THE STUDY OF MIXTURED RATIO OF FUEL FROM FAT DREGS, RESIDUE OF FAT DREGS AND AGRICULTURAL WASTE

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***Abstract*— *Fat dregs from wastewater sumps and the residue of fat dregs, which is left after the extraction of lipids from fat dregs are required to be treated properly to prevent environmental pollution and appropriate treatment costs money. This research aimed to investigate the potential of the utilization of the above wastes as fuels for combustion in factories by mixing them with agricultural wastes. This work studied the heat of combustion of the mixtures when the quantities of fat dregs and residue of fat dregs were varied between 25-75%. Grinded agricultural wastes used in this study were rich husks, sawdust, cassava rhizomes, and corn cobs. The results of this work showed that the mixture of corn cobs and fat dregs was most suitable for further studies and development of combustible fuel. It was found that the heat of combustion of fat dregs was 13.706 ± 0.442 kJ/g which was lower than saw dust and corncobs. Saw dust and corncobs had the heat of combustion of 13.929 ± 0.096 kJ/g and 14.041 ± 0.289 kJ/g, respectively, which were higher than those of other agricultural wastes while that of rice husks was the lowest i.e. 11.533 ± 0.728 kJ/g. The heat of combustions were of the mixtures of fat dregs correlated with the quantity of fat dregs. Meanwhile, the heat of combustions of the mixtures of the residue of fat dregs and sawdust, and corncobs were correlated reversely with the quantity of the residue of fat dregs. The mixtures containing 50% of fat dregs or residue of fat dregs and above were semi-solid therefore further processes might be needed for convenient utilization as combustible fuel.*

***Keywords*— W fat dregs, residue of fat dregs, rice husks, saw dust, cassava rhizomes and corn cobs**.

1. INTRODUCTION

Due to hectic lifestyles and traffic congestions; especially in the big cities, most people are hurried in their living concerning travelling, working and looking for foods. This can be seen from many malls where people like to eat in those malls rather than cooking at home because of convenience and variety of foods. Generally, these malls have a system to get rid off waste water by using waste water well for a large area of the malls before letting the water to different wells. At the surface of the water, it will have some fat that mingled with waste water and float up to the water surface as thick and thin layers depending on fat and oil volume in waste water. These fat layers can be called fat dregs: waste that has to be treated in the right way in order to protect the pollution to environment. The one easy and popular way to treat is to bury and cover with earth. It costs one thousand cubic meters for hiring manufacturers in taking these fat to bury; excluding shipping payment. Therefore it is beneficial to utilize these fats and it will lower the expense in eliminating them. It also reduces pollution that might happen in eliminating in the wrong way.

Producing biodiesel from distilled fat of fat dregs is the one interesting way. Nevertheless, solid that distilled from fat distillation will be called residue of fat dregs which has to be eliminated as those fats. This research therefore is aimed to study heat energy obtained from mixing between fat dregs and agricultural waste and mixing between residue of fat dregs and agricultural waste. This will be the fundamental information that can be used as potentiality assessment for the use of fuel in the future.

2. RESEARCH METHODOLOGY

2.1 Materials used in an experiment

2.1.1 Fat dregs obtained from wasted water reservoir in Carrefour shopping malls. We dip and split the water as much as possible then separate big garbage and spin ingredients together. After that we keep it at -20°C temperature for using through the experiment. These fat dregs have the amount of fat 63.3%.

2.1.2 Residue of fat dregs prepared from taking fat dregs to distill the fat using the method of humid heat (121°C 15 minutes). Then we take the remaining solid from separating fat and oil and use it as residue of fat dregs. We finally keep it at -20°C temperature for using through the experiment.

2.1.3 Agricultural waste used in the experiment includes rice husks (not burnt), saw dust, corn cobs and cassava rhizomes.

2.2 The Method of Analyzing Fat

We calculate the fat using separating funnel. Then it is started by preparing Erlenmeyer flask that we know the exact weight. Next, we take it into an oven with the temperature of 105 ± 3°C in 2 hours. After that, we bring it out then leave it cool in desiccator at the room temperature then weight it and do it repeatedly two times until the weight results are different ±1 milligram. We

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take the samples 5 grams to weight, record the weight into the beaker, fill ethyl alcohol and hydrochlolic acid solution 10 milligram. Stir all of them together with stirring rod and place the beaker on a tripod at the temperature of 80°C for 60 minutes in cooker hood. We have to stir while it is broiling. When the time is finished we have to leave them cold and add ethyl alcohol 10 milligrams and pour in the separated cone. We add ethyl alcohol 25 milligrams in the separating funnel then shake it strongly. We have to open a cork of the funnel separately while shaking. We then add petroleum ether 25 milliliter and shake strongly. Next, we place the separating funnel on a tripod in order to divide the substances. After that, pour and segregate the last substance on the top of the funnel then split down in the prepared Erlenmeyer flask with filter paper and fill sodium sulphate to drain the water. Do it the same two times then take the Erlenmeyer flask with the sample to place on a water bath at the temperature 100°C until it remains only the oil. Next we weight the oil remaining in the Erlenmeyer flask and note the last weight**.**

2.3 Method in mixing fat dregs and residue of fat dregs with agricultural waste

We crush agricultural waste into small pieces or into powder using a crushing-machine such as grinder, mortar, coarse, crushed stone and electric crushing-machine. Put fat dregs or residue of fat dregs with agricultural waste in a container then weight them by mass in the mixed ratios. Mash all the ingredients together then weight the mixed fuel for being 1 gram. Finally, we put them in mechanical strength compressed machine for becoming short cylindrical grain similar to pills.

