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Production bio-diesel from fat tail and internal organs of Iraqi sheep's in Kirkuk city.

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Abstract: **-** This study was performed on production process of bio-diesel from fats and internal organs of sheep's in Kirkuk city, Northern of Iraq. It revealed that great proportions of the productivity of these fats in conjunctions with using different ratios of ethanol at each production process with varying temperature.
The first stage was production small samples of bio-diesel by using different parameters and conditions (the ethanol percentage additive and temperature changes) to obtain practically the largest proportion of production.

Keywords: **-** *bio-diesel, Iraqi sheep's in Kirkuk city.*

I. INTRODUCTION

Biodiesel refers to a vegetable oil- or animal fat-based diesel fuel consisting of long-chain alkyl (methyl, ethyl, or propyl) esters.Biodiesel is typically made by chemically reacting lipids (e.g., vegetableoil,animalfat (tallow[1][2]))withan alcohol producing fatty acid esters.
Biodiesel is meant to be used in standard diesel engines and is thus distinct from the vegetable and waste oils used to fuel converted diesel engines. Biodiesel can be used alone, or blended with petro diesel in any proportions. Biodiesel can also be used as a low carbon alternative to heating oil.
The National Biodiesel Board (USA) also has a technical definition of "biodiesel" as a mono-alkyl ester.[3]
Biodiesel sample:
Blends of biodiesel and conventional hydrocarbon-based diesel are products most commonly distributed for use in the retail diesel fuel marketplace. Most of the world uses a system known as the "B" factor to state the amount of biodiesel in any fuel mix:[4]

- 100% biodiesel is referred to as **B100**
- 20% biodiesel, 80% petrodiesel is labeled **B20**
- 5% biodiesel, 95% petrodiesel is labeled **B5**
- 2% biodiesel, 98% petrodiesel is labeled **B2**

Blends of 20% biodiesel and lower can be used in diesel equipment with no, or only minor modifications,[5] although certain manufacturers do not extend warrantycoverage if equipment is damaged by these blends. The B6 to B20 blends are covered by the ASTM D7467 specification.[6]Biodiesel can also be used in its pure form (B100), but may require certain engine modifications to avoid maintenance and performance problems.[7] Blending B100 with petroleum diesel may be accomplished by:

- Mixing in tanks at manufacturing point prior to delivery to tanker truck.
- Splash mixing in the tanker truck (adding specific percentages of biodiesel and petroleum diesel).
- In-line mixing, two components arrive at tanker truck simultaneously.
- Metered pump mixing, petroleum diesel and biodiesel meters are set to X total volume, transfer pump pulls from two points and mix is complete on leaving pump.

II. PROPERTIES OF BIODIESEL

Biodiesel has better lubricating properties and much higher cetane ratings than today's low sulfur diesel fuels. Biodiesel addition reduces fuel system wear,[8] and in low levels inhigh pressure systems increases the life of the fuel injection equipment that relies on the fuel for its lubrication. Depending on the engine, this might include high pressure injection pumps, pump injectors (also called unit injectors) and fuel injectors.

The calorific value of biodiesel is about 37.27 MJ/kg.[9] This is 9% lower than regular Number 2 petrodiesel. A variation in biodiesel energy density is more dependent on the feedstock used than the production process. Still, these variations are less than for petrodiesel.[10] It has been claimed biodiesel gives better lubricity and more complete combustion thus increasing the engine energy output and partially compensating for the higher energy density of petrodiesel.[11]
Biodiesel is a liquid which varies in color between golden and dark brown depending on the production feedstock. It is slightlymiscible with water, has a high boiling point and low vapor pressure. The flash point of

biodiesel (>130 °C, >266 °F)[12] is significantly higher than that of petroleum diesel (64 °C, 147 °F) or gasoline(−45 °C, -52 °F).Biodiesel has a density of ~ 0.88 g/cm³, higher than petro diesel(~ 0.85 g/cm³).
Biodiesel has virtually no sulfur content,[13] and it is often used as an additive to Ultra-Low Sulfur Diesel (ULSD) fuel to aid with lubrication, as the sulfur compounds in petrodiesel provide much of the lubricity. The aim of this work is producingBio-diesel process from fat tail and internal organs of Iraqi sheep's in Kirkuk city as follows;

This process includes two stages which is Pre-treatment- Esterification & production (transistor fiction) in which the acidic cracking fat saturated by adding concentrated sulfuric acid to it with continuous mixing. Then added ethanol to extract the sulfuric acid, remaining of broken fat and others (saturated), where notes are two layers. Upper room layer include saturated fat and sulfuric acid, ethanol and the density is less than the lower and the lower layer include fat Broken using small samples to find the optimum yield of bio-diesel from different conditions include change of temperature range and the percentage of ethanol additive.

