

A STUDY ON EFFICIENCY OF CONDUCTIVE MATERIAL FOR WASTEWATER TREATMENT FROM HOUSEHOLDS BY ELECTROLYSIS PROCESS

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Abstract

Residential wastewater is a major drainage source of wastewater generated from household activities without proper management and treatment of wastewater that impact on water quality and the environment. From the preliminary study, the wastewater treatment system by electrolysis process to treat some organic substances dissolved in water, high concentration. It used to treat wastewater after standard treatment and high cleanliness. The aim of this study was to compare the effect of wastewater treatment on three types of electrical conductivity. This research was an experimental design. We examined three conductive materials, graphite, copper and aluminum. The samples were collect before and after treatment for analysis pH, BOD (Biochemical Oxygen Demand), SS (Suspended Solids), Fat and Oil, according to the wastewater control standards in wastewater from households, Muang Surat Thani District. In wastewater treatment direct current voltage of 24 volts, was use current of 10 amperes the electrode was made of each conductive material. The results demonstrated that pH, BOD, SS and Fat and Oil of pre-treatment wastewater was 5.784, 5.231 mg/L, 0.47 mg/L and 0.063 mg/L, respectively. After treating wastewater was using graphite sheet, copper and aluminum and was the electrolytic conductors, it was find that pH equal to 5.17, 5.11, 5.20 and SS equal to 0.08, 0.11, 0.085 mg / L and BOD equal to 223, 244, 235 mg/L and Fat and Oil equal to 0.051, 0.061, 0.055 mg / L, respectively. It can be seen that when comparing the results of the parameters of household wastewater, it was find that after treatment, the results were compare between graphite, copper and aluminum. It was finding that the use of graphite sheets gave the best results. The use of graphite sheet gives the best results. This makes the water quality after treatment better than using other conductive materials. Researchers are interested in the materials used in conducting graphite sheet electricity to apply in the construction of wastewater treatment equipment. It should be increase the number of times to analyze for reliable results; it should analyze the nutrients remaining in the water after treatment for the benefit of bringing water to add other benefits, such as growing hydroponics vegetables or bringing sludge to make fertilizer.

Keywords: Wastewater treatment, Electrolysis, Graphite sheet

Introduction

Community wastewater is a major problem that affects the quality of water to natural sources, which is the main source of water for consumption. Accommodation is a major source of sewage. Household wastewater, including toilet wastewater, wastewater from bathing, wastewater from washing and cooking, these wastewater without good management and treatment They are not reducing pollution before draining to the water source will have an impact on water quality and the environment, causing the water quality and the environment to become one of the causes of stink, as well as spreading germs and breeding mosquitoes are harmful to the health and well-being of people and communities in the area. One problem that has arisen and results in poorly managed waste water is that people and communities are still lacking in knowledge about waste water management. Most of the household waste water is not treated properly before being drained into the environment or public water.

Based on the preliminary study of wastewater treatment by electrolysis for some organic substances that are soluble in water with the concentration is very high. They were found after treatment this water through standards and highly clean. Germs that are contaminated in water are eliminated. The use of treatment space and less time to build the system. The cost of construction of the system is low. In addition, wastewater and solids that have undergone electrolysis treatment can be recycled.

From the reasons mentioned above. As a result, the researcher is interested in studying the wastewater treatment by electrolysis. This study investigates the comparison of materials in electrical conductivity and wastewater treatment. It is expected that this research will be one of the ways to treat wastewater from community wastewater.

Research Design and Methodology

An experimental study was performed at household in Muang district Surat Thani during October 2017. The samples used in this study were household wastewater in Surat Thani. They are willing to cooperate in the research and cooking in the household regularly. Sample was selected by purposive sampling technique by researcher household in Muang District Surat Thani Province for 1 household. In the study, the researchers used three conductive materials, copper, aluminum and graphite. Collecting household effluents and analyze the contamination in water before treatment. Thereafter, three wastewater treatment tanks were constructed and analyzed for contaminants in water after treatment. The method can be summarized and described as shown in the picture one.

The experimental design was divided into 3 sets. The researcher used 3 conductive materials, namely copper, aluminum and graphite. The container size is 20x45x40 cm². Then prepare the material for the electrode to be connected to the DC power supply and arrange the serial electrode. Subsequently, the collected samples were collected from household effluent 300 ml. Then start the electricity supply for 30 minutes and collected for further analysis.

