

PHOTODEGRADATION OF METHYLENE BLUE BY PLA/TiO₂ COMPOSITE MEMBRANES PREPARED BY THE PHASE INVERSION METHOD.

Awobifa Olaolu Samuel¹, Rosa Idalia Narro-Céspedes¹, Alejandro Samuel Lozano Morales² and Francisco José González González²

1. Universidad Autónoma de Coahuila (UadeC), Saltillo, México, Blvd. V. Carranza s/n. Col. República Oriente, Saltillo, Coahuila. C.P. 25280

2. Centro de Investigación en Química Aplicada (CIQA), Saltillo, Mexico Blvd. Enrique Reyna Herosillo No.140, Saltillo, Coahuila, México. C.P.25294

INTRODUCTION & AIM

Dyes released from textile industry and other industries are non-degradable and remains in the environment which are harmful to human and the environment and the thought of removing it have been a major concerned [1,2]. Photocatalysis is a process that involve degradation of organic pollutants in wastewater, using a semiconductor material that generate various reactive species when activated with either visible light or UV irradiation [3–5]. Coupling of TiO₂ into PLA matric (Biodegradable polymer) by phase inversion method had been used in the photocatalysis of Methylene blue dyes at room temperature and neutral pH.

Fresh drinking water in the environment is scarce due to the contamination of water bodies by pollutants such as dyes, pharmaceuticals, heavy metals, and other industrial waste. Dyes have been a major concern in industries, especially the textile, paper, and tile production industries. When these dyes are deposited in the environment, they cause various diseases, including cancer, and disrupt photosynthesis. They are resistant to the oxidizing agent and heat because they are not biodegradable. Therefore, the ability to remove them has become a serious problem. This project deals with the preparation of biodegradable PLA/TiO₂ composites prepared by the phase inversion method for the photocatalysis of methylene blue. The composite membrane produced was characterised by FTIR to determine the functional groups of the membrane. SEM was used to identify the morphology of these porous membranes. The thermal properties of the composite membrane were determined by the TGA and DSC. The adsorption of the methylene blue and the photodegradation of the dyes were carried out at room temperature for 80 mins at 10 mins interval. The adsorption by the pure PLA was higher than that of the composite membrane throughout the 180 min time. The composites containing 10 wt. % TiO₂ showed the highest dye removal.

