TOC removal from Methylene Blue aqueous solutions by adsorption and oxidation in the presence of coal fly ash

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Received 16 March 2015; Accepted 13 July 2015

ABSTRACT

Total organic carbon (TOC) removal from Methylene Blue aqueous solutions in the presence of coal fly ash was experimented comparing adsorption alone with oxidation potentially catalyzed by ash carried out with oxygen or ozone-enriched oxygen flow. The experiments were performed in continuous stirred tank reactor with fixed amounts of ash and dye solution, while gaseous flow was continuously bubbled in the solution. The results of TOC removal from 20 mg/L Methylene Blue aqueous solution showed that in the case of adsorption alone the removal yield rose from 62 to 90% increasing ash dosage from 4.0 to 8.0 g/L. However, in oxygen flow only the removal with 4.0 g/L increased up to 72% and attained about 80% with ozone-enriched oxygen, yielding the best final values of TOC removed per unit mass of ash of 2.19 and 2.38 mg/g, respectively. The kinetic results have been satisfactorily fitted by a pseudo-second-order model yielding a kinetic constant which strongly increased in adsorption alone increasing ash dosage, while a further increase with oxygen was observed only for 4.0 g/L of ash. In the treatment with ozone, the removal process was slowed down.

Keywords: Coal fly ash; Methylene Blue; TOC removal; Adsorption; Oxidation; Ozone