Experimental study of batch electrocoagulation treatment of peat water in Sarawak with aluminium electrodes

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Abstract. Peat water is commonly found in the coastal areas of Southern and Central Sarawak. About 39% of the rural communities in Sarawak are yet to receive clean water supply. As such the rural communities depend excessively rainwater and peat water for domestic usage. However, the usage of untreated peat water for domestic usage may cause harm to human health and well-being as it contains natural organic matters such as humic substances. Electrocoagulation is an environmentally friendly and simple process of water treatment. This research aims to develop a batch electrocoagulation process for treatment of peat water in Sarawak using Aluminium electrodes. The research includes the study on electrocoagulation for peat water treatment, design, and fabrication of batch electrocoagulation process using Aluminium, experimental study for optimum performances of the electrocoagulation, and economic analysis of the electrocoagulation system. Several parameters that affect the performances of the electrocoagulation system are studied such as the inter-electrode distance, number of electrodes, current density and treatment time. The performance of the system is evaluated based on the removal efficiency on turbidity, colour, Chemical Oxygen Demand (COD), Total Organic Content (TOC) and Total Suspended Solid (TSS). The system successfully removes 100% of colour, 93.35% of turbidity, 89.80% of COD, 88.22% of TOC, and 87.50% of TSS by using a current density of 25 A/m2 in 80 minutes and 8 Aluminium electrodes with inter electrode spacing of 2 cm. The final quality of treated peat water is determined to be suitable for domestic usage which falls under Class 1 water of the National Water Quality based on the parameters analyzed. The operating cost of 25 A/m2 current density for 80 minutes of treatment time by using 8 electrode plates is RM 4.32 per m3 of peat water.

1. Introduction

Electrocoagulation, which is characterized by the in-situ generation of coagulant and hydroxide flocs with high absorption ability, is an environmental-friendly process for treating wastewater with heavy metal ions and toxic organics [1]. Aluminum is usually used as electrodes and their cations are generated by dissolution of sacrificial anodes upon the application of a direct current [2]. The process is an alternative method to chemical coagulation for many reasons in which the electrocoagulation system capable of reducing the need for additive chemicals [3]. Several reactions occur during electrocoagulation as shown in the **Equation (1), Equation (2)** and **Equation (3)**.

$$Al \rightarrow Al^{3+}_{(aq)} + 3e^{-} \quad (1)$$