METHOD

a) Phase inversion technique

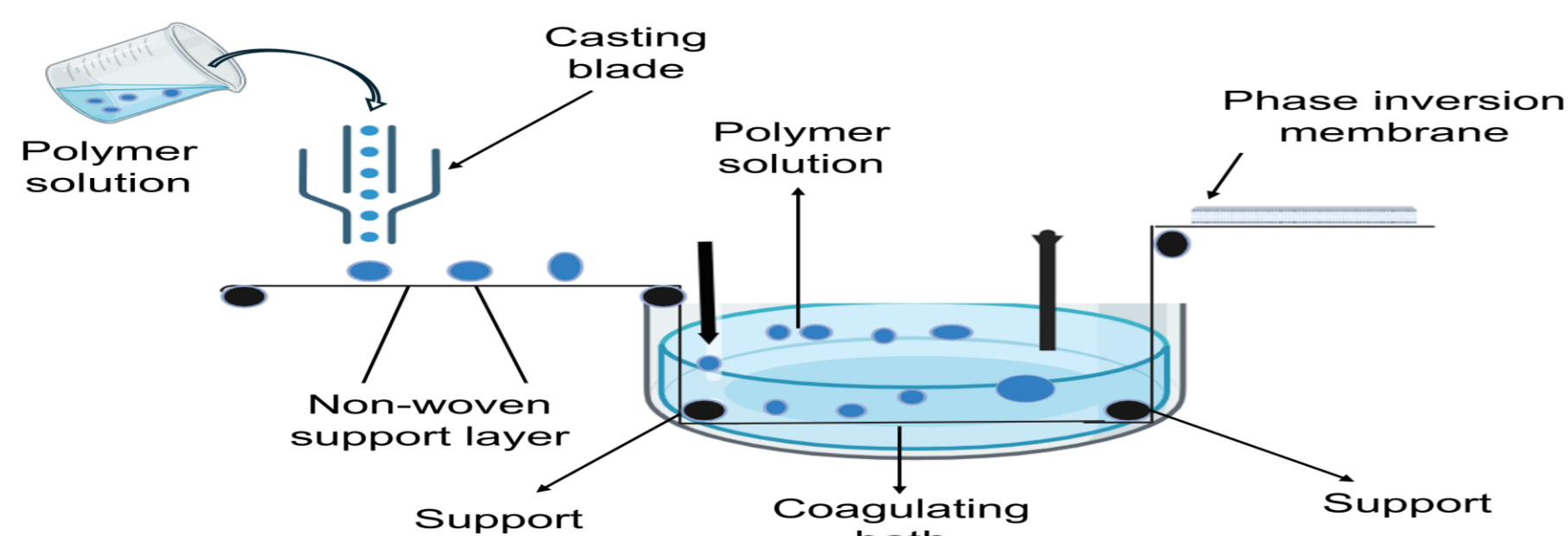


Fig .1. a) Phase inversion method.

b)

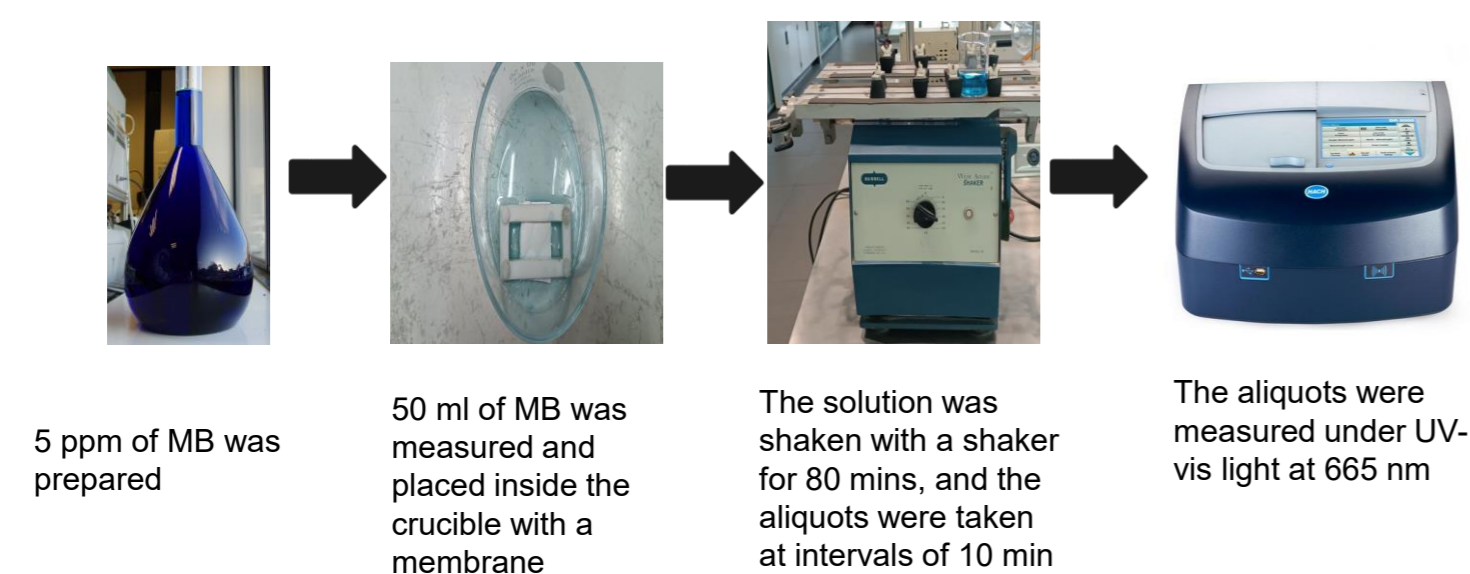


Fig .1. bi) Adsorption of Methylene Blue.

