

SUMMARY

Dye pollution in textile manufacturing effluent brings a major environmental concern as these effluents contaminate water bodies by blocking sunlight penetration for the photosynthesis processes carried out by freshwater species and general production of sea water oxygen. As industrial textile activities across the world continue, the need for cost effective methods for dye degradation from textile wastewater and purification methods is becoming important.

In this study, a non-thermal plasma AOP method, pulsed corona discharge (PCD), was used to degrade acid orange 7 (AO7) and indigotetrasulfonate textile dyes. The effect of surfactant, conductivity, temperature, and pulse repetition frequency on the energy efficiency was evaluated and reported.

A laboratory-scale PCD reactor made by FlowRox Oy was used. Power supply to the reactor provided high-voltage pulses at the voltage peak of 18 kV, current peak 380 A, pulse duration 100 ns and pulse repetition rate of 50, 200 and 880pps, which correspond to 9, 32, and 123 W. The electrode system of the reactor consists of multiple strings, 20 m of total length and 0.55 mm in diameter. The strings are horizontally placed between two ground plates which are parallel to each other; the distance between the strings and the plates is 18 mm.

Results showed indigo dye reacting fast with oxidants at the oxidation energy efficiency of 859 g/kWh. Oxidation energy efficiency during the degradation of AO7 is also seen to increase with lesser delivered energy as 200 and 800 pps degraded at 69 and 62 g/kWh energy efficiencies respectively, considering 90% dye degradation.

Conductivity and temperature were noticed to have a negative effect on oxidation efficiency. The effect of electrolysis was neglected as the two inorganic salts used, sodium sulphate and sodium chloride, showed no practical difference in results. Sodium dodecyl sulphate (SDS) increased the degradation rate of AO7 by 57.7% at 200 mg/L of SDS and acted as a scavenger during the degradation of indigo blue dye reducing its oxidation efficiency by 9.7% at similar concentration.

In summary, the PCD method appears to be promising being effective with less energy consumption. Recommended further study would be to understand the role of surfactants in PCD oxidation of specific dyes and possible use of the effect of surfactant in practice.