

ABSTRAK

PENGOLAHAN LIMBAH PEWARNA TEKSTIL SINTETIS *REACTIVE BLUE 19* PADA BERBAGAI KONSENTRASI MENGGUNAKAN *ADVANCED OXIDATION PROCESS* (AOP) Ozon/UV

Industri tekstil menghasilkan limbah zat warna sintetis seperti *Reactive Blue 19* (RB 19) yang bersifat kompleks serta sulit terdegradasi. Penelitian ini bertujuan untuk mengevaluasi efektifitas metode *Advanced Oxidation Process* (AOP) berbasis Ozon/UV dalam mendegradasi RB 19 dan menganalisis parameter kualitas air dan kinetika reaksinya. Penelitian ini dilakukan dalam reaktor berkapasitas 60 L menggunakan ozon dengan laju alir 5 L/menit terhadap konsentrasi awal zat warna (20, 40, 80, dan 120 ppm). Hasil penelitian menunjukkan bahwa teknologi AOP Ozon/UV sangat efektif dalam mendegradasi dengan efisiensi mencapai > 95% pada semua konsentrasi. Konsentrasi awal mempengaruhi laju degradasi; konsentrasi 20 ppm terdegradasi hingga 0,049 ppm dalam waktu 200 menit, sedangkan konsentrasi 120 ppm membutuhkan waktu 1120 menit untuk mencapai 1,360 ppm. Analisis kinetika menunjukkan bahwa proses degradasi mengikuti model reaksi orde satu, dengan konstanta laju reaksi (k) yang cenderung menurun seiring meningkatnya konsentrasi awal zat warna. Selain efektif menurunkan konsentrasi warna, metode ini juga mampu menurunkan nilai COD, meskipun dengan efisiensi yang lebih rendah. Sementara itu, nilai TDS, DHL, dan pH menunjukkan fluktuasi yang diduga akibat terbentuknya senyawa intermediat selama proses degradasi. Secara keseluruhan, AOP Ozon/UV terbukti efektif dalam pengolahan limbah RB 19, namun pada konsentrasi awal yang lebih tinggi diperlukan waktu proses yang lebih panjang.

Kata Kunci: *Advanced Oxidation Process* (AOP), *Reactive Blue 19*, Ozon/UV, Kinetika Orde Satu, Degradasi Zat Warna.

ABSTRACT

TREATMENT OF SYNTHETIC TEXTILE DYE WASTEWATER CONTAINING REACTIVE BLUE 19 AT VARIOUS CONCENTRATIONS USING AN OZONE/UV-BASED ADVANCED OXIDATION PROCESS

The textile industry generates synthetic dye wastewater such as Reactive Blue 19 (RB 19), which is complex in structure and difficult to biodegrade. This study aims to evaluate the effectiveness of the Advanced Oxidation Process (AOP) using an Ozone/UV system in degrading RB 19, as well as to analyze water quality parameters and reaction kinetics. The experiments were conducted in a 60 L reactor with an ozone flow rate of 5 L/min at various initial dye concentrations (20, 40, 80, and 120 ppm). The results showed that the AOP Ozone/UV system was effective in degrading the dye, achieving more than 95% efficiency across all concentrations. The initial concentration significantly affected the degradation rate; at 20 ppm, the concentration decreased to 0.049 ppm within 200 minutes, while at 120 ppm it required 1120 minutes to reach 1.360 ppm. Kinetic analysis indicated that the degradation followed a first-order reaction model, with the rate constant (k) decreasing as the initial dye concentration increased. In addition to effectively reducing color concentration, the method was also able to decrease COD levels, although with lower efficiency. Meanwhile, fluctuations in TDS, electrical conductivity (EC), and pH were observed, which were likely caused by the formation of intermediate during the degradation process.. Overall, the AOP Ozone/UV process was effective for treating RB 19 wastewater, although higher initial concentrations required longer treatment times.

Keywords: Advanced Oxidation Process (AOP), Reactive Blue 19, Ozone/UV, First Order Kinetics, Dye Degradation.