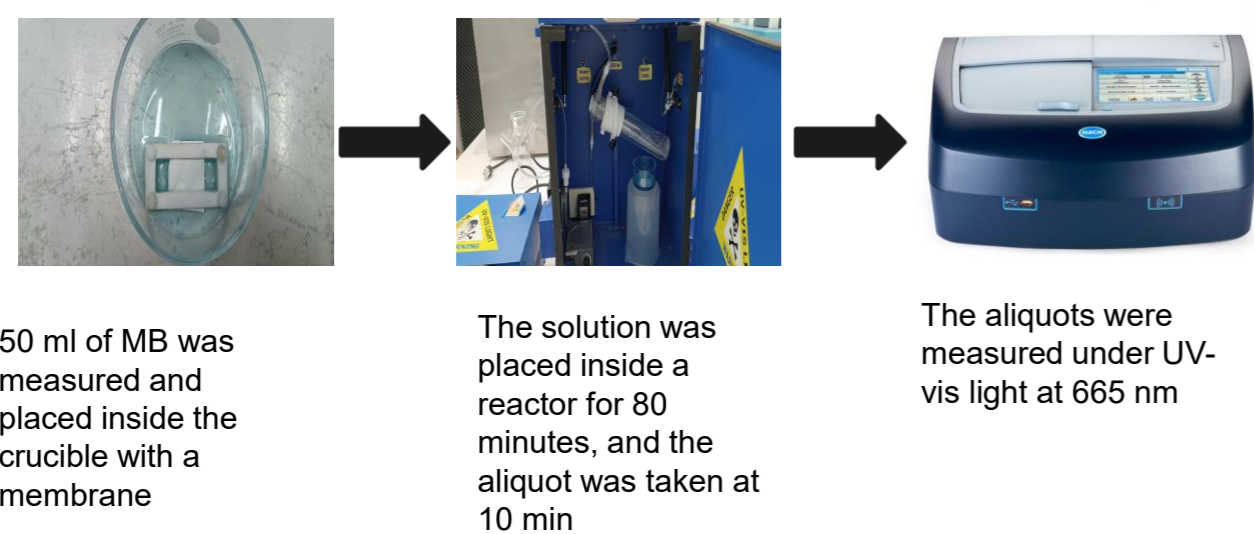


Fig .1. bii) Photodegradation of Methylene Blue.

