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ABSTRACTSBOOK

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Study of Structure-Properties Relationship of TiO_2: Photodegradation of Azo Dyes, Catalyst Efficiency and Stability

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1. Introduction – Water pollution problems are an important issue correlated negatively with the human health and the environment. For the photocatalytic water purification processes the most important is the type of used catalyst. One of the most studied and widely used photocatalysts is titanium dioxide (TiO_2) due to its good photocatalytic activity, nontoxicity and low price. As the photocatalytic activity of TiO_2 strongly depends on its crystalline structure and composition the study of preparing conditions and post-treatments of the samples (calcination temperature, time and reactant concentration) is of crucial importance [1]. Therefore, the aim was to investigate the photocatalytic efficiency of synthesized TiO_2 in correlation with its structure and to establish its stability during photodegradation of azo dyes.

2. Experimental – TiO_2 photocatalyst samples were prepared by sol–gel synthesis using tetra-n-butyl titanate ($Ti(OC_4H_9)_4$) as the precursor with hydrochloric or acetic acid at three different temperatures (25°C, 85°C, 105°C). The obtained samples were calcined for 3 hours at 400°C, 500°C and 600°C. Two model water solutions (30 mg/L) of azo dyes Reactive red 45 (RR45) and Acid blue 25 (AB25) were prepared and photocatalytic degradation of 90 min under UV irradiation has been performed using synthesized TiO_2 photocatalysts (1 g/L). TiO_2 photocatalysts have been characterized by X-ray diffraction (XRD), Fourier transform infrared spectroscopy (FTIR) and scanning electron microscopy (SEM).

3. Results and Discussion - The influence of TiO_2 structure obtained by various synthesis conditions on the degradation efficiency of RR45 dyes under UV irradiation can be seen in Image 1. It is obvious that the efficiency of photocatalytic degradation of RR45 by TiO_2 is strongly correlated with the synthesis conditions (TiB, TiV, TiCh) and it depends on the calcination temperature, which can be seen for the TiV samples. The results also indicate that the adsorption process differs among the studied TiO_2 samples.

4. Conclusions – All TiO_2 samples calcined at 400 °C showed the best catalytic performance. The highest efficiency demonstrate TiB samples as the percentage of coloration was only 2% after 90 minutes.

The catalytic performance of TiB samples calcined at 400 °C was similar to P25 Degussa sample used as a reference.

The results of TiB stability confirmed that it can be reused with activity loss of 30% after the fourth cycle.

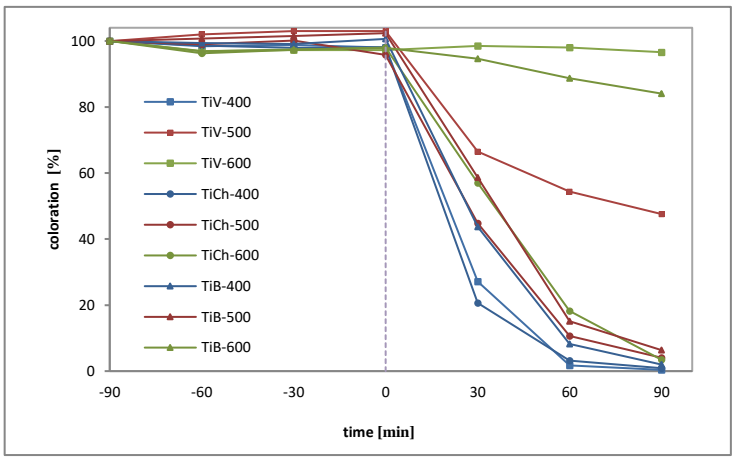

Image 1. Coloration during adsorption and photocatalysis process of RR45 dye by TiO_2 photocatalyst.

5. References

[1] L. Yang, M. Zhang, S. Shi, J. Lv, X. Song, G. He, Z. Sun, *Nanoscale Res Lett.*, **9**(1), (2014) p. 621.