PHOTOCATALYTIC ACTIVITY OF NANO TiO_2 POWDER FOR DYE AND ANTIBIOTIC DEGRADATION

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Introduction

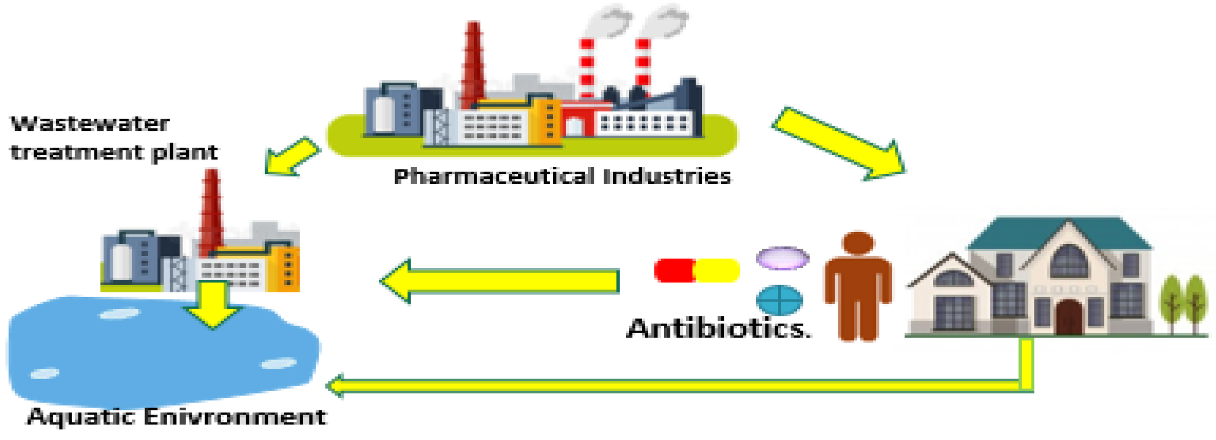


Figure 1. Illustrating the Emergence of Organic pollutants in water

Objectives

- ❑ Characterization of the photo-catalyst, commercial TiO2 material
- ❑ Optimization of the experimental condition including initial dye concentration, the catalyst dose and irradiation time
- ❑ Analyze the photo-catalytic activity of commercially purchased TiO_2 during the degradation of Tetracycline and methylene blue pollutants under UV Irradiation

Methods

❑ Materials and apparatus

- ❖ Methylene blue Trihydrate
- ❖ Tetracycline crystalline powder
- ❖ Commercial Titanium (IV) oxide, Anatase (with purity of 99.7%)
- ❖ 6oo mL Homemade dark beaker
- ❖ 360 W ultraviolet lamp.

❑ Analytical calculation

❖ Adsorption Efficiency and photo-catalytic activity is calculated as (%) = $\frac{C_0 - C_e}{C_0} \times 100$