RESULTS & DISCUSSION

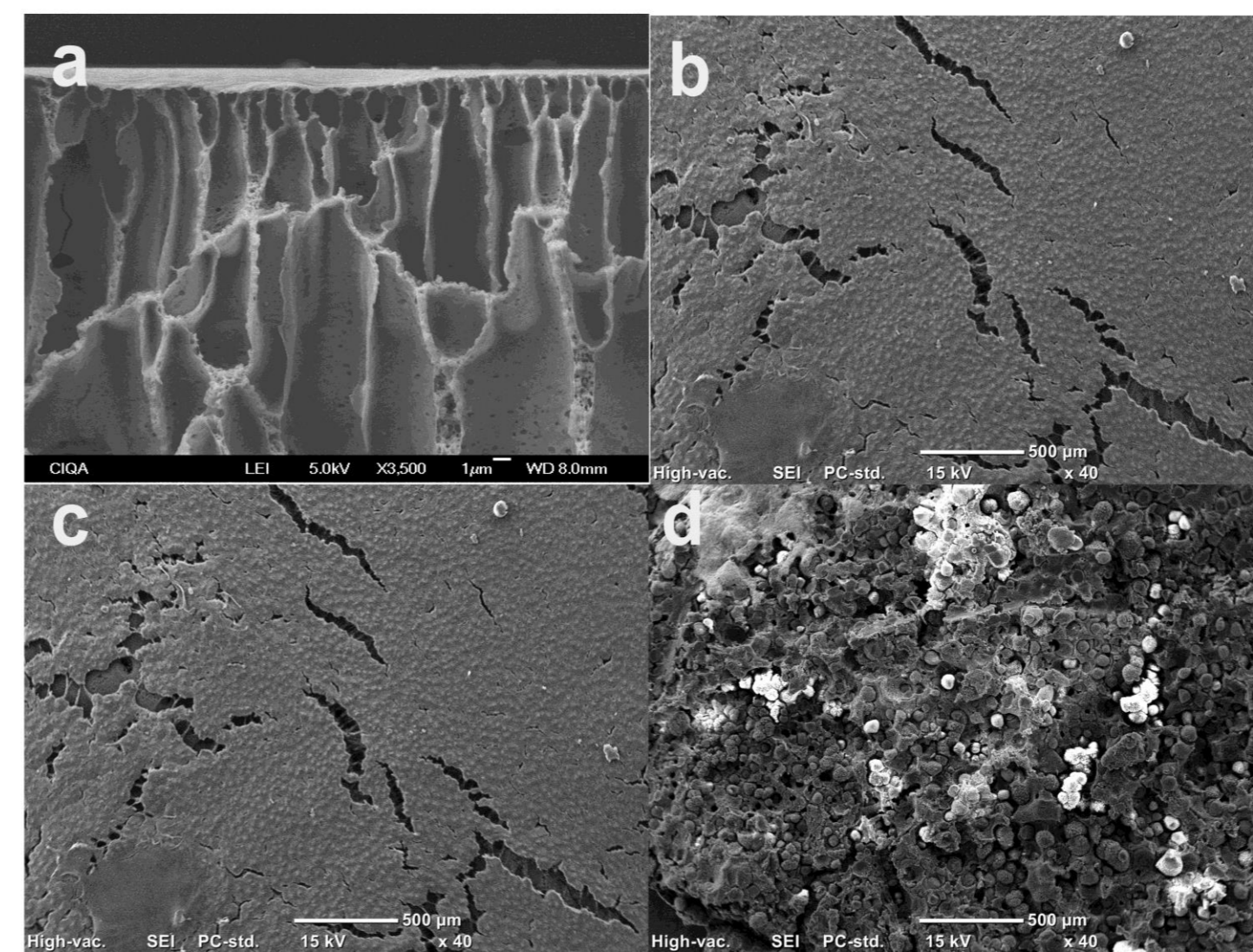
