

TREATMENT OF EFFLUENTS CONTAMINATED BY SYNTHETIC DYES USING HETEROGENEOUS PHOTOCATALYSIS

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INTRODUCTION & AIM

Contaminated wastewater from the textile or food industry contains multiple recalcitrant xenobiotic substances, so its direct discharge into ecosystems is a source of high environmental impact pollution.

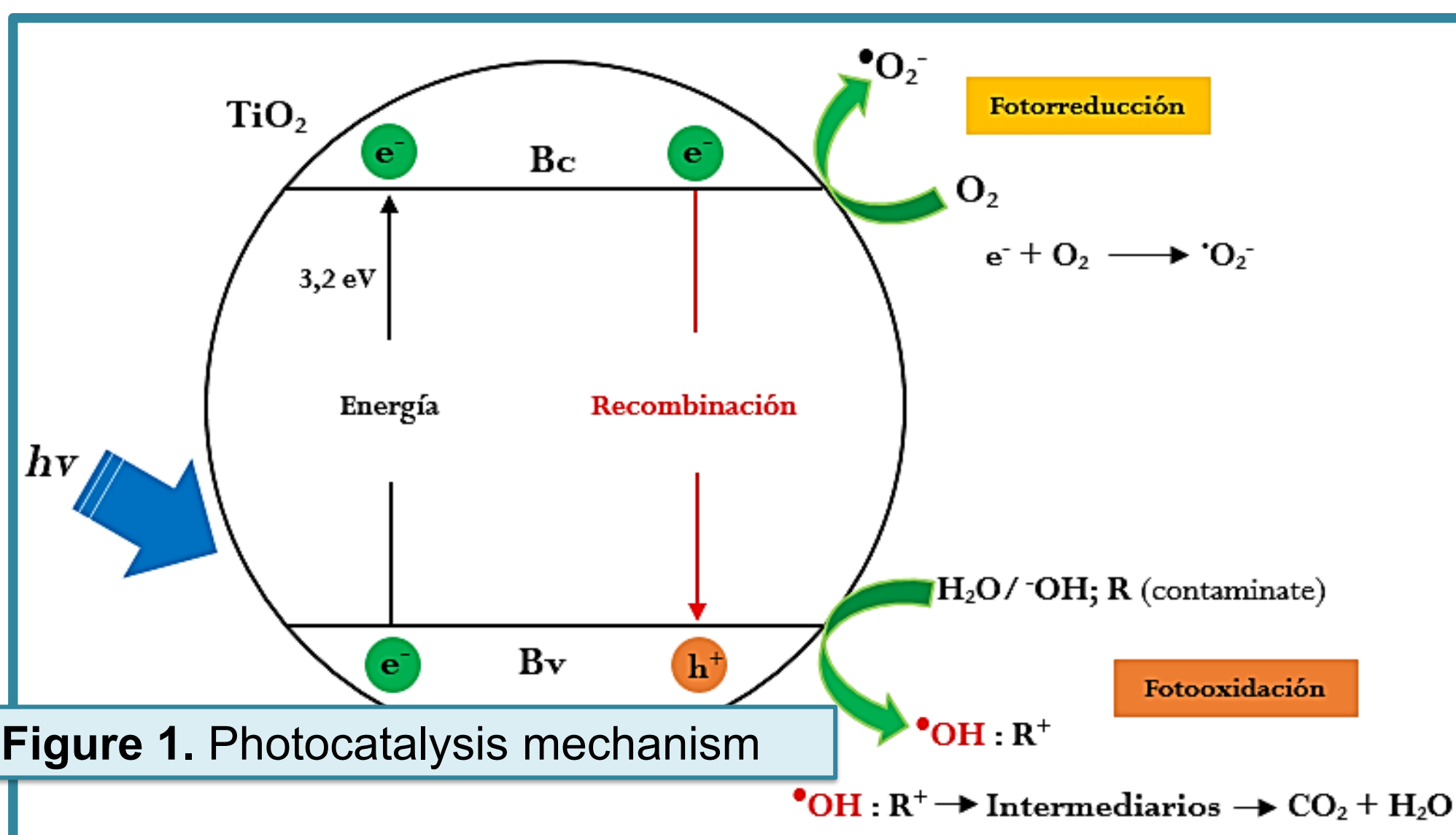


Figure 1. Photocatalysis mechanism

Objective: Degrading five dyes thru heterogeneous photocatalysis and the influence of process variables on the reaction kinetics.

