DECOMPOSITION OF METHYLENE BLUE BY A DIELECTRIC BARRIER DISCHARGE

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Abstract. The decomposition of methylene blue in aqueous solution was investigated using a dielectric barrier discharge in coaxial configuration, operated in pulsed regime. The methylene blue solution (volume = 300 ml, concentration = 50 mg/l) contained in a reservoir was circulated by a pump and made to flow as a film over the surface of the inner electrode of the plasma reactor. The best results were obtained when the discharge was operated in oxygen. The conversion of methylene blue reached 95% after 30 minutes of plasma treatment and the corresponding yield was 57 g/kWh.

1. INTRODUCTION

Organic dyes constitute a group of chemical compounds that are a source of environmental pollution and therefore their removal from waste water receives increasing attention. Since conventional biological treatment is ineffective for dyes degradation [1] due to the large number of aromatic rings present in the dye molecules, advanced oxidation techniques have been investigated as an alternative. Electrical discharges in water or at the water-gas interface have been studied for the degradation of various organic compounds, including organic dyes [2-11]. The objective is either complete mineralization, or only partial degradation of the compounds, which is in most cases sufficient in order to make the effluent more amenable to conventional treatment.

Pulsed corona discharges either under water or above water were used in the majority of the studies [2, 4-7], however, gliding arc discharges [9, 11], diaphragm discharges [3] and dielectric barrier discharges [8, 10] were investigated as well.

The formation of OH radicals and atomic oxygen was evidenced by spectroscopic investigations of the light emitted by the plasma [12, 13]. The generation of ozone and hydrogen peroxide was studied as well [14-16].

In the present work the degradation of methylene blue (MB) in aqueous solution was investigated using a pulsed dielectric barrier discharge (DBD) and the effect of the gas introduced on MB decomposition was investigated.

2. EXPERIMENTAL

The experiments were carried out in a cylindrical reactor made of quartz shown in Fig. 1.

The inner diameter of the tube was 19 mm and its length was 210 mm. The outer electrode was painted with silver paste on the outside of the tube on a length of 100 mm. The inner electrode was a cylinder with a diameter of 16 mm, made of stainless steel sintered fibers.

The solution containing the dye was circulated by a peristaltic pump and was made to flow as a film

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