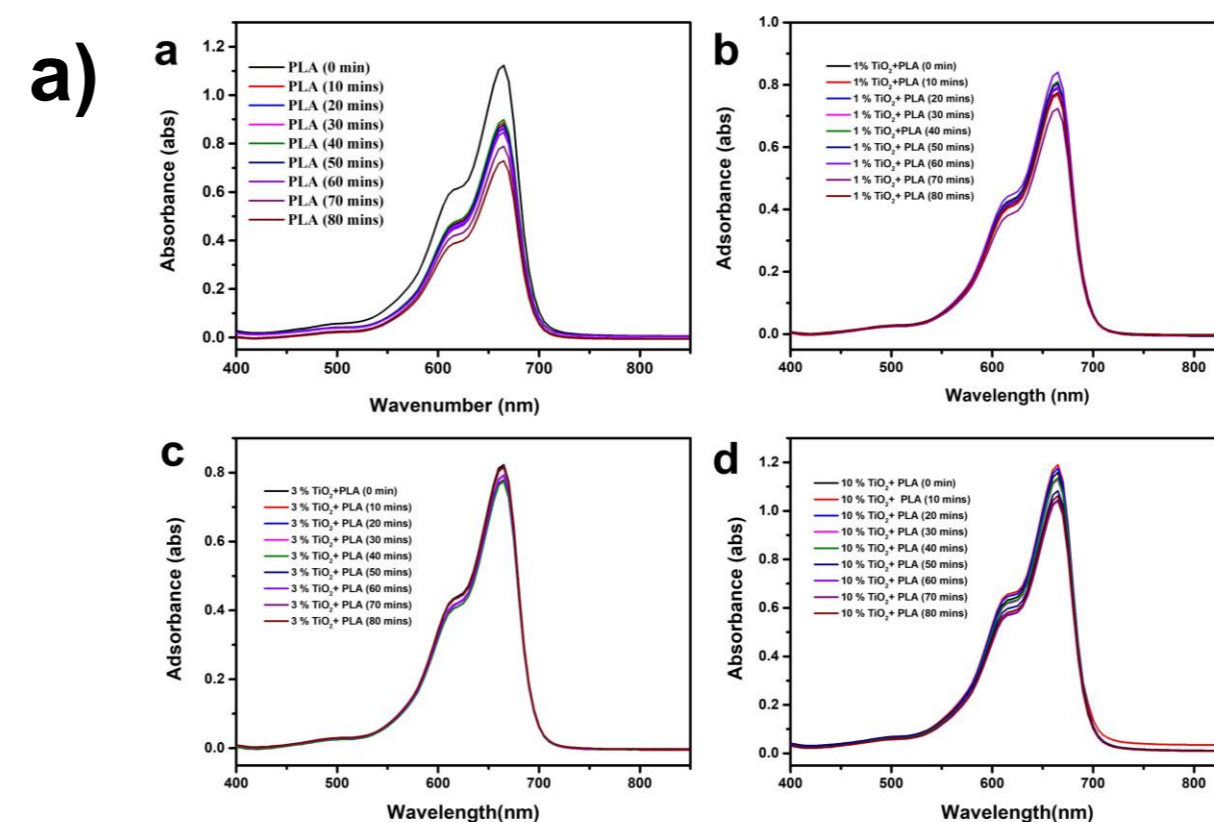
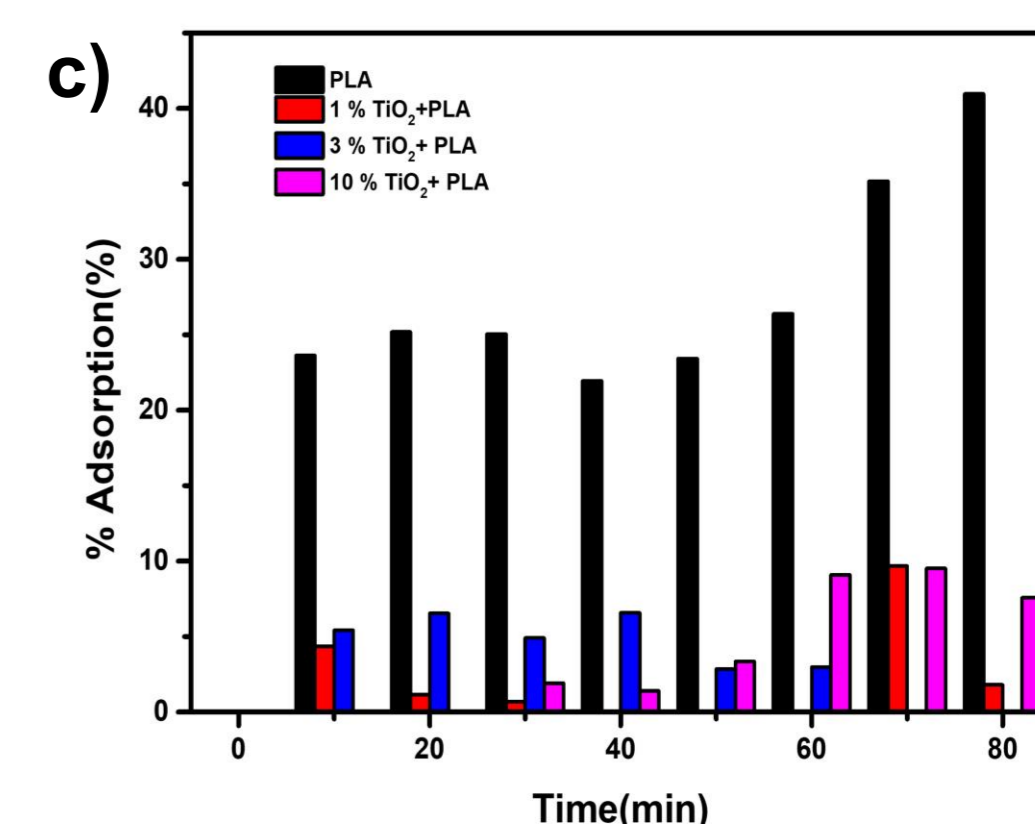


