

ABSTRACT

Water scarcity is still a major problem in Sarawak's rural areas. Peat water is abundantly found in the rural coastal regions but peat water is associated with a distinct red-brown colour and unpleasant smell. As such, this research investigates the application of an electrocoagulation treatment system for peat water with aluminium electrodes in which a low cost, easy maintenance, and locally fabricated electrocoagulation treatment system prototype is developed. In addition to experimental studies, the study also attempts to study the kinetics and statistical studies, as well as the optimisation of the developed electrocoagulation system parameters for peat water treatment. The electrode design with the most effective areas and number of electrodes impact on the system's overall efficiency are also investigated. This study also investigated the effectiveness of the post-treatment process, particularly on the filtration and disinfection system. From the study, the optimum operating conditions of the developed electrocoagulation system are 60 minutes of treatment time and current density of 18.52 A/m^2 with 10 plates in which produced treated water quality parameters on par with the Malaysian water standard. It is also found that with a post-treatment process, the overall operating cost and treatment time is reduced to about 50%. The kinetics of electrocoagulation peat water adheres to pseudo-second-order kinetics, whereas the kinetic model follows the Langmuir adsorption isotherm and Variable-Order kinetics model. For the statistical and optimisation study, the optimized parameters attained are current density at 19.109 A/m^2 and treatment time of 57.08 minutes, with effective removal of turbidity (89.8%), COD (96.6%), and colour (97.06%). Overall, the electrocoagulation process is an efficient process to treat peat water.

Keywords: Peat Water, electrocoagulation, aluminium electrodes

Rawatan Elektrokoagulasi Air Gambut di Sarawak dengan Elektrod Aluminium

ABSTRAK

Masalah kekurangan air masih dialami oleh kawasan luar bandar Sarawak. Air gambut mudah didapati di kawasan pesisiran tetapi air gambut dikaitkan dengan warna merah-coklat dan bau yang tidak menyenangkan. Penyelidikan ini menyelidiki kegunaan sistem 'electrocoagulation' bagi merawat air gambut dengan menggunakan elektrod aluminium. Sebagai tambahan kepada kajian eksperimental, kajian ini juga turut mengkaji kinetik dan kajian statistik, serta pengoptimuman parameter sistem 'electrocoagulation' yang dikembangkan untuk rawatan air gambut. Reka bentuk elektrod dan jumlah elektrod terhadap kecekapan keseluruhan sistem juga diselidiki. Kajian ini juga mengkaji keberkesanan proses pasca rawatan terutama dengan sistem penapisan dan pembasmian kuman. Dari kajian, operasi optimum sistem 'electrocoagulation' adalah 60 minit masa rawatan, 'current density' 18.52 A/m^2 dan 10 plat bagi menghasilkan parameter kualiti air terawat setanding dengan standard air Malaysia. Keseluruhan kos operasi dan masa rawatan dapat dikurangkan sehingga 50% dengan menggunakan proses pasca rawatan. Dari segi kinetik pula, didapati bahawa kadar kinetik mematuhi 'pseudo-second-order', manakala model kinetik mengikuti 'Langmuir Adsorption Isotherm' dan 'Variable-Order Kinetic'. Parameter yang dioptimumkan yang diperolehi dari perisian adalah 'current density' 19.109 A/m^2 dan masa rawatan 57.08 minit, dengan penghapusan kekeruhan yang berkesan (89.8%), COD (96.6%), dan warna (97.06%). Kesimpulannya, proses 'electrocoagulation' mampu merawat air gambut dan mengatasi masalah air di kawasan pesisir luar bandar.

Kata kunci: Air Gambut, elektrokoagulasi, elektrod aluminium