The sample was sent to pre and post-test analyzes. After that, sample was analyzed of pH, BOD, SS, Fat and Oil, according to the standard of wastewater discharge from wastewater treatment system, according to the announcement of the Ministry of Natural Resources and Environment. Set standards for controlling wastewater from communal wastewater treatment system. Have the following parameters: pH=5.5 -9.0, BOD (Biochemical Oxygen Demand) ≤ 20 mg / L, SS (Suspended Solids) ≤ 30 mg / L, Fat and Oil ≤ 5 mg / L. Follow the steps below:

1) Measurement of pH, to use a pH meter, the pH electrode is first calibrated with standard buffer solutions with known pH values that span the range being measured. To make a pH measurement, the electrode is immersed into the sample solution until a steady reading is reached. The electrode is then rinsed after each sample and stored in a storage solution after all the measurements have been completed. 2) Measurement of BOD, preparing water for analysis in case of non-neutral water samples, it must be adjusted to pH 6.5-7.5 by adding sodium hydroxide. In case of water, chlorine residue must be removed first by setting the water sample for 1-2 hours. The water sample is adjusted to 20±1°C. After that, fill the air with dissolved oxygen. Take about 10-15 minutes and pour to 3 BOD bottles. Take one bottle to find of dissolved oxygen and 2 bottles take in incubation at 20±1°C for 5 days, after 5 days, the water sample is then dissolved oxygen. Calculate the BOD from the formula: $BOD = D_1 - D_2$, D_1 = dissolved oxygen value on the first day, D_2 = dissolved oxygen value on day five. 3) Measurement of SS (Suspended Solids), the sequence is as follows; Dry the filter paper at 103-105°C for 1 hour. Allow to cool in the desiccator and filter paper. Place the paper in the banner cone. Use a distilled water to put the filter paper wet and allow it to suck into the cone. Filter the water sample in the right amount. Remove the filter paper from the cone into a fireproof container and dry it at 103-105°C for 1 hour. Wait for it to cool. Calculate the number of suspended solids from the formula: $SS = \{(A-B) \times 1,000 / \text{sample}\}$, A = weight of filter paper with suspensions (mg), B = weight of filter paper (mg), Sample = volume of water sample (liter). 4) Measurement of Fat and Oil, add 1:1 HCl acid to the water. Shake well and measure the pH to less than 2. Bring all sample water into aliter separator funnel. Add 30 ml of n-Hexane and rinse. Shake separator funnel as mix well for about 2 minutes, leaving it to separate the solution. The n-Hexane portion is located on the top of the sample water. Remove the lower part of the water from the separator funnel. Transfer the n-Hexane solution bottle to a 125 ml flask. Whatman No. 40 was used to remove the sample from the bottle and then extracted twice. The solution was extracted to reduce the volume by rotary-evaporator at 85°C for 15 minutes. Allow to cool in the desiccator for about 20 minutes. Calculate the amount of oil and fat from the formula:

Oil and Grease = $\{(A-B) / \text{sample}\}$, A = weight of evaporated cup of water (mg), B = weight of evaporated cups without added impurities (mg), Sample = volume of water sample (liter).

Data were analyzed using descriptive statistics, percentage, mean and standard deviation for compare the standard values at before and after treatment of wastewater of the materials used in making three different electrodes are copper, aluminum and graphite.

Findings and Discussion

Collection of household wastewater was carried out in accordance with standards for wastewater drainage from community wastewater treatment systems. The parameters are tested pH, BOD, SS, Fat and Oil. Compare the results between before and after wastewater treatment by designing the wastewater treatment tank using graphite plates as a conducting electrode. The results are shown in Table 1.

Table 1: Shows the results of analysis parameters of household effluent from the treatment using graphite sheet as the electrode.

Parameter	Results	
	Before treatment	After treatment
pH	5.784	5.17
Suspended Solids(SS)	0.47 mg/L	0.08 mg/L
Biochemical Oxygen Demand(BOD)	5,231 mg/L	223 mg/L
Fat and Oil	0.063 mg/L	0.051 mg/L

From Table 1, Analysis of parameter follows by the standard of wastewater from the community, the effect of water from the treatment using graphite sheet was the electrode in the conductivity, it was found that before to treatment, the pH value was 5.784, SS was 0.47mg/L, BOD equal to 5,231mg/L and Fat and Oil equal to 0.063 mg/L and after to treatment, pH equal to 5.17, SS were 0.08 mg/L, BOD equal to 223 mg/L and Fat and Oil equal to 0.051 mg/L.

As a result, when comparing the parameters between before and after treatment by using a graphite sheet as a polarity in the conductivity, it was found that pH decreased by 10.62%, SS decreased 82.98%, and BOD decreased 95.73% and Fat and Oil decreased by 19.05%. It can be seen that the wastewater treated by the graphite electrode can improve water quality after treatment although; the BOD is still below standard. However, after treatment, the value was significantly reduced to 95.73%.

Collection of household wastewater was carried out in accordance with standards for wastewater drainage from community wastewater treatment systems. The parameters are tested pH, BOD, SS, Fat and Oil. Compare the results between before and after wastewater treatment by designing the wastewater treatment tank using copper as a conducting electrode. The results are shown in Table 2.

Table 2: Shows the results of analysis parameters of household effluent from the treatment using copper as the electrode.

Parameter	Results	
	Before treatment	After treatment
pH	5.784	5.11
Suspended Solids(SS)	0.47 mg/L	0.11 mg/L
Biochemical Oxygen Demand(BOD)	5,231 mg/L	244 mg/L
Fat and Oil	0.063 mg/L	0.061 mg/L

From Table 2, Analysis of parameter follows by the standard of wastewater from the community, the effect of water from the treatment using copper was the electrode in the

conductivity, it was found that before to treatment, the pH value was 5.784, SS was 0.47mg/L, BOD equal to 5,231mg/L and Fat and Oil equal to 0.063 mg/L and after to treatment, pH equal to 5.11, SS were 0.11 mg/L, BOD equal to 244 mg/L and Fat and Oil equal to 0.061 mg/L.

