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Subject Area	Water treatment
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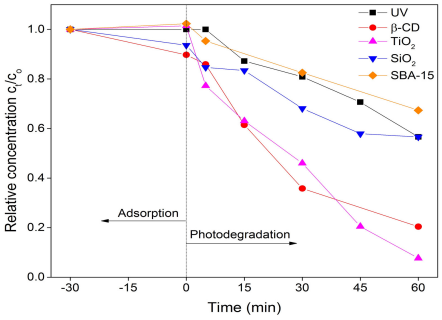
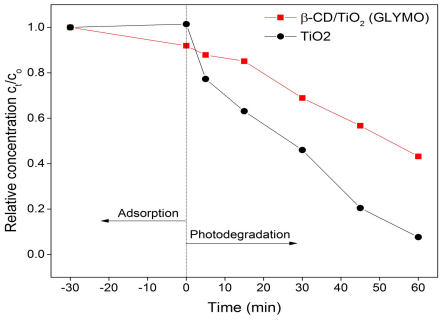
Removal of BPA from Aqueous Solutions over TiO_2, SiO_2 or SBA-15 modified with beta-Cyclodextrin

Synthesis and study of catalysts for bisphenol A degradation



Reference experiments: BPA concentration relative to initial concentration after a certain time of adsorption and UV irradiation.



BPA adsorption and subsequent degradation under UV radiation using a TiO2 catalyst before (black) and after (red) modification with beta-cyclodextrin.

Experimental setup of two 10W UV batch reactors with (left) and without (right) cover.

Introduction: Bisphenol A (BPA) is an industrial chemical which is widely used in the production of plastics and epoxy resins. The carbon-based molecule gained attention because of its possible endocrine disruption on humans and mammals. Today's wastewater treatment plants are not designed for the selective removal of micropollutants like BPA. Consequently, of a considerable amount of BPA is discharged to surface water. New methods are needed to remove BPA from wastewater. Beta-Cyclodextrins (β-CD) are able to capture, host and release guest molecules like BPA. Recent studies have proven their potential for the adsorption of organic pollutants from wastewater with subsequent degradation under UV irradiation. However, β-CD remains in water after capturing pollutants. Therefore, a procedure to immobilize β-CD irreversibly onto a preferably recyclable carrier material was developed.

Approach/Technologies: Different approaches were made to attach β-CD onto TiO_2, SiO_2 or SBA-15 supporting materials. Eight different catalysts were synthesized using three different synthesis methods, called dark adsorption method, self-assembly method and copolymer method (GLYMO and APTES were used as copolymers). Adsorption ability and photodegradation of all synthesized materials were examined using batch photoreactors with a UV lamp. The two most effective catalyst were further characterized for their adsorption kinetics and adsorption isotherms.

Result: Photodegradation experiments have shown that none of the synthesized catalysts performed better in facilitating the degradation of BPA than its reference material or than UV Radiation by itself. However, three of the catalysts showed an increased adsorption of BPA compared to the pure supporting material. These three catalysts were a β-CD/TiO_2 catalyst prepared by self-assembly method, a β-CD/TiO_2 and a β-CD/SiO_2 catalyst, both prepared by copolymer method with GLYMO as coupling agent.