METHOD

A 2k DOE was used with pH, T, and Φ as process parameters. The response factors include %ERD, t, pH, kapp. The compounds are: methylene blue, toluidine blue, malachite green, violet, phenol red.

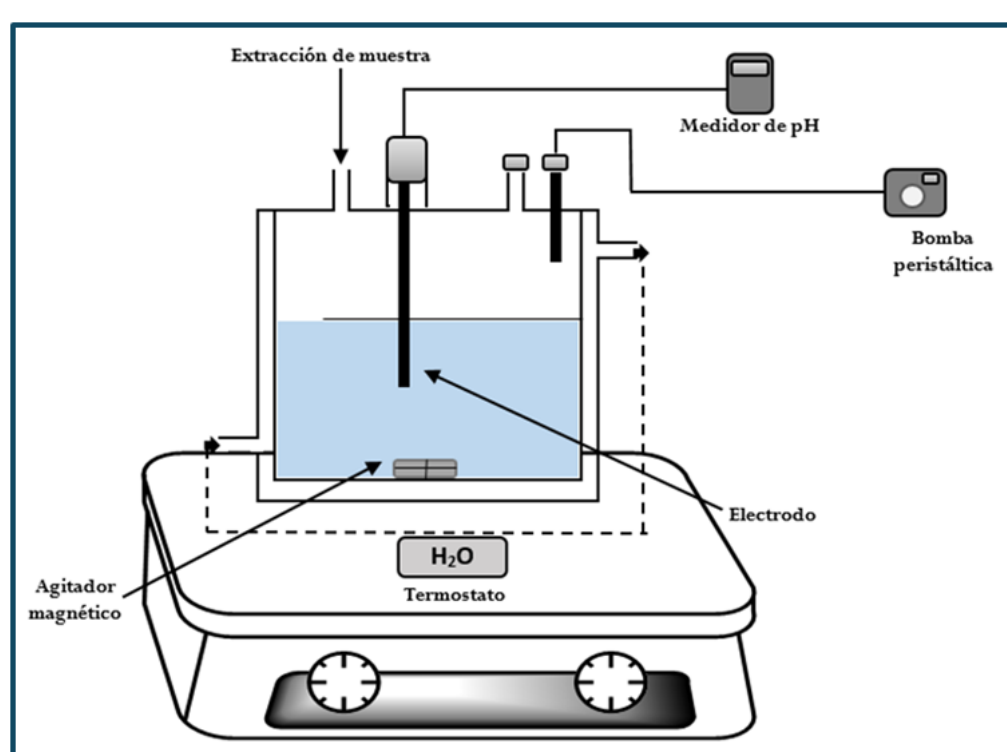
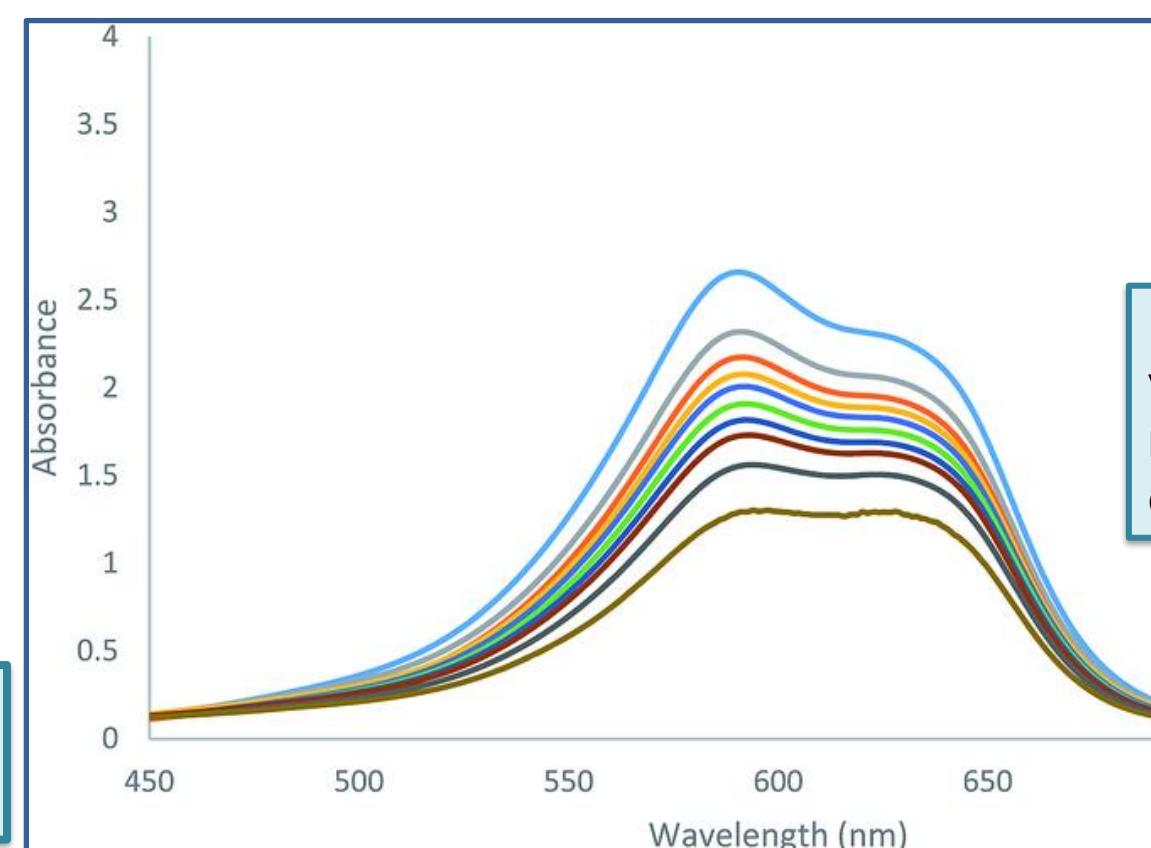
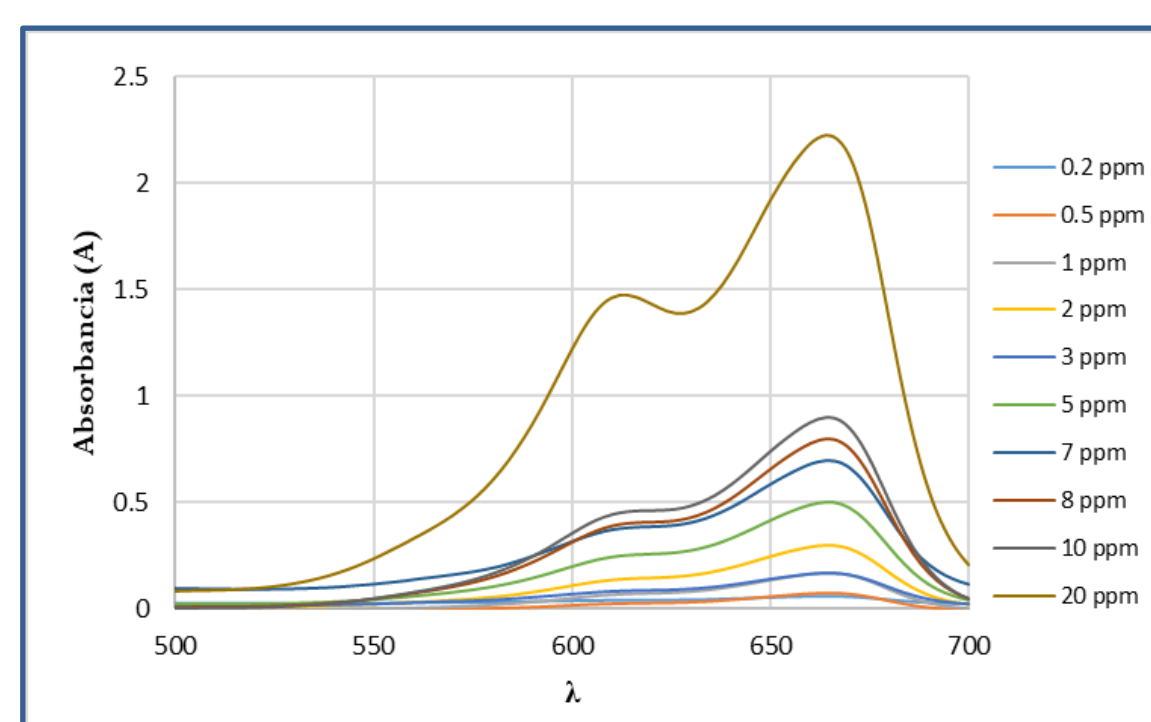


