**STUDY ON SOME FACTORS AFFECTING TO COD REMOVAL EFFICIENCY IN LEACHATE BY ELECTROCOAGULATION**

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**Abstract:**

Landfilling is one of the most popular methods of municipal solid waste disposal, however leachate from landfill has become an enormous challenge for landfill managements and leachate treatment technologies. This research proposed and investigated the Nam Son landfill leachate treatment performance by electrocoagulation method. A mono-polar electrocoagulation unit was set up in a batch system with iron electrodes and approximately 1.8 litter of leachate. The effects of factors namely current intensity, electrolysis time, initial pH, anode materials and inter-electrode distance on chemical oxygen demand (COD) removal efficiencies were studied. The results showed that the optimum operating conditions were current intensity of 3A, electrolysis time of 40 min, the raw pH (pH =8), iron electrodes and inter-electrode distance of 1 cm. At the above conditions, with the initial COD concentration of 6247 ± 295 mg/l, about 73.21% COD was removed after electrocoagulation.

**Keywords**: landfill leachate, electrocoagulation, COD removal efficiency, iron electrodes.

1. **Introduction**

Landfilling is one of the most popular methods of municipal solid waste disposal because of its relative simplicity and low cost. Conventional leachate treatment methods, such as air stripping, coagulation, flocculation and settling, are often costly in terms of initial outlay of plant equipment, energy requirements additional chemicals. Hence, some effective and economical methods has developed to solve these problems. One of the simple, effective and economic-efficient is electrocoagulation (EC) which is successful electrochemical methods for many kinds of wastewater treatment [1]. The purpose of this paper is to study the COD removal efficiency from leachate by EC.

1. **Methods and Materials** 
   1. **Landfill leachate**

The leachate sample taken from Nam Son landfill with the properties was given in Table 1.

**Table 1**. The properties of leachate from Nam Son landfill

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Leachate parameters | COD (mg/l) | NH3-N (mg/l) | NO3- (mg/l) | pH |
| Properties | 1. ± 295 | 2 ± 38 | 2.1 | 8 ± 0.1 |

* 1. **Electrocoagulation system**

The mono-polar electrocoagulation unit consisted of approximately 1.8 L of leachate and eight electrodes connected directly to a Direct Current. Each electrode was made of iron or aluminum with the dimension of 11 cm x 10 cm, the electrodes were submerged and the inter-electrode distance was 1cm.

* 1. **Analytical methods**

The COD and pH were measured by the dichromate method (TCVN 6491:1999, corresponding to ISO 6060:1989) and pH monitor (HANNA HI 991001), respectively.

1. **Results and Discussion** 
   1. ***Effects of current intensity and operating time***

Figure 1 shown that COD treatment yield was directly proportional to current intensity and electrolysis time. COD removal percentage at intensity of 3 and 4A were not considerably different, at 79.29 and 82.69% (80 min). COD removal percentage rocketed in first 40 min, then remain stably; at above 73% (I = 3A). Hence, current intensity of 3A and operating time of 40 min were chosen for the next experiments.

**Figure 1**. Effects of current intensity and operating time on COD removal efficiency

* 1. ***Effect of initial pH***

Figure 2 shown that COD was removed effectively in pH from 6 to 8, around 70% while both the acidic and basic condition experienced a considerably decrease. To compare with the raw leachate pH, it is not necessary to regulate initial pH of leachate. This is consistent with the findings of Li X. et al, 2011 [2].

**Figure 2.** Effect of initial pH on COD removal efficiency

* 1. ***Effect of electrode materials***

Figure 3 indicated that Fe-electrode has a higher treatment efficiency than Al one for COD removal. In detail, the COD removal efficiency by iron electrodes increases by 20 to 30% compared to the aluminum anode in the first 40 min electrolysis time because the settle ability of particle formed by Fe(OH)3 is better than that formed by Al(OH)3 [2].

**Figure 3.** Effect of electrode materials on COD removal efficiency

* 1. ***Effect of inter-electrode distance***

When inter-electrode distance increased, the ohmic loss in relation to the anode and cathode over voltages and the resistance to mass transfer became larger; the kinetics of both charge transfer and the iron oxidation was slowed down. So, there was a smaller amount of iron cations at the anode leading to slower formation of coagulants [3]. This resulted in lower removal efficiency at a larger inter-electrode distance.

**Figure 4.** Effect of inter-electrode distance on COD removal efficiency

1. **Conclusion**

The research shown that the optimum condition for Nam Son leachate treatment by electrocoagulation was obtained as current intensity of 3A, electrolysis time of 40 min, raw pH (around 8), iron electrodes and inter-electrode distance of 1 cm, resulting the maximum COD removal efficiencies of 73.21%. In conclusion, electrocoagulation can be applied to leachate pre-treatment.

**References**

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