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Management of Renewable Sources of Energy: A Case on Rice Bran oil and Vegetable oils of Bangladesh Perspective

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Abstracts
Renewable energy is a now burning issue for sustainable development. Moreover, it is also environmentally compatible. Bangladesh produces huge amount rice every year. From this, a significant amount of wastes are generated from rice. Rice bran is one of them. On the other hand oil seeds such as coconut, soybean, pulm and mustard are available in Bangladesh. In this view, rice bran oil and vegetable oils are considered for a case study for renewable sources of energy and alternative fuel for lighting purposes of Bangladesh.

Key words: Rice bran oil; Vegetable oil; Renewable energy; Management; Bangladesh

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INTRODUCTION

In Bangladesh fuel is needed in plenty to sustain our industrial growth, agricultural production and for domestic purposes. Existing sources of fuel such as coal, oil and water may not be sufficient to meet the increasing demands. This requirement should undertake research work, which would help in explaining the possibilities of energy from several renewable source of energy. Natural gas may be the main source of energy for different purposes such as cooking, lighting and power generation etc for next 40-50 years. While Bangladesh depend on the crude mineral oils of Middle East countries. Although, these liquid fuels are non-renewable sources of energy. Moreover, crude oil is expensive. In addition, a major portion of rice bran is rejected as waste product [Rashid et al. 2000] as shown in following figure 1:

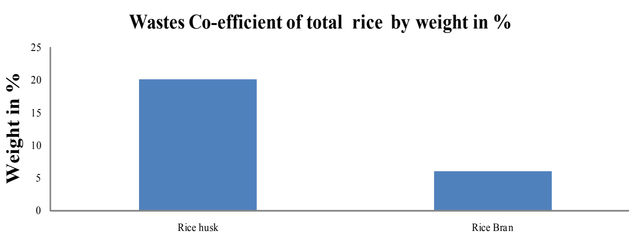

Figure 1
The Estimation of Rice is Based on Wastes Co-efficient

In this case, rice bran oil and vegetable oils provide a new dimension in the alternative fuel technology as renewable sources of energy. Moreover, this type of renewable energy can mitigating greenhouse Gas (GHG) emission, and preserving sustainable development for Bangladesh (Ali, 2011a). It can also meet the demand of socio economic up gradation of Bangladesh (Ali, 2011b). In this aspect, this paper is divided the following section:

- Present Uses of Rice Bran in Bangladesh
- Classes, Chemical Analysis of Rice Bran and Production Flow Chart of Rice Bran Oil
- Objectives of the study
- Procedure to determine the fuel properties
- Discussion
- Recommendations
- Conclusion

1. PRESENT USES OF RICE BRAN IN BANGLADESH

Rice bran is primarily used as fodder and domestic fuel for cooking and parboiling paddy. It is considered as a very tasty and nutritious food for cattle, fishes and poultry in figure 2:

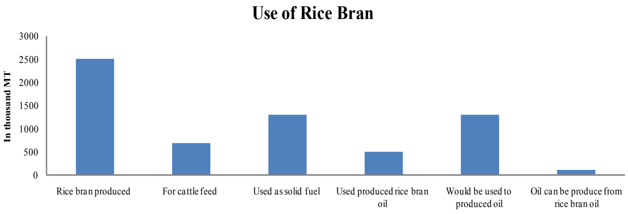

Figure 2
Use of Rice Bran

It is also used for the production of rice bran oil. This rice bran oil is used for soap manufacturing in Bangladesh for an example Lever Brothers Bangladesh limited, Chittagong. The following data was collected from Unilever Brothers Bangladesh Limited [3] is shown in Table 1.

Table 1
Demand and Price of Rice Bran Oil in Bangladesh

Approximate Demand of Rice bran oil/ year in MT	1200
Price /MT in BDT	50,000/-

It can apply for laundry soap manufacturing as a raw material instead of costly coconut oil. Hence, the production cost of laundry soap can be reduced.