Practical Part:

Materials;

1. Sheep fats andinternal organs of Iraqi sheep's used in the present study were collected from main slaughterhouses in Kirkuk city.
2. Ethyl alcohol obtained from local markets and its purity about 99.9 % and the specific gravity is 0.789-0.790.
3. Sodium hydroxide as a base catalyst(Scharau SO04251000 Kg 0360 Batch 11467002,M.Wt. 40).
4. Sulfuric acid obtained from local market, the purity of this acid is 98% (Sp.Gr. is 1.84) AR.
5. Glycerol 99% chem. Pure$(CH_2OH)_2CHOH$ Mw. =92.09Product code : 15523.

Equipment:

The equipment used in this study for both steps of pretreatment (extraction and esterification) and transesterfication steps are summarized in table(A), with their producing company and country.

Table (A), The Apparatus used and their Manufactures

No.	Name of equipment	Company / origin
1	Heat flat magnetic stirrer	Type: MR Hei-standard Ser. No. :011355160 No. :505-20000-00-3 Ac230\240 V 50\60 Hz 825 W 100-1400 1\min. Germany
2	Reflux Condenser	Germany
3	Centrifuge	D-78532 Tuttingen Germany 208-240 V~ 50-60 Hz 0.28A Zul. Drehzahl 6000U\min zul. Dichte 1.2 Kg\dm^3
4	Mercury thermometer from 0 to 100°C	Germany
5	3-Neck flask (500 ml)	Germany

The practical procedure includes:

At the laboratory, they were melted by slowly heating up to 60°C and filtered in order to obtain the fat and remove gums, protein residues, and suspended particles. Thus, obtained fats were homogenous in nature, which were stored in air tight opaque plastic jars to prevent oxidation.The specific gravity of the sheep fat is 0.8772**.**The practical includes the following main steps;

1. Pre-treatment- Esterification.2. Production (transistor fiction).
1. Pre-treatment-Esterification:

Where they are in the process to get rid of saturated fat acid using strong sulfuric acid works to break the bonds of these fats At the same time, ethanol is used as a derived work to pull (H_2SO_4) with non-fat broken from fat.

The stepsofPre-treatment- Esterification;

After installing the parts preparation device as shown in Fig (1) we go to the following steps;

Fig (1) Apparatus for Pre-treatment-Esterification

1. We are part of the fat weight and part of the Maly of the sheep as much as 100g of each part.
2. We take different amounts of ethanol at each experiment as much as (22% -27% -35% -40%) of the weight of the fat and the Maly of the sheep and different temperature 57.5^{o}C and 67.5^{o}C.
3. Sulfuric acid H_2SO_4 weigh as much as 1% of the weight of the fat and the Maly of the sheep.
4. The fat and the Maly of the sheep added to the distillation flask after dissolving them with magnetic stirrer driver and at a certain temperature
5. Ethanol is added to the mixture of fat, and after ten minutes sulfuric acid is added and left the mixture to react for half an hour within the specified temperature as shown in fig (2).

Fig (2) Ethanol adding.

Make sure the water circulation through the condenser so as not to ethanol evaporates.

6. After half an hour content is discharged to the distillation flask separating funnel to separate the sulfuric acid, ethanol and acid saturated fat unsaturated fats. Where the lower layer represents a saturated fat others because of the intensity and Upper layer represents sulfuric acid and ethanol and saturated fats, as shown in Fig (3).

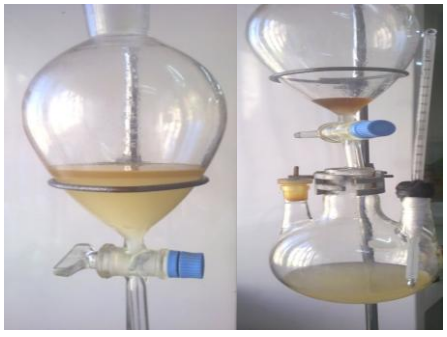

Fig (3) Upper and lower layer.

III. PRODUCTION (TRANSISTOR FICTION)

Transesterification of animal fat for the production offatty acid methyl esters was carried out in the presence ofacidic and basic catalysts as shown in fig (1).

The steps of production:

1. Taken the fat that has been processed by the first process and once again due to the distillation flask and also heats up within the same range that was selected in the first operation and maintain its survival within the same range.

2. Taken a certain weight of (NaoH) which is 1% of the weight of the fat and dissolves in ethanol which weight is equal to the weight that was used in the first operation as shown in fig (4).

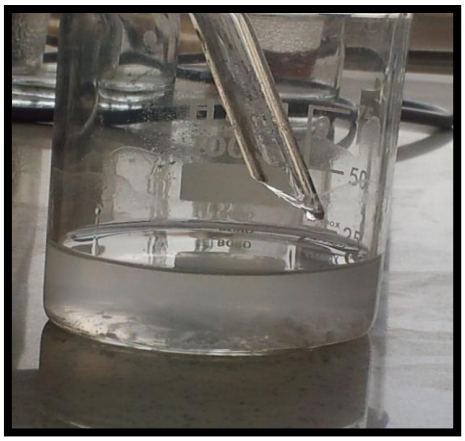

Fig (4) NaoH dissolving in ethanol.