Figure 2. Reactor and [AT] of 0.2 a 20 ppm



RESULTS & DISCUSSION

From the monitoring of the maximum absorptions (nm) in the UV-Vis, the %ERD were 99.99% in the 5 compounds. The reaction times were 20 minutes for VM and 2 minutes for VG. The kinetic model describes the apparent degradation, with pseudo-first-order behavior.

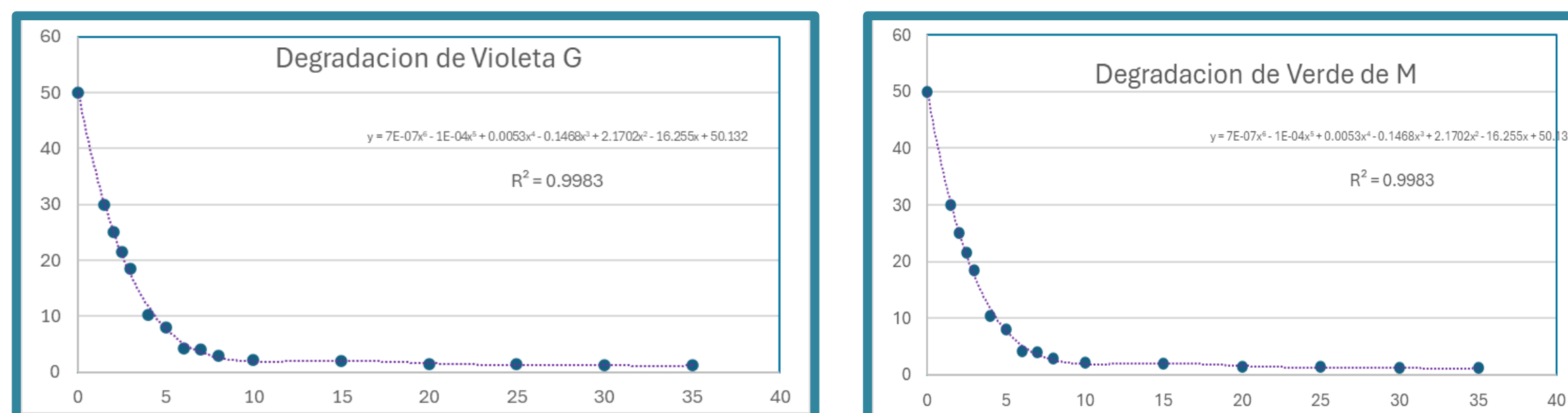


Figure 3. Changes in the concentration of VG and VM dyes under photocatalytic conditions