C_0 = initial pollutant concentration

C_e = concentration of the pollutant at the time (t) of aliquot withdrawal

❖ Removal Efficiency = Adsorption + photo catalytic activity

❑ Experimental design and procedure

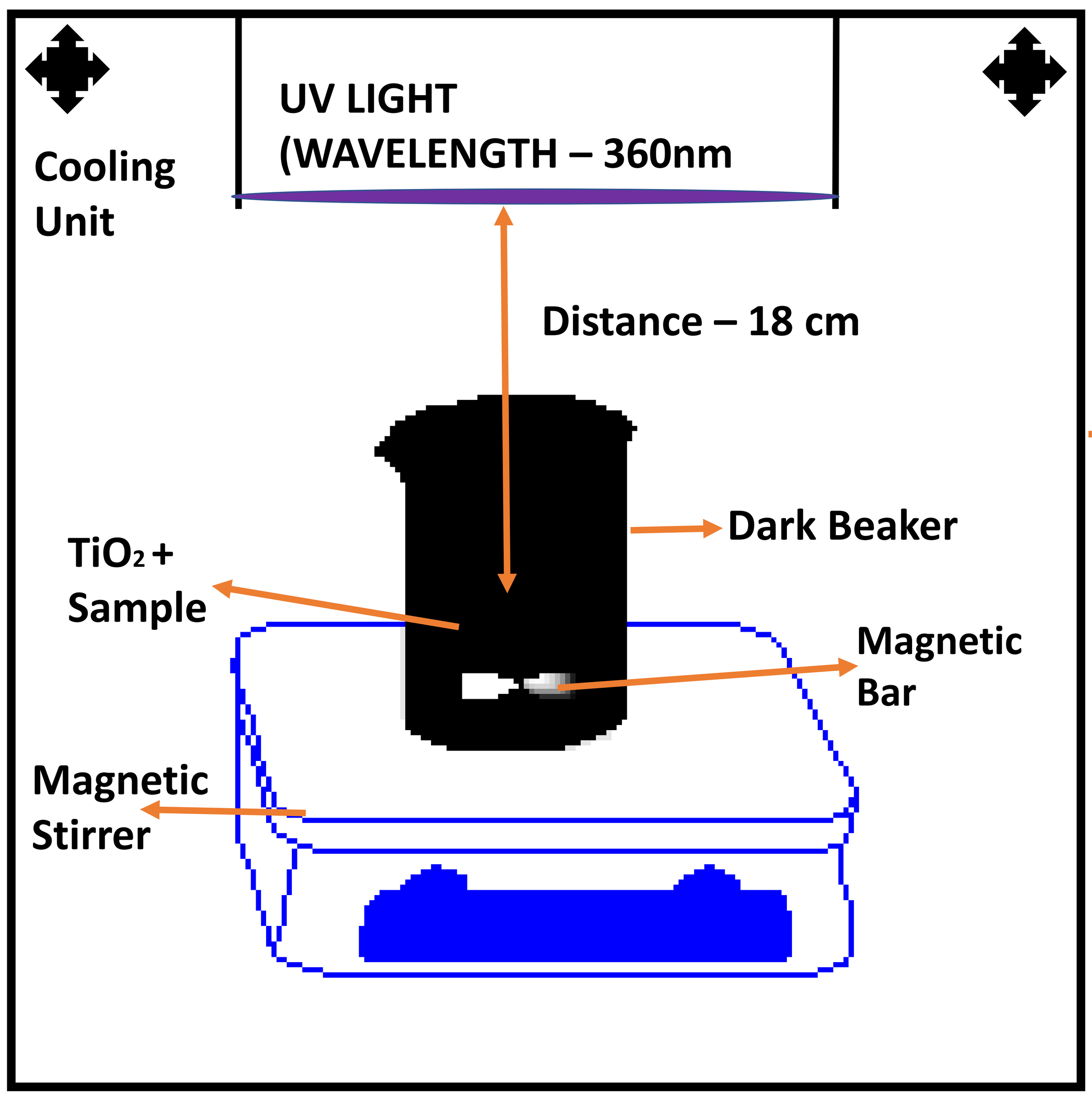


Figure 2. Schematic illustration of the set-up of the photocatalytic experiment

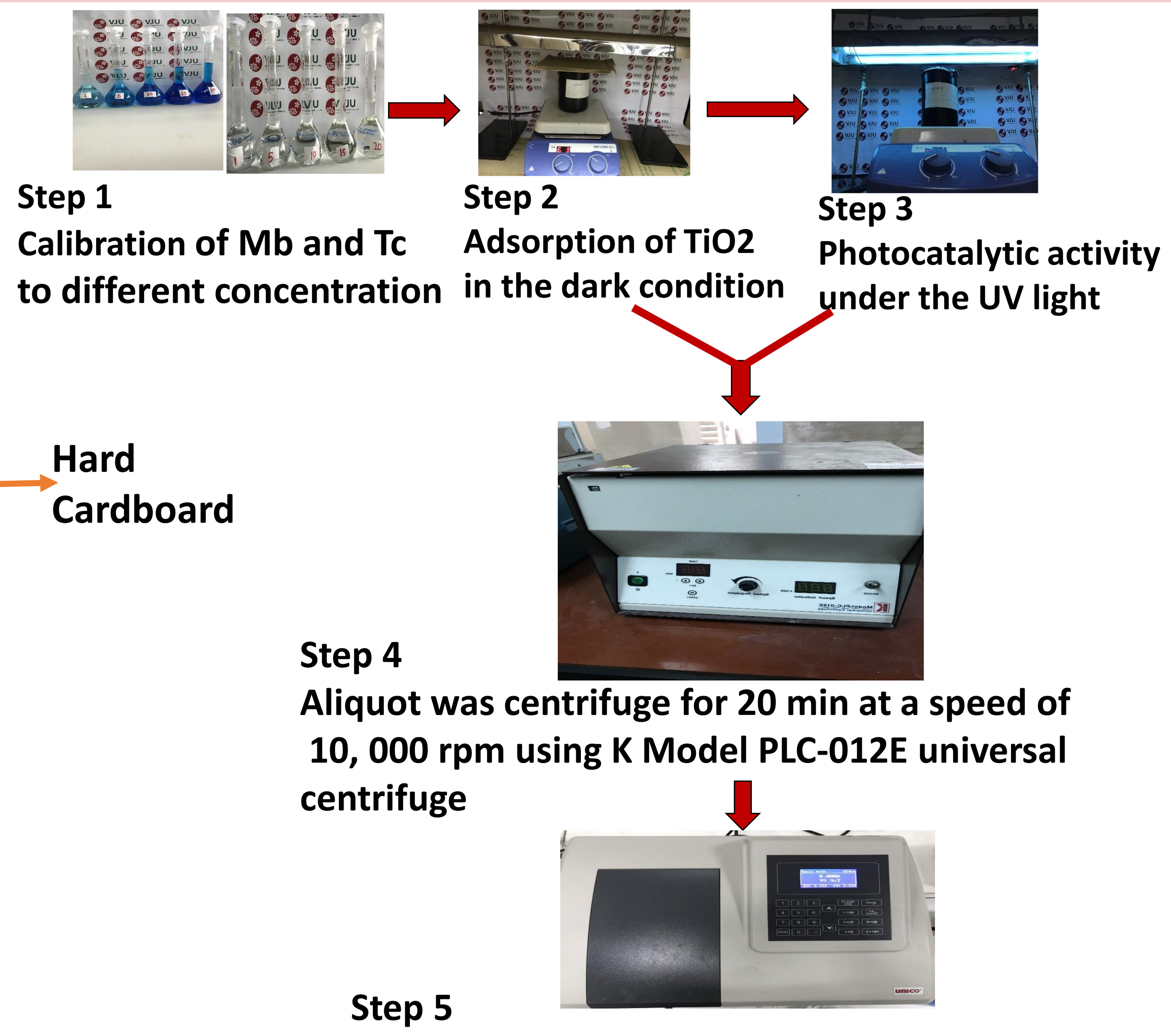
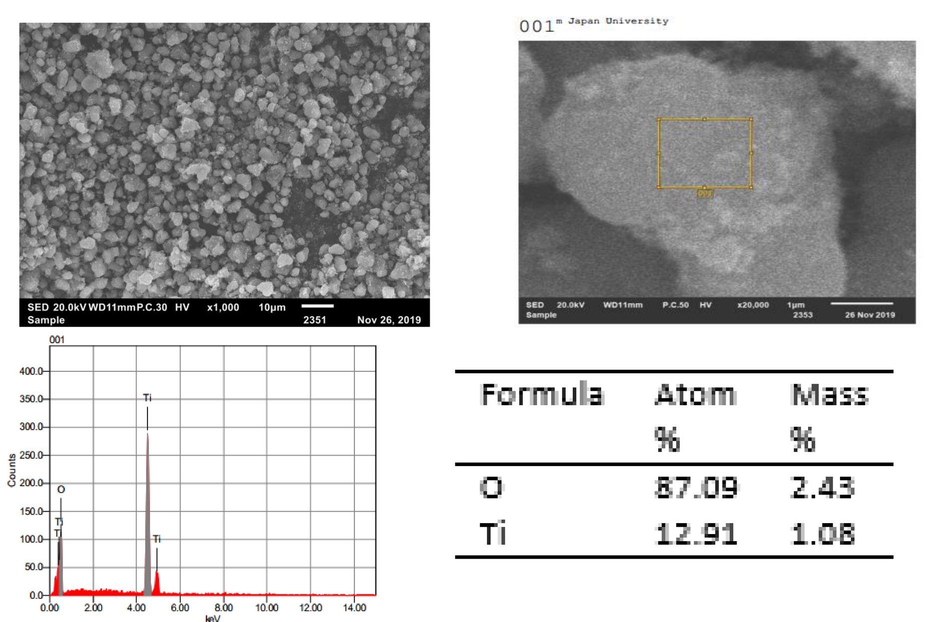