2. CLASSES, CHEMICAL ANALYSIS OF RICE BRAN AND PRODUCTION FLOW CHART OF RICE BRAN OIL

From the chemical analysis of rice bran, it is observed that bran consists of the constituents as presented in table 2:

Table 2
Chemical Analysis of Rice Bran

Constituents	Range in %
Moisture	8 to 12
Oil	8 to 18
Ash	14 to 24
Crude oil	14 to 28
Protein	12 to 16
San/silica	0.5 to 6

Rice bran is generally collected from automatic rice mills and general husking mills. The quantity of bran collected from the automatic rice mills is better and free from husk. Three classes of rice bran are produced in Bangladesh. These are shown in table 3:

Table 3
Classes of Rice Bran

Class A Bran	Collected from the automatic rice mills
Class C Bran	Collected from the general husking rice mills containing rice husk with bran
Class B Bran	Collected from the class C bran , where the rice husk is removed from the bran

At Rupon oil and Feeds Limited, Dinajpur, Bangladesh was produced rice bran oil. The following production flow chart of Rice bran oil was collected from Rupon oil and Feeds Limited is shown in figure 3:

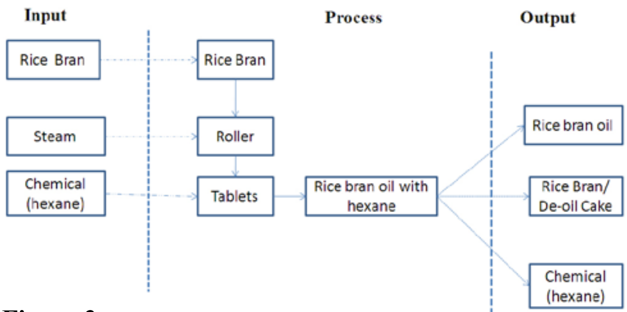

Figure 3
Rice Bran Oil Extraction Process Diagram

3. OBJECTIVES OF THE STUDY

The research work consists of the following aspects:

a) Technological aspect
b) Economic aspect

For the study, some locally available rice bran oil and vegetable oils are being used specially for lighting purposes. Experimental results attempt may be taken to find out the reasons of experimental findings, especially fuel properties of the oils, such as smoke point, pour point, cloud point, flash point and fire point etc. In the other side, use of vegetable oils and rice bran oil, as an alternative of Kerosene oil are viable.

4. PROCEDURE TO DETERMINE THE FUEL PROPERTIES

The following experimental analyses have been performed to determine fuel properties:

4.1 Cloud Point and Pour Point Determination

The cloud point of an oil temperature at which a hage or cloud first appears in the oil, when it is cooled. The temperature is below at which oil will not flows or be solidified or ceases to flow in pour point. It indicates the temperature below which the oil losses its fluidity and will out flow or circulate in a fuel system. The temperature, expressed as a multiple of 2°F (1°C), at which a cloud or hage or wax crystal appears at the bottom of the test jar, when the oil is cooled under prescribed conditions [2]. When such inspection is hold, in the first cereal, a distinct cloudiness or hage in the oil at the bottom of the test jar is observed. At that time the record of the reading of the test thermometer as the cloud point. The lowest temperature, expressed as a multiple of 5°F (3°C), at which the oil is observed to flow, when cooled and examined under prescribed conditions for pour point. The cloud point and pour point of Rice bran oil and vegetable oils as obtained from the experiment are presented and compared with traditional fuel in table 4.

4.2 Flash and Fire Point Determination

The temperature to which an oil must be heated, in order to give of sufficient vapors to form combustible mixture with air is termed the flash point. The fire point is defined as the minimum temperature at which an oil to continue burn after inflammable vapors with air mixture is ignited. This method of test covers the determination of the flash point of all mobile liquids flashing below 175°F (79°C), except products classified as grade No.4 or heavier fuel oil. The sample is placed in the cup of the tag closed tester and, with the lid closed, be heated at a slow constant rate. A small flame of specified size is directed into the cup at regular intervals. The flash point is taken as the lowest temperature at which application of the test flame has become the vapor above the sample to ignite. The next stage of flash point is fire point. The flash and fire point of vegetable oils and Rice bran oil as obtained from the experiment are presented and compared with traditional fuels in table 4.

4.3 Smoke Point Determination

Smoke point is the maximum flame height that can be achieved without smoking. The sample of vegetable oils and rice bran oil is burned in an enclosed smoke lamp with normal scale. The maximum flame height that can be achieved without smoking is estimated. The smoke point of vegetable oils and rice bran oil as obtained from experiment are presented and compared with traditional fuel in table 4.