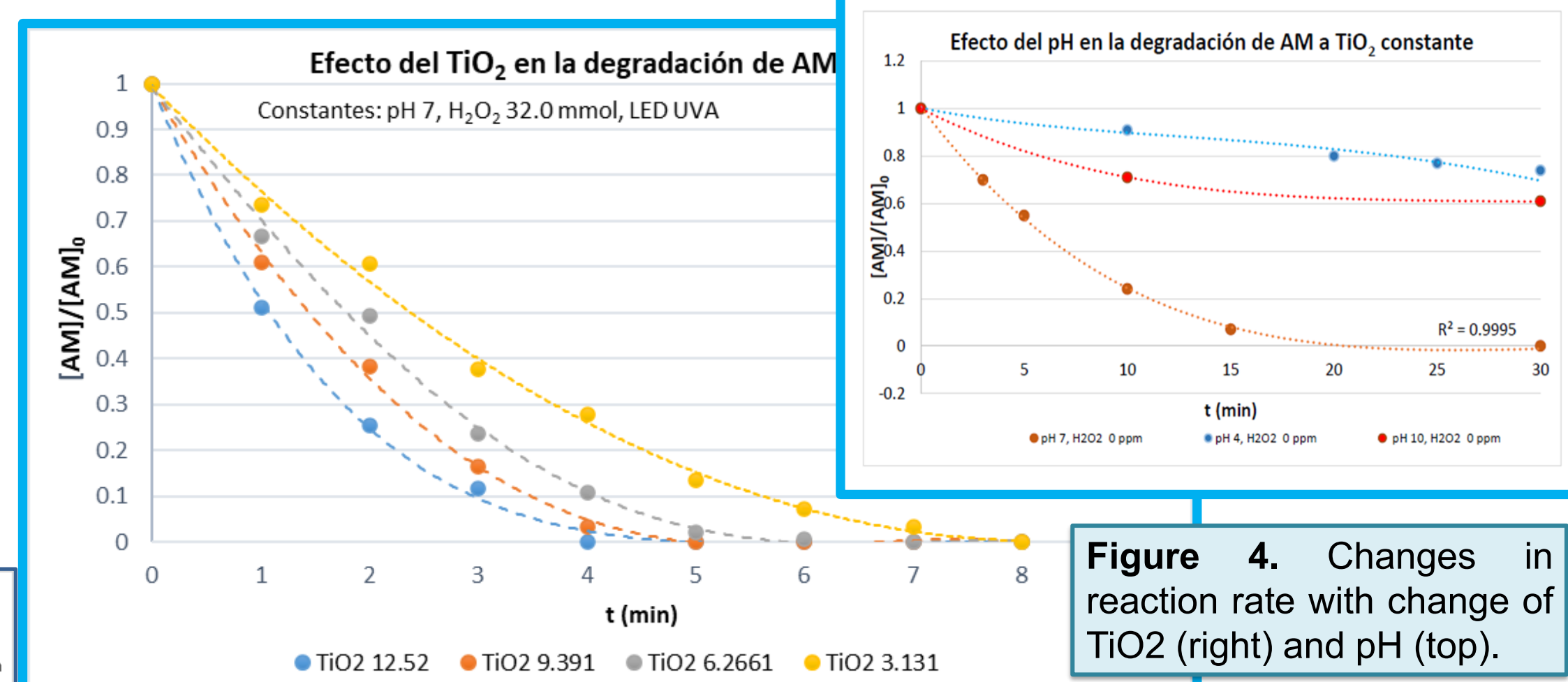


Figure 4. Changes in reaction rate with change of TiO2 (right) and pH (top).