Figure 3. The overall process of the photocatalytic experiment

Results and discussion

❑ Characterization of TiO_2

❖ Morphology analysis using Scanning Electron Microscope (SEM)



Formula	Atom %	Mass %
O	87.09	2.43
Ti	12.91	1.08

Figure 4. The SEM images and EDX pattern of TiO2 particle

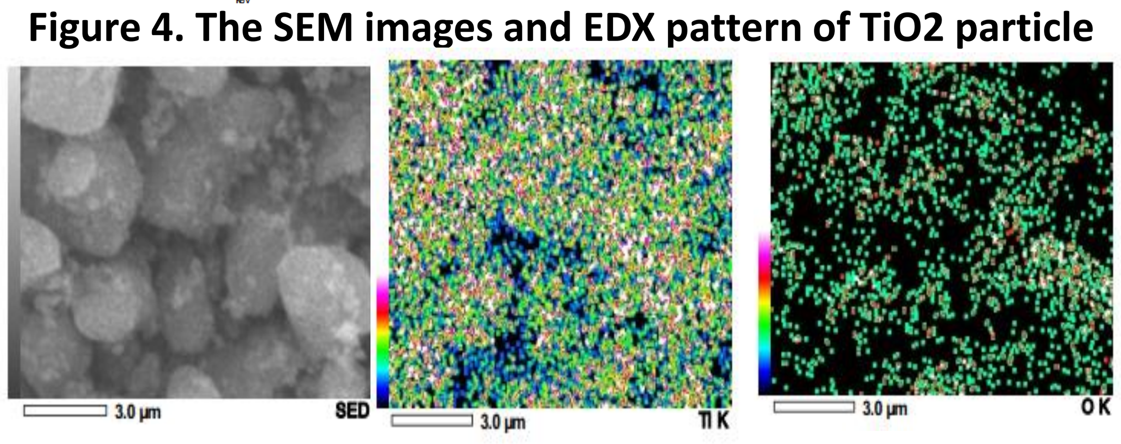


Figure 5. The mapping images of a) TiO_2 material consisting of b) oxygen and c) titanium elemental particles