As a result, when comparing the parameters between before and after treatment by using copper as a polarity in the conductivity, it was found that pH decreased by 11.65%, SS decreased 76.59%, and BOD decreased 95.34% and Fat and Oil decreased by 3.17%. It can be seen that the wastewater treated by the graphite electrode can improve water quality after treatment although; the BOD is still below standard. However, after treatment, the value was significantly reduced to 95.34%.

Collection of household wastewater was carried out in accordance with standards for wastewater drainage from community wastewater treatment systems. The parameters are tested pH, BOD, SS, Fat and Oil. Compare the results between before and after wastewater treatment by designing the wastewater treatment tank using aluminum as a conducting electrode. The results are shown in Table 3.

Table 3: Shows the results of analysis parameters of household effluent from the treatment using aluminum as the electrode.

Parameter	Results	
	Before treatment	After treatment
pH	5.784	5.20
Suspended Solids(SS)	0.47 mg/L	0.085 mg/L
Biochemical Oxygen Demand(BOD)	5,231 mg/L	235 mg/L
Fat and Oil	0.063 mg/L	0.055 mg/L

From Table 3, Analysis of parameter follows by the standard of wastewater from the community, the effect of water from the treatment using aluminum was the electrode in the conductivity, it was found that before to treatment, the pH value was 5.784, SS was 0.47mg/L, BOD equal to 5,231mg/L and Fat and Oil equal to 0.063 mg/L and after to treatment, pH equal to 5.20, SS were 0.085 mg/L, BOD equal to 235 mg/L and Fat and Oil equal to 0.055 mg/L.

As a result, when comparing the parameters between before and after treatment by using copper as a polarity in the conductivity, it was found that pH decreased by 10.09%, SS decreased 81.91%, and BOD decreased 95.51% and Fat and Oil decreased by 12.69%. It can be seen that the wastewater treated by the graphite electrode can improve water quality after treatment although; the BOD is still below standard. However, after treatment, the value was significantly reduced to 95.51%.

The parameters tested were: pH, BOD, SS, Fat and Oil by comparison of the results between graphite, copper and aluminum, the results were after wastewater treatment shown in Table 4.

Table 4: Shows the results of Comparison of household effluent parameters using three conductive materials

Parameter	Results			Standard
	Graphite	Copper	Aluminum	
pH	5.17	5.11	5.20	5.5 -9.0
SS (mg/L)	0.08	0.11	0.085	≤ 20
BOD (mg/L)	223	244	235	≤ 30
Fat and Oil(mg/L)	0.051	0.061	0.055	≤ 5

From Table 4, the household wastewater parameters after treatment were compared; the results of the comparison between the copper, aluminum and graphite found that the use of graphite plates gave the best results. This makes the water quality after treatment better than using other conductive materials. Researchers are interested in materials in the conductive graphite sheet to apply for the construction of wastewater treatment equipment in the further.

Comparative of conductive materials for Household Wastewater Treatment, case study in Amphoe Mueang Surat Thani Surat Thani, the researchers discussed the following important issues: 1) Efficiency of household wastewater treatment using electrical system in the wastewater treatment, the standard parameters of household wastewater was 3 parameters: pH, SS, Fat and Oil, the values of which are quite good, can be developed to increase the efficiency. Although, BOD was still slightly above the standard thresholds. 2) The BOD is still higher than the benchmark. Researchers expect that as a result of aerating into the water. This may be due to the fact that the air inlet is not sufficient to adjust the BOD and should be added to the filtering system into the device, such as the use of materials that can filter and absorb sludge from the rest of the process.

Conclusion

This study was to compare the effect of wastewater treatment on three type of electrical conductivity. It can be seen that when comparing the results of the parameters of household wastewater, it was find that after treatment, the results were compare between graphite, copper and aluminum. It was finding that the use of graphite sheets gave the best results. The use of graphite sheet gives the best results. This makes the water quality after treatment better than using other conductive materials. Researchers are interested in the materials used in conducting graphite sheet electricity to apply in the construction of wastewater treatment equipment. It should be increase the number of times to analyze for reliable results; it should analyze the nutrients remaining in the water after treatment for the benefit of bringing water to add other benefits, such as growing hydroponics vegetables or bringing sludge to make fertilizer.

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Biography



Chukrait Krajangmek was born on August 31st 1980 in Muang Ranong, Thailand. He earned his Bachelor's degree from Civil Engineering Major, Faculty of Technical Education (Thewes Campus) at Rajamangala University of Technology Phra Nakhon (RMUTP) in 2006. After the graduation, he was a lecturer at the program in Building Construction, Surat Thani Technical College, Surat Thani, Thailand. In the present time, he is a lecturer at the program in Building Construction in Ranong Technical College, Ranong, Thailand.



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