

Magnetic field enhanced electrocoagulation using iron electrode in removing glyphosate from aqueous solution

ABSTRACT

The widespread use and high solubility nature of glyphosate posed a significant threat to water contamination. Glyphosate is a non-selective herbicide for weed control in various agricultural applications. Electrocoagulation method was thus proposed to coagulate this pollutant, and a magnetic treatment was introduced to shorten settling time and to assist sedimentation of suspended solids. The effects of operational variables such as initial glyphosate concentration, electrolysis time and applied voltage towards removal of glyphosate, chemical oxygen demand (COD) and total suspended solids (TSS) were explored to broaden the core understanding of settling velocity and ferromagnetic effects of magnetic fields. The combination of electrocoagulation and the magnetic field was designed and setup into batch laboratory experiment and static mode with two parallel iron (Fe) plates for both anode and cathode. This design used permanent magnets namely NdFeB of 0.55 T and the magnetic exposure time was 6 h. Results showed that the increment in both applied voltage and treatment time and the reduction in initial glyphosate concentration were beneficial for improving glyphosate, COD, and TSS removal efficiencies. An initial glyphosate concentration of 25 mg/l, applied voltage of 30 V and treatment time of 40 min, were obtained as optimum experimental conditions. Respective glyphosate, COD and TSS removal efficiencies of 95.84%, 71.43%, and 79.08% were observed in experiments conducted in optimum conditions. As a conclusion, magnetic field strongly encouraged electrocoagulation process in obtaining better results due to a ferromagnetic mechanism in aqueous solutions.

Keyword: Glyphosate aqueous solution; Electrocoagulation; Permanent magnet; Iron electrode; Suspended solid; Sedimentation