❖ Fourier Transform Infrared Spectroscopy

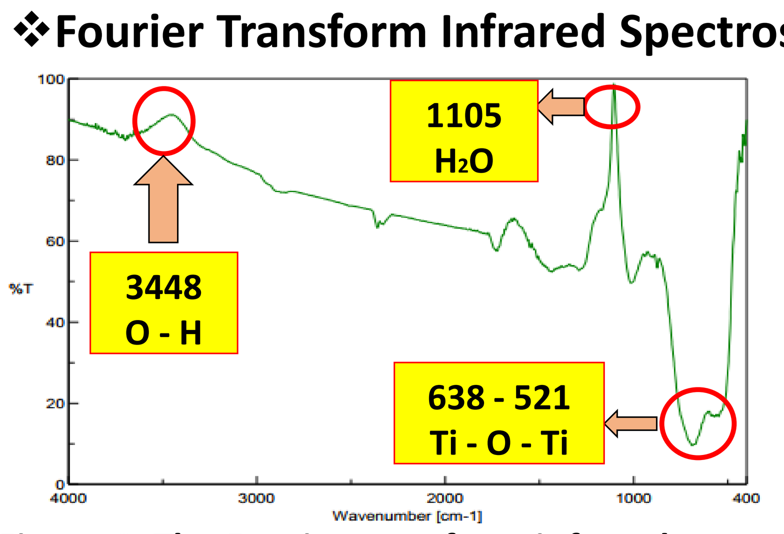


Figure 6. The Fourier transform infrared spectra of TiO_2 material

❑ Treatment of Methylene blue and Tetracycline with TiO_2

❖ ADSORPTION TEST IN THE DARK CONDITION

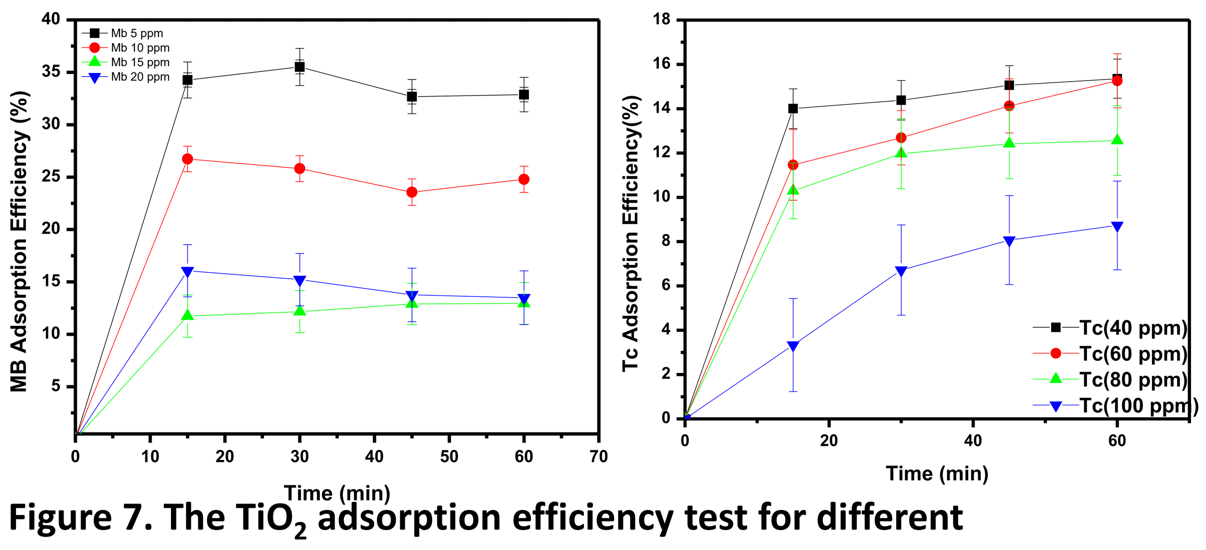


Figure 7. The TiO_2 adsorption efficiency test for different concentration of methylene blue and tetracycline. Total reaction time= 60 min; temperature= 25°c; Volume of the sample solution= 200mL; absorbance wavelength for methylene blue =664 nm, tetracycline= 357 nm