Table 4
Fuel Properties

Name of the fuel	Room temp in °C	Smoke point maximum in mm	Flash point in °C	Fire point in °C	Cloud point in °C	Pour point in °C
Rice bran oil	27	14.4	52.5	110.5	10	1
Mustard oil	27	19.5	78.5	165.5	10	-7
Pulm oil	27	13.5	110	140	12	-10
Soyabean oil	27	21.5	225	239.5	16	-11
Coconut oil	27	18.5	120	140	19	17
Petrol	27	21.5	5	15	-2	-12
Kerosene	27	20.5	10	20	-2.5	-12.5
Diesel	27	21	50.1	60.1	-1	-13

4.4 Illumination of Light Intensity Measurement

Three different size lanterns were used for experiment to determine the illumination of light intensity i.e. of different fuel capacity, length and section any enclosure as usually used in the rural areas of Bangladesh. The fuel capacity, length and section area (cross-sectional) presented in table 5.

Table 5
Specification of Lanterns

Type of Lantern	Top to bottom Size in cm	Fuel capacity in ml	Oil tank height in cm	Periphery (2ΠR) in Cm
Large	31	331	6	38
Medium	29	450	8	39
Small	26	325	7	35

Illumination of light intensity of lantern, of different composition of rice bran oil and vegetable oils was measured by Luxmeter. The Luxmeter is a portable electronic photometer for the measurement of a wide range of illumination levels, which is presented and compared various types of renewable oils with mixture of Kerosene and different proportion of those oils in table 6.

Table 6
Light Intensity

Name of the fuel	Temp. in °C	Intensity in Lux (lm/m^2)
Rice bran oil	27	180
Rice bran oil	55 to 40	190
Soyabean oil	27	175
Pulm oil	27	175
Coconut oil	27	180
Mustard oil	27	150
Kerosene: Rice bran oil (1:1)	27	200
Kerosene: Mustard oil (1:9)	27	205
Kerosene: Rice bran oil (9:1)	27	210
Kerosene: Pulm oil (9:1)	27	205
Kerosene: Soyabean oil (9:1)	27	200
Soyabean oil: Rice bran oil (1:1)	27	170
Soyabean oil: Rice bran oil (1:1)	95 to 40	175
Kerosene: Rice bran oil (1:5.67)	27	212
Kerosene: Mustard oil (1:5.67)	27	206
Kerosene: Coconut oil (1:5.67)	27	211
Kerosene: Soyabean oil (1:5.67)	27	202
Kerosene: Pulm oil (1:5.67)	27	206
Rice bran oil: Soyabean oil (1:5.67)	27	170
Rice bran oil: Soyabean oil (1:5.67)	100 to 40	175
Rice bran oil : Coconut oil (1:4)	27	168
Rice bran oil : Coconut oil (1:4)	82 to 40	170
Kerosene: Coconut oil (9:1)	27	210

4.5 Fuel Properties: Higher Calorific Value, Density, Specific Gravity Kinematic Viscosity

Fuel properties were obtained from experiment and comparisons with traditional fuels are given in following table 7:

Table 7
Fuel Properties

Name of the fuel	Room temp in °C	Density gm/cm^3	Specific gravity	Kinematics viscosity, mm^2sec	Higher calorific values (cal/gm)
Rice bran oil	20	0.924	0.953	40.88	8929.3
Mustard oil	20	0.905	0.9095	55	9419.11
Pulm oil	20	0.9051	0.9097	43	9038
Soyabean oil	20	0.926	0.93	45	9092.32
Coconut oil	20	0.909	0.9136	32	9307.45
Petrol	20	0.664	0.684	0.6	9683.44
Kerosene	20	0.755	0.728	2.55	10804.75
Diesel	20	0.803	0.828	4.3	10318

5. DISCUSSION

Bangladesh normally produced around 2 million MT of rice bran every year of which 40000 MT of rice bran can be used to produce 3300 MT of rice bran oil. Besides, vegetable oil seeds such as coconut, Soyabean, pulm and mustard are available in Bangladesh. The collection of rice bran can do fully than more bran oil can be produced. According to table 7, the rice bran oil and vegetable oils have closed caloric value in compared with traditional fuel and density and specific gravity of rice bran oil and vegetable oils are found to be very much higher than that of conventional fuel, hence rendering more resistance to fuel flow. This may some sort of problem, when used in lantern and again an attempt may be taken to decrease this viscosity by blending conventional fuel kerosene and same time decrease the density. When blend 80% kerosene with rice bran oil and vegetable oils to get satisfactory illumination time, burning rate continuous. Thus, we can save 20% kerosene of rural lighting purposes. The price of rice bran oil and vegetable oils is around 2~7 times than Kerosene. Additionally, the kinematic viscosity of rice bran oil and vegetable are 16-68 times greater with compared to traditional fuels according to table 7. Light intensity are compared with traditional fuel in table 6, in that case light intensity almost same with traditional fuels. The study and comparison among Rice bran oil, vegetable oils and Kerosene for lighting purposes are shown in following table 8.