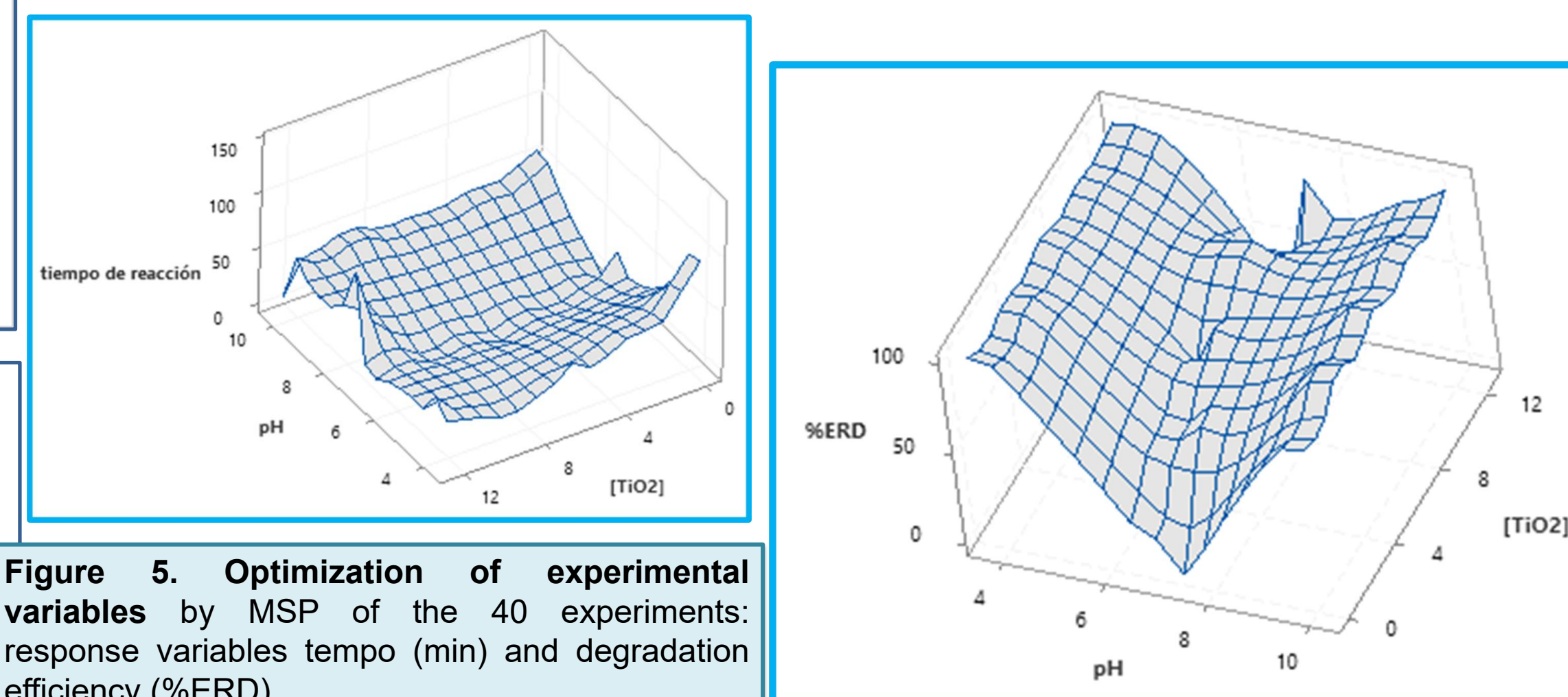


Figure 5. Optimization of experimental variables by MSP of the 40 experiments: response variables tempo (min) and degradation efficiency (%ERD).

CONCLUSION

Heterogeneous photocatalysis represents an effective alternative for the removal of the 5 dyes. The photocatalyst, its morphology, and the irradiation source determine the overall efficiency of the process. Understanding the photoinduced mechanism allows for the design of optimized systems that favor the generation of reactive radicals and promote the complete mineralization of the contaminant.

FUTURE WORK / REFERENCES

- Samsamia S., Mohamadia M., Sarrafzadeha H. M., Renab R. E., Firoozbahr M. Recent advances in the treatment of dye-containing wastewater from textile industries: Overview and perspectives. Process Safety and Environmental Protection. 2020.
- Martínez S. A., Rosa M. T. M., Alcalá M.I., Abellána L.C., Gabaldóna A.J., López G. M. V. Degradation and toxicity evaluation of azo dye Direct red 83:1 by an advanced oxidation process driven by pulsed light. Journal of Water Process Engineering. 2020, 1-5.

TABLA 1. Experimental variables

Independent variables			Dependent variables	Constants
Energy source	[TiO2] mM	pH	<ul style="list-style-type: none"> Degradation time (t) Rate constant (kapp) Degradation efficiency %ERD 	Initial concentration [C]0=31.26 μM Temperature 22.0 ± 1.6 °C
Fluorescent	12.52	4		
White LED	9.39	7		
UVA LED	6.26	10		