Fig 3. SEM image of PLA and 1,3 and 10 % TiO₂ /PLA.

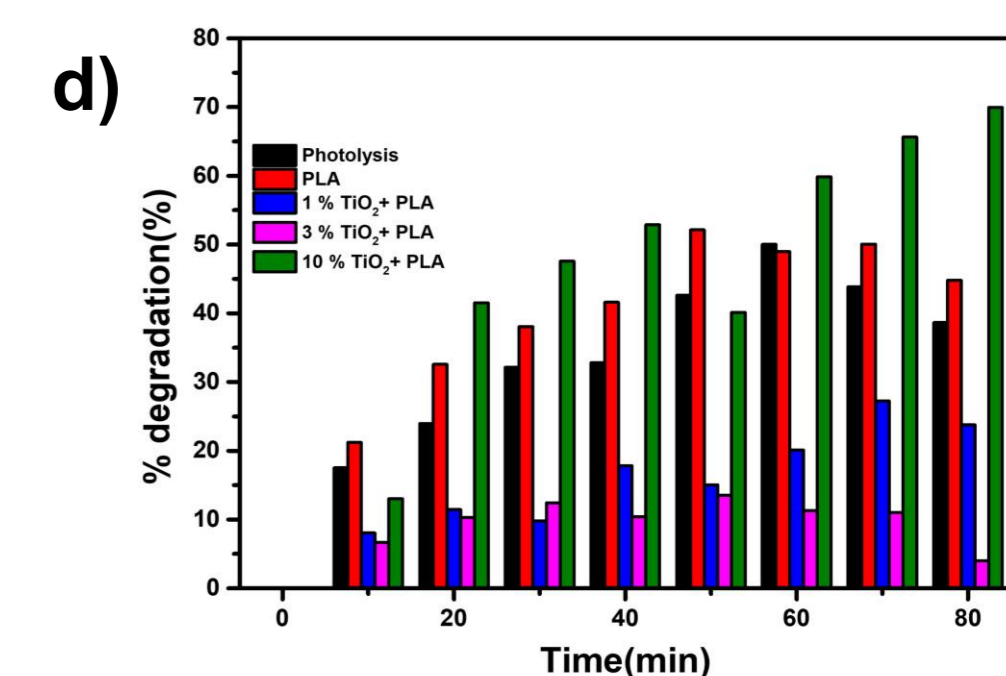
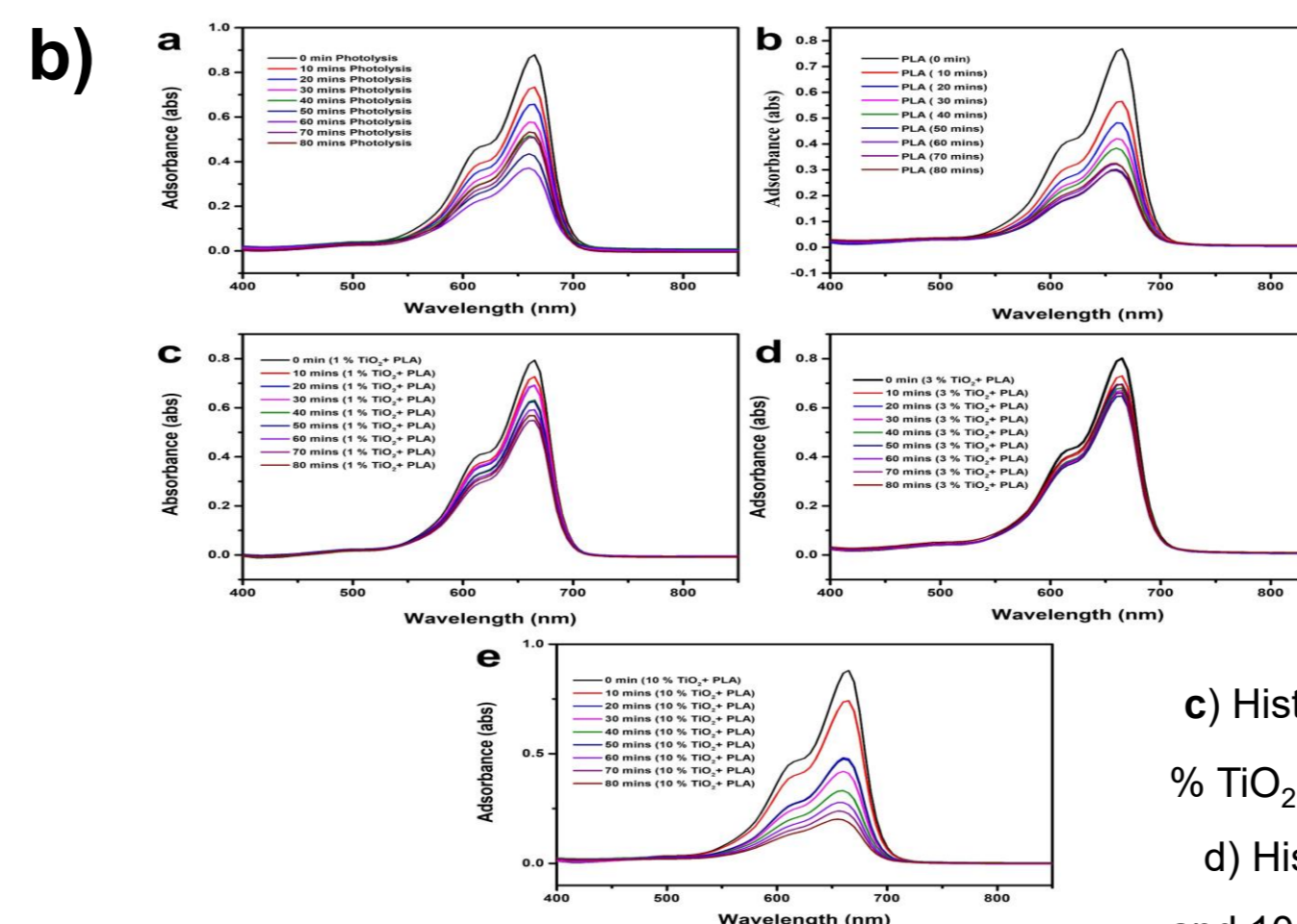
ADSORPTION OF METHYLENE BLUE DYE