Table 8
Sustainability Capacity of Lighting of Rice Bran Oil and Vegetable Oils

Name and Qty of Oil in ml	Illumination time in Min	Temp in °C	Color	Soot	Flame size in cm	Fuel consumption in ml/min	Burning quality	Smoke	Intensity of light
Rice bran oil (200 ml)	3	40 to 95	Yellow	Small	2.45 × 1.5	0.43	Bad	Less	Good
Rice bran oil (200 ml)	20	Normal	Bright Yellow	Nil	2.45 × 1.5	0.5	Fair	Small	Medium
Kerosene 100 ml +Rice bran oil 100 ml	105	Normal	Yellow	Small	3 × 1.5	0.095	Medium	Small	Improved
Kerosene 180 ml +Mustard oil 20 ml	1755	Normal	Bright Yellow	Small	2 × 1.5	0.11	Good	Less	Best
Kerosene 180 ml +Rice bran oil 20 ml	750	Normal	Bright Yellow	Nil	2.5 × 2	0.266	Excellent	Less	Good
Kerosene 180 ml +Pulm oil 20 ml	210	Normal	Bright Yellow	Small	3 × 2	0.8	Good	Less	Best
Kerosene 180 ml +Soyabean oil 20 ml	277	Normal	Bright Yellow	Small	2.5 × 2	0.18	very Good	Less	Fair
Kerosene 180 ml +Coconut oil 20 ml	240	Normal	Bright Yellow	Small	2 × 3	0.83	Best	Less	Best
Rice bran 75 ml +Soyabean oil 75 ml	6	95 to 45	Yellow	Small	2 × 1.25	0.83	Poor	Less	Good
Rice bran 20 ml +Soyabean oil 100 ml	6	Normal	Yellow	Small	2.5 × 1.25	0.83	Bad	Less	Good
Rice bran 20 ml +Soyabean oil 100 ml	10	100 to 40	Yellow	Small	2.75 × 1.21	1.5	Fair	Less	Good
Rice bran 25 ml +Coconut oil 100 ml	10	Normal	Bright Yellow	Small	3 × 1.5	0.3	Medium	Less	Good
Rice bran 20 ml +Coconut oil 100 ml	15	82 to 40	Bright Yellow	Small	3.25 × 1.5	0.66	medium	Less	Good
Kerosene 170 ml +Rice bran oil 30 ml	1260	Normal	Bright Yellow	Small	2.5 × 2	0.135	Excellent	Less	Good
Kerosene 170 ml +Mustard oil 30 ml	725	Normal	Bright Yellow	Small	3 × 2	0.138	Good	Less	Good
Kerosene 170 ml +Coconut oil 30 ml	915	Normal	Bright Yellow	Small	3 × 2	0.281	Excellent	Less	Good
Kerosene 170 ml +Soyabean oil 30 ml	1275	Normal	Bright Yellow	Small	2.5 × 2	0.122	Good	Less	Good
Kerosene 170 ml +Pulm oil 30 ml	975	Normal	Bright Yellow	Small	3 × 2	0.143	Excellent	Less	Good

6. RECOMMENDATIONS

The cost of rice bran oil and vegetable oils can be accomplished by reducing or withdrawing governmental taxes. And the government should motivate the use of those oils as locally available new renewable sources of energy. At the same time more automatic rice mills should be setup in Bangladesh and more vegetable oil seeds are cultivated to introduce incentive plan. It is very much important to consider the aspect of social acceptance of rice bran oil and vegetable oils as an alternative fuel for lighting purpose, necessary motivation strategies have to be taken.

CONCLUSION

Kerosene is blended with rice bran or vegetable oils as 4: 1 proportion, then getting satisfactory result of lighting. Thus 20 % kerosene can be saved easily. Therefore, Rice bran oil and vegetable oils may be given higher priority as an alternative fuel for lighting purposes. For this reasons, the following points may be remarkable:

• A government incentive is needed for the production of rice bran oil and vegetable oils.
• Supply chain system can be implemented to collect and produce rice bran and vegetables oils.
• Rice bran oil and vegetable oils may be given importance to use as an alternative engine fuel.

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