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ABSTRACTSBOOK

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Development of the novel poly(3,4-ethylenedioxythiophene)/TiO_2 photocatalysts with enhanced performance under solar light for azo dye degradation in wastewater

Z. Katančić [(1)], V. Gilja, I. Gavran, J. Smolković, Z. Hrnjak-Murgić

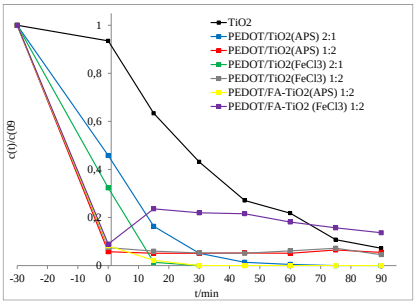
[(1)] University of Zagreb, Faculty of Chemical Engineering and Technology, Marulićev trg 19, Zagreb, Croatia

+385 1 4597 118, katancic@fkit.hr

1. Introduction – During the manufacturing and the processing of synthetic organic dyes approximately 12% of dyes are lost annually [1]. Advanced oxidation processes (AOPs) represent water treatment methods able to decolourize and to fully degrade organic compounds into non-toxic and non-hazardous components. Photocatalysis is established as an effective and sustainable AOP for water treatment offering a perspective for the degradation of many organic water pollutants, converting them to biodegradable compounds or completely mineralizing them into carbon dioxide and water. Titanium dioxide, TiO_2, is widely used as photocatalyst but its relatively high band gap of 3,2 eV restricts its photocatalytic activity under visible light irradiation thus hindering its practical application in the water treatment processes. Conducting polymers as poly(3,4-ethylenedioxythiophene) (PEDOT) with extended π-conjugated electrons can act as stable photosensitizers of TiO_2 under solar light irradiation. The objective of the work was to synthesize PEDOT/TiO_2 based photocatalysts and to investigate its photocatalytic activities under simulated Solar light irradiation.

2. Experimental - Simulated wastewater containing organic azo dye C.I. Reactive Red 45 (RR45) as water pollutant was used to determine the degradation efficiency in terms of decolourization and total organic carbon (TOC) removal. Photocatalysts were synthesized by oxidative chemical polymerization with two different oxidants, $FeCl_3$ and $(NH_4)_2S_2O_8$ (APS) at different ratio of monomer to oxidant. Since PEDOT/TiO_2 photocatalyst cannot be easily retrieved after the reaction due to its nanometre particle size, fly ash supported PEDOT/TiO_2 photocatalyst, was also synthesized to facilitate easier phase separation after photocatalysis.

3. Results and Discussion – Scanning electron microscopy (SEM) and X-ray diffraction (XRD) analyses showed that samples prepared with APS oxidant had more amorphous-like



structure of nanocomposite while opposite was found for samples prepared with $FeCl_3$ oxidant which generated crystalline-like structure. A photocatalysis result showed that decolourization with pure TiO_2 is complete after 90 min while it takes only 30 to 60 min for PEDOT/TiO_2 photocatalyst to completely remove colour, partially due to higher adsorption effect which was especially pronounced for fly ash supported version. TOC measurements showed that 85 % of organic carbon was removed after 90 min with PEDOT/TiO_2 photocatalyst synthesized with $FeCl_3$ while only 30 % was removed with pure TiO_2.

4. Conclusions – Unsupported and fly ash supported PEDOT/TiO_2 photocatalysts showed improved photocatalytic behaviour under simulated Solar light with much faster decolourization time and higher organic carbon removal when compared to TiO_2.

5. References

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