❖ PHOTO-CATALYTIC ACTIVITY UNDER THE ULTRAVIOLET LIGHT

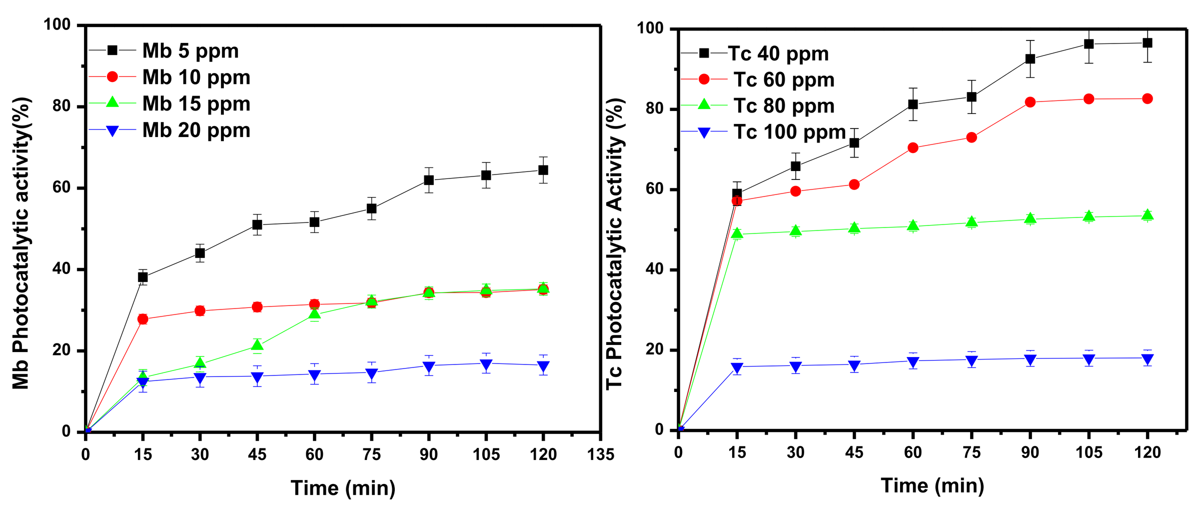


Figure 8. The rate of photo-catalytic activity of UV/ TiO_2 on concentrations of methylene blue and tetracycline. Total reaction time = 120 min; temperature= 25°c; Volume of the sample solution= 200mL; absorbance wavelength for methylene blue =664 nm, tetracycline= 357 nm, UV Lamp=360W; exposure time intervals = 15 min

