

Laboratory of inorganic technology

Work name: **Characterization of photocatalytic active layers**

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Objective: Determine photocatalytic activity of thin layer containing titanium dioxide via photocatalytic degradation of Acid Orange 7. Construct concentration curve and determine rate of photocatalytic degradation of AO7.

Principle: Photocatalysis is based on adsorption of radiation with suitable wavelength in the semiconductor particle. Thereby excitation of electron e^- from valence to conduction band of semiconductor takes place. The positive charge carrier – the hole h^+ remains at valence band. Energy of initiating radiation must be minimally equal to the difference of energies of conduction and valence band of semiconductor and reduction/oxidation potential of electrons/holes is equal to this energy difference. The charge carriers (e^- and h^+) then can migrate to the surface of semiconductor, where they can react with substances which are present in the system (adsorbed on the semiconductor surface). Most used photocatalyst is titanium dioxide at anatase crystal modification. Difference of its conduction and valence band is equal to 3.2 eV what means that for excitation of electrons (= start of the photocatalytic reaction) the UV light with wavelength less than 388 nm is necessary.

Acid Orange 7 (= Orange II) used as model compound is azo-dye which is a big pollutant of waste-water in textile industry. Its degradation by classical bio-technology process is not effective. So photocatalysis can be desirable method for removal of this pollutant from waste-water.

Technique: Into the each of the four glass cells put 25 ml of AO7 which concentration is about $2.5 \times 10^{-5} \text{ mol} \cdot \text{dm}^{-3}$ and insert inside sample with photocatalytic layer, magnetic stirrer and cooling spiral. Start irradiating of the samples by UV light and measure absorbance of solution at 485 nm in 15 minutes intervals. Using these values, you can calculate concentrations (using calibration curve) which you need for constructing concentration-time dependence and then calculate the rate of photocatalytic degradation of AO7.

Questions: How can be degradation rate of AO7 express?
Which parameters of the photocatalytic system are crucial?
What is the most important application of titanium dioxide?
What is the main source of the titanium in the nature and how is titanium dioxide producing?