2.4 Testing to find out the heat value of fuel

Test the heat value of blended substances between fat dregs and agricultural waste and residue of fat dregs with agricultural waste at the ratios of 25, 50 and 75 % using bomb calorimeter (Figure 2.1) as the following steps.

- Pour the water 2 kilograms in the tin of bomb calorimeter.

- Put down the tested sample in a cup filling with the sample and put in the bomb calorimeter.

- Bring the spiral with the length about 10 centimeters then bind it at the two ends as shown in the Figure 2.2.

- Pour the water just 1 drop in the bomb calorimeter for absorbing the steam obtained from combustion.

- Close the lid tightly then contain oxygen with the pressure 23 bar.

- Put the bomb calorimeter in the calorimeter tank then operate water mixing machine.

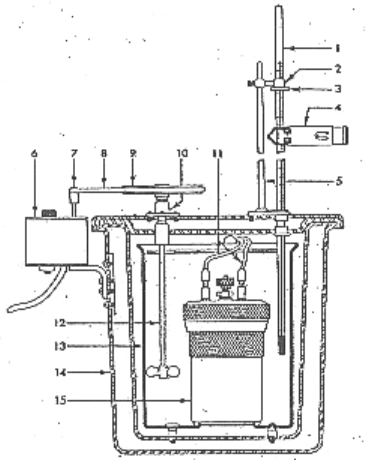
- Connect the power cord then put thermometer and operate water mixing machine when the water temperature changes regularly .

- Note the temperature every 1 minute for 5 minutes then blast and note the temperature every 10 seconds until the temperature begins to drop regularly.

- Note the temperature every 1 minute for five more minutes.

- Measure the length of the spiral remaining from combustion and calculate the heat value.

- Do the experiment in the Figure 3 repeatedly.



1. Thermometer, 19 - 35 °C
2. Thermometer bracket
3. Thermometer support bracket
4. Thermometer reading lens
5. Thermometer support rod
6. Motor assembly with pulley, 115v 50/60Hz
   Motor assembly with pulley, 230v 50/60Hz
7. Motor pulley
8. Stirrer drive belt
9. Stirrer pulley
10. Stirrer bearing assembly
11. Ignition wire
12. Stirrer shaft with impeller
13. Oval bucket
14. Calorimeter jacket with cover
15. Oxygen combustion bomb

Figure 2.1 in of bomb calorimeter [1]

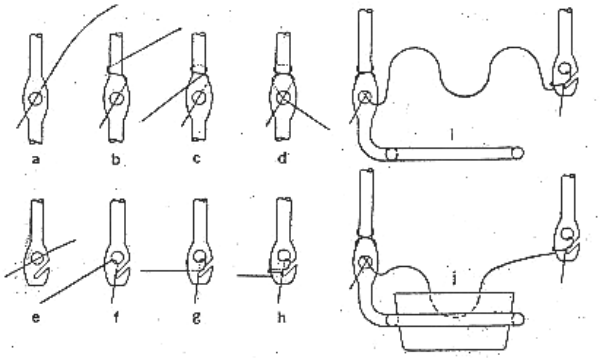


Figure 2.2 The process in using spirals to bind the two ends [1]

3. RESULTS

3.1 Physical aspects of substances mixing between fat dregs with agricultural waste and residue of fat dregs with agricultural waste

Mixed substances between every crushed

agricultural waste testing with fat dregs and residue of fat dregs which has the amount of fat residue of fat dregs over 50% will have the aspects of semi-solid and semi-liquid. That is to say, they both cannot compress as mass. When the fat volume and residue of fat dregs have increased, mixed substances will sharply have the aspect of semi-solid and semi-liquid.

3.2 Heat value of different materials using as ingredients

From analyzing the heat value of agricultural waste being tested found that corn cobs gave the heat value more than other waste. Fat dregs had the heat value a little less than corn cobs and saw dust whereas residue of fat dregs gave the lowest heat value which has been similar to the value of rice husks. (TABLE 3.1)

TABLE 3.1 The average heat value (kJ/g) of different materials used as ingredients of mixed substances

Materials	Average heat value ± standard deviation (SD)
fat dregs	13.706 ± 0.442
residue of fat dregs	11.311 ± 0.696
rice husks	11.533 ± 0.728
saw dust	13.929 ± 0.096
cassava rhizomes	12.369 ± 0.167
corn cobs	14.041 ± 0.289

TABLE 3.2 Heat value of mixed substances between fat dregs and agricultural waste.

