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Abstract

Application of Fly Ash of Lignite Combustion in Air and Water Purification †

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The study was aimed at evaluating the catalytic and photocatalytic properties of lignite fly ash samples, S1 and S2, from the Pilsen Power Station (Teplárna Plzeň) collected using electrostatic precipitators with relatively high contents of Fe_2O_3 (6.0–7.4%) and TiO_2 (4.6–4.8%). Iron oxides are used often as heterogeneous Fenton(-like) reaction catalysts in certain compositions, as they have iron oxides and oxo-hydroxides attached to catalyst supports with developed contact surfaces, such as zeolites [1,2]. TiO_2 is the most studied photocatalyst for the photocatalytic oxidation of gaseous volatile organic compounds (VOCs) [3]. Experimental tests investigating the catalytic oxidation of the textile dye Acid Orange 7 in aqueous solutions, using the heterogenous Fenton-like system (H_2O_2/fly ash) and the photocatalytic oxidation of acetone vapors in the UV-A/fly ash system, were carried out. In water treatment trials, adsorption and Fenton-like experiments were carried out in parallel, under similar treatment conditions. The adsorption of the VOC was characterized by its concentration in the reactor's effluent growing with the adsorbent saturation with the acetone vapors. Once the studied sample of fly ash had accumulated a certain amount of acetone, the UV-A light was switched on to start the photocatalytic oxidation reaction. The results showed moderate catalytic and negligible photocatalytic properties of S1 and S2 in the studied systems, although they exhibited certain adsorption properties. Surprisingly, S2 showed a noticeably stronger catalytic ability in the Fenton-like system than S1, despite having an almost 2.6 times lower surface area at a similar chemical composition. The fly ashes were also used for zeolite synthesis [4]. They were subsequently tested in ion exchange with respect to ammonium cations and showed abilities close to those of a commercial zeolite specimen.

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