ADSORPTION AND PHOTODEGRADATION OF METHYLENE BLUE BY PLA AND 1, 3, AND 10 % TiO₂



PHOTODEGRADATION OF METHYLENE BLUE DYE



c) Histogram of Adsorption of Methylene blue by PLA and 1,3 and 10 % TiO₂

d) Histogram of Photodegradation of Methylene blue by PLA and 1,3 and 10 % TiO₂.

CONCLUSION

- ❖ The membrane of PLA and varying percentages of Titanium oxide was successfully prepared by the phase inversion method.
- ❖ The characterisation of the membrane prepared was done to determine the effect of the membrane on TiO₂.
- ❖ The SEM micrographs show the presence of TiO₂ on the membrane and that the membrane is porous in nature.
- ❖ The membrane adsorbed the methylene blue.
- ❖ The photodegradation of the methylene blue was performed using the membrane and 10 % TiO₂ with the membrane giving the highest result.

FUTURE WORK / REFERENCES

1. M. Sattar, F. Hayeeye, W. Chinpa, O. Sirichote, *Journal of Environmental Chemical Engineering*, 5 (2017) 3780–3791.
2. W. Ruan, J. Hu, J. Qi, Y. Hou, C. Zhou, X. Wei, *Adv. Mater. Lett.*, 10 (2019) 9–20.
3. S. Alkaykh, A. Mbarek, E.E. Ali-Shattle, *Heliyon*, 6 (2020) e03663.
4. N. Labhasetwar, G. Saravanan, S. Kumar Megarajan, N. Manwar, R. Khobragade, P. Doggali, F. Grasset, *Science and Technology of Advanced Materials*, 16 (2015) 036002.