

THE APPLICATION OF MAGNETIC FIELDS FOR LANDFILL  
LEACHATE TREATMENT

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## ABSTRACT

This research is mainly focused on the capability of magnetic application of 0.55 Tesla magnetic field strength on reduction of suspended solid (SS), BOD<sub>5</sub> and COD in landfill leachate through a circulation magnetic device which was conducted using the settling column test. The parameters monitored which effect the reduction of suspended solids and organic concentration were the magnetic exposure time of between 1 hour and 6 hours, operating flow rate of between 1 mL/s and 5 mL/s, and pH of between 2 and 13. Empirical mathematical models of sedimentation and column settling test were investigated to fulfill the behaviour of sedimentation under operating conditions due to the effect of magnetic exposure time, operating flow rate, and pH of the sample. Using the empirical mathematical models were analysed based on total suspended solids (SS), BOD<sub>5</sub> and COD removal efficiency to variation of the operating flow rate, magnetic exposure time and pH. The model coefficients were derived from combined analysis of correlated sets of data, thus giving an indication for their possible general applicability. The pH had significant effects on the percentage of SS, BOD<sub>5</sub> and COD removal, but pH increased the starting SS, BOD<sub>5</sub> and COD removal rate. The study reveals that percentage of SS, BOD<sub>5</sub> and COD removal efficiency decreased as the pH below 7 was increased, but it increased as the pH of between 7 and 13 was increased the reduction of SS, BOD<sub>5</sub> and COD in the sample. The experimental design at an exposure time to magnetic field of 6 hours, a flow rate of 2 mL/s with pH of 13 show that the removal efficiency of SS, BOD<sub>5</sub> and COD at 72.57%, 63.93% and 56.97% respectively. Statistically tested by SPSS, there was a significant linear increase in average treatment efficiency to the magnetic exposure time and pH of sample at 95% confidence level. The experimental results were also generated empirical mathematical model relating percentage of SS, BOD<sub>5</sub> and COD removal efficiency to flow rate, magnetic exposure time and sample of pH using MINITAB statistical software. The empirical mathematical models can be helpful in designing application of magnetic fields for landfill leachate treatment.

## ABSTRAK

Kajian ini menumpukan kepada keupayaan penggunaan magnet dengan kekuatan medan magnet 0.55 Tesla kepada pengurangan zarah terampai, BOD<sub>5</sub> and COD dalam air sisa dari tapak pelupusan menerusi kaedah pengolahan aliran pengelilingan secara ujian turus pengenapan. Parameter yang mempengaruhi keupayaan pengurangan zarah terampai, BOD<sub>5</sub> and COD dinilai merangkumi tempoh pendedahan kepada medan magnet antara 1 dan 6 jam, kadar alir antara 1 mL/s dan 5 mL/s dan pH sample antara 2 dan 13. Model matematik yang empiris untuk mengenalpasti keupayaan kadar pemendapan zarah terampai, BOD<sub>5</sub> and COD menerusi kaedah pengolahan pengelilingan secara uji turus pengenapan terhadap tempoh pendedahan pada medan magnet, kadar alir dan pH sample. Daripada hasil data, model matematik yang empiris untuk kecekapan penyingkiran zarah terampai, BOD<sub>5</sub> and COD terhadap parameter kadar alir, tempoh pendedahan pada medan magnet dan pH sample dapat dikaji. Pemalar pada model dihasilkan daripada kombinasi dan korelasi data, memberikan indikasi untuk keupayaan model umum yang dapat digunakan. pH didapati mempunyai kesan yang signifikan terhadap kecekapan penyingkiran zarah terampai, BOD<sub>5</sub> and COD. Hasil kajian mendapati peratus kecekapan penyingkiran zarah terampai menurun pada keadaan pH sample kurang daripada pH 7, akan tetapi meningkat pada keadaan sample antara pH 7 dan 13. Ujian berdasarkan rekabentuk selama tempoh 6 jam pendedahan kepada medan magnet, kadar alir 2 mL/s dan pH 13 mendapati kecekapan penyingkiran kepekatan zarah terampai, BOD<sub>5</sub> and COD dalam sampel dapat dikurangkan secara pengenapan sebanyak 72.57%, 63.93% dan 56.97%. Uji statistic dengan SPSS mendapati adanya hubungan linear pada purata peningkatan kecekapan pengolahan dalam kumpulan kajian untuk parameter kadar alir dan pH sampel pada 95% paras kepercayaan. Pada akhir kajian analisa dengan bantuan MINITAB digunakan untuk merumuskan model matematik yang empiris pada kecekapan penyingkiran zarah terampai, BOD<sub>5</sub> and COD terhadap parameter kadar alir, tempoh pendedahan pada medan magnet dan pH sampel. Model yang empiris sangat membantu untuk perancangan aplikasi kesan medan magnet pada pengolahan air sisa dari tapak pelupusan.