❖ REMOVAL EFFICIENCY OF METHYLENE BLUE AND TETRACYCLINE WITH TiO_2

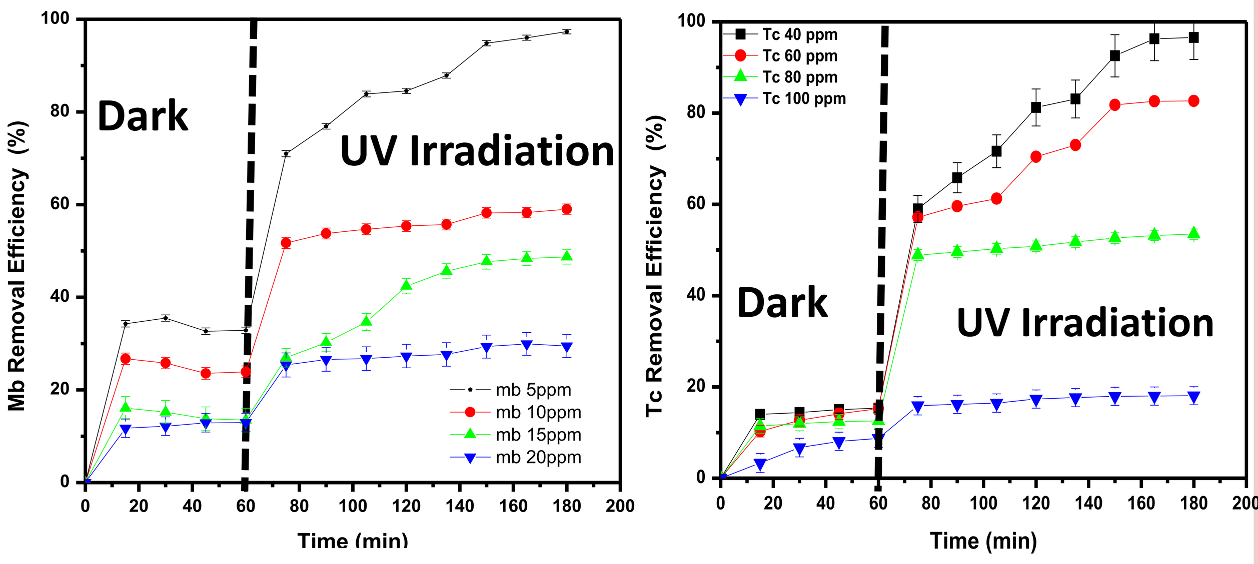


Figure 9. The effect of initial concentration on Mb and TC removal efficiency. Mb concentration= 5,10,15,20 ppm; Tc concentration= 40,60,80,100 ppm; Mb absorbance = 664 nm; TC absorbance= 357nm; temperature= 25°C, total reaction time=3 hr

❖ EFFECT OF CATALYST DOSE ON PHOTO-CATALYTIC ACTIVITY

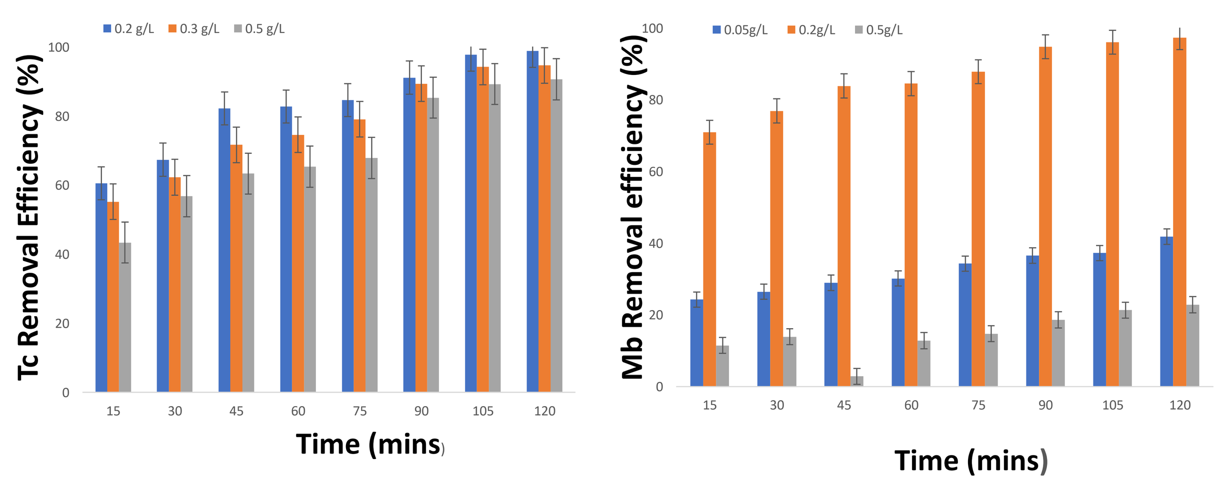


Figure 10. Effect of Catalyst dosage on the photocatalytic degradation of the optimized concentration of organic pollutants; Concentration of methylene blue= 5 ppm, Tetracycline= 40 ppm; catalyst=TiO_2 (0.2g/L, 0.3g/L, 0.5g/L); temperature= 25°c

Conclusion

This study applied the photo-catalytic process in removing organic pollutants; methylene blue and tetracycline using commercial TiO2 material

- **❖ The results obtained from SEM, EDX and FTIR analysis confirmed the purchased commercially produced material to be TiO2**
- **❖ The optimal concentration for Mb and Tc was found to be at 5 ppm and 40 ppm respectively within 180 mins**
- **❖ The result obtained showed UV/TiO2 to be an efficient photocatalyst in the removal of organic pollutants from water**