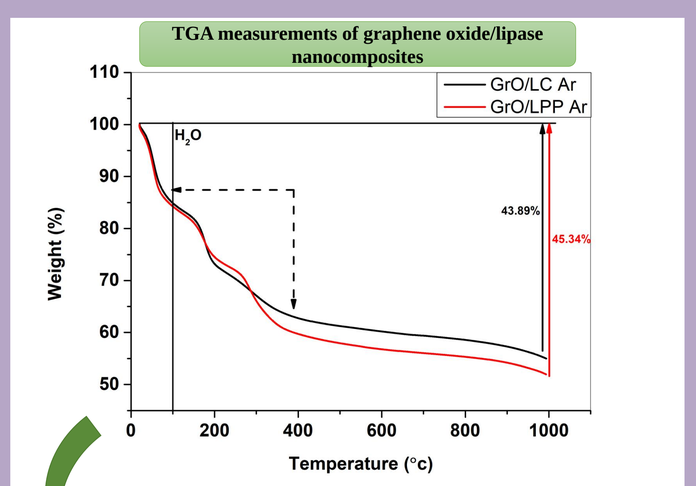


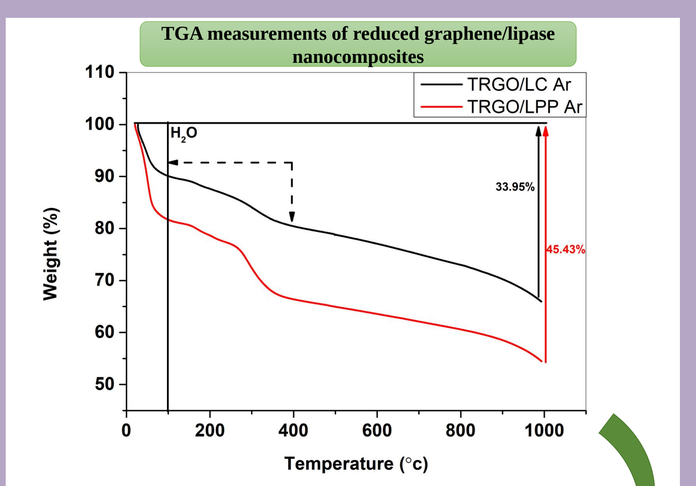






We ovserved the diffraction lines corresponding to GrO, TRGO and Lipase





In TGA spectra we can observe different profiles of nanocomposites; the mass difference is insignificant.
- from 0°C to 100°C the H_2O is gone
- range 100-400°C is assigned to the protein part
- after 600°C graphene leaves

CONCLUSION

1. Lipase was successfully immobilized on the GrO and TRGO substrate, using the noncovalent immobilization method.
2. Experimental results show that the enzyme is on the surface of graphene oxide respectively reduced graphene.
3. GrO and TRGO lose some of their crystallinity due to lipase.
4. We will further study the beneficial contributions of GrO and TRGO in enzymatic hydrolysis.