Fat volume (%)	Average heat value of mixed substances between fat dregs and agricultural waste (kJ/g) ± standard deviation (SD)			
	rice husks	saw dust	cassava rhizomes	corn cobs
25	14.096 ± 0.193	15.322 ± 0.442	13.873 ± 0.334	14.319 ± 0.511
50	14.821 ± 0.511	15.489 ± 0.255	14.263 ± 0.255	14.654 ± 0.097
75	15.099 ± 0.255	15.712 ± 0.501	14.821 ± 0.193	16.381 ± 0.289
100	13.706 ± 0.442			

TABLE 3.3 Heat value of mixed substances between residue of fat dregs and agricultural waste.

Residue of fat dregs volume(%)	Average heat value of mixed substances between fat dregs and agricultural waste (kJ/g) ± standard deviation (SD)			
	rice husks	saw dust	cassava rhizomes	corn cobs
25	11.199 ± 1.016	13.567 ± 0.460	10.921 ± 0.255	14.319 ± 0.421
50	11.979 ± 0.696	13.873 ± 1.205	11.534 ± 1.170	13.094 ± 0.256
75	12.425 ± 1.683	11.589 ± 0.348	12.815 ± 1.864	12.039 ± 1.457
100	11.311 ± 0.69			

3.3 Heat value of mixed substance between fat dregs and agricultural waste

Mixing fat dregs with every agricultural waste will increase the heat value of mixed substance. That is to say, the heat value of every mixed substance between fat dregs and agricultural waste will increase when the amount of fat is higher. In other words, the heat value of mixed substance directly varies with the amount of fat dregs (TABLE 3.2). The highest value mixed substance is fat dregs mixing with corn cobs consisting of fat dregs 75% and have the heat value at16.381 ± 0.289 kJ / g. Fat dregs make the heat value of mixed substance and rice husks higher till it has the value similar to saw dust mixing with fat dregs in the equal quantity: especially, fat dregs 75%. In contrast, it is obviously seen that the heat value of rich husk is lower than saw dust when not mixing with fat dregs (TABE 3.1). When comparing the heat value of saw dust and corn cob as shown in TABEL 3.1, we will see that both materials give the similar heat value. When mixing fat dregs with the equal ratios (fat dregs 50%), mixed substance from corn cobs give the heat value a bit higher than saw dust so that corn cobs mixing fat dregs at the amount of 75% will give the highest heat value at 16.381 ± 0.289 kJ/g.

3.4 Heat value of mixed substance between residue of fat dregs and agricultural waste

As the heat value of residue of fat dregs has the value less than the value of fat dregs and ever agricultural waste (TABLE 3.1). Therefore, when we mix residue of fat dregs with any of agricultural waste the obtained heat value will not be different. When we mix with agricultural waste with the similar heat value like rice husk no matter with any ratios, we found that the heat value was lower while the amount of residue of fat dregs increased. When the amount of residue of fat dregs had been increased or the heat value inversely varied with the amount of residue of fat dregs to mixed substance consisting of saw dust and corn cob, the heat value will be higher than residue of fat dregs. (TABLE 3.3)

4. CONCLUSIONS

Mixed substances between fat dregs and agricultural waste give the heat energy in burning higher than agricultural waste which is not mixed with fat dregs. Therefore, such mixed substance is appropriate to use as fuel for burning; especially corn cob is the most appropriate. It is because corn cob can be mixed with fat dregs more than 50% and gives the heat value higher than using other agricultural waste. The heat energy value obtained from burning varied directly with the amount of fat dregs in mixed substance. However, the high amount of fat dregs will affect the physical aspect of mixed substance transforming into semi-liquid and very liquid. Consequently, appropriate fat dregs volume for mixed substance depends on the aspect appearing with mixed substance which is related to the method of taking this mixed substance to be used as fuel in burning. Mixed substance between residue of fat dregs and agricultural waste have the value of heat energy in burning lower than using mixed fat dregs about 3-4 kJ/g. when comparing with mixed substance having the amount of fat dregs equal with residue of fat dregs. The heat energy in burning inversely varies with the amount of residue of fat dregs when we mix residue of fat dregs with agricultural wastes that have higher heat value such as saw dust and corn cob. When we mix residue of fat dregs with agricultural wastes that have the heat energy in burning similar to residue of fat dregs, mixed substance will have the heat energy close to each of agricultural waste before mixing no matter it will vary with residue of fat dregs using in the experiment. Therefore the stated mixed substance is not appropriate for being fuel. In terms of the use of existing waste, using mixed substances between residue of fat dregs and agricultural wastes being fuel may help decrease costs in eliminating waste.

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