3. Add mixture ethanol (NaoH) to the fat and after each (10 minutes) is withdrawn sample of this fat and placed in the test tube as much as 8 ml with 1 mL of glycerol and shake the tube and placed in a centrifuge for one minute and then go out is observed to be two layers layer, Upper layer bio-diesel represent and the lower layer represents glycerol as shown in fig (5).

Fig(5) Bio-diesel layer and glycerol layer

The use of glycerol is very necessary is the one who puts an end to the interaction. Non-existence of it interaction to be indefinitely.

IV. RESULT AND DISCUSSION

Through the first set of experiments the ethanol percentage is 22%wt and temperature 57.5^{o}C so we take four samples in the beginning after 10Min, the second sample after 20Min, the third after 30Min and the fourth after 40Min. In order to check the samples we let it at an ambient temperature for five days, then we see some part of sample frizzed due to a high proportion of non-saturated fats extracted as shown in table(1).

Time (min)	Sample (ml)	Glycerol (ml)	Total	bio	fat	Product(%)
10	8	1	9	4	3	44.9
20	8	1	9	4	3	44.9
30	8	1	9	4	3	44.6
40	8	1	9	4	3	44.9

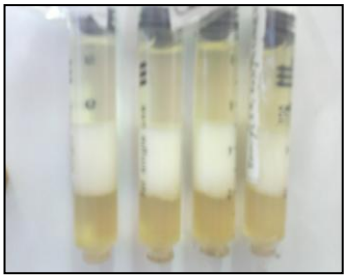

Table (1) Ethanol wt. percentage 22% and temp.57^{o}C.

It is clearly from the picture attached with table (1) the four samples freeze with general a productive percentage is 44.825%.

Time (min)	Sample (ml)	Glycerol (ml)	Total	bio	fat	Product(%)
10	8	1	9	3.4	3	37
20	8	1	9	3.4	3.2	37
30	8	1	9	3.4	3	37.7
40	8	1	9	3.4	3	37.7

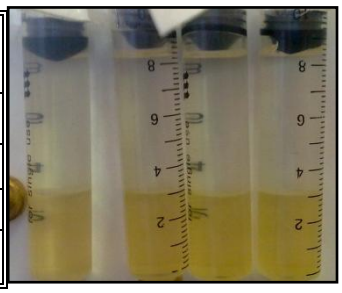

Table (2) Ethanol wt. percentage 27% and temp.57^{o}C.

From the second experiment, shown in table(2) with it's picture also the four samples freeze with 27% ethanol wt. percentage the overall productivity was 37.77%.

Time (min)	Sample (ml)	Glycerol (ml)	Total	bio	Glycerol	Product(%)
10	8	1	9	6	3	66.66
20	8	1	9	6	3	66.66
30	8	1	9	6	3	66.66
40	8	1	9	6	3	66.66

Table (3) Ethanol wt. percentage 35% and temp.57^{o}C.

Through the third sample we see there is no freezing and it is clear from the attached picture and the production of bio-diesel is 66.66%.

Time (min)	Sample (ml)	Glycerol (ml)	Total	bio	fat	Product(%)
10	8	1	9	5.9	0.2	62.22
20	8	1	9	5.8	0.1	64.44
30	8	1	9	5.7	0.1	62.2
40	8	1	9	5.8	0.1	63.33

Table (4) Ethanol wt. percentage 40% and temp.57^{o}C

Time (min)	Sample (ml)	Glycerol (ml)	Total	bio	fat	Product(%)
10	8	1	9	5.6	3.4	62.2
20	8	1	9	5.6	3.4	62.2
30	8	1	9	5.6	3.4	62.2
40	8	1	9	5.6	3.4	62.2

The fourth sample the average productivity is equal to 64.44%.
During the results from the 4th experiments there is an inverse proportion between the productivity and the ethanol percentage under constant temperature.

Time (min)	Sample (ml)	Glycerol (ml)	Total	bio	fat	Product(%)
10	8	1	9	6.4	2.6	71.1
20	8	1	9	6.35	2.65	70.55
30	8	1	9	6.4	2.6	71.1
40	8	1	9	6.35	2.65	70.55

Table (5) Ethanol wt. percentage 22% and temp.67.5^{o}C.

The other experiments we change the ethanol percentage with constant temperature 67.5^{o}C as following;

Time (min)	Sample (ml)	Glycerol (ml)	Total	bio	fat	Product(%)
10	8	1	9	5.6	3.5	64.4
20	8	1	9	5.6	3.25	63.8
30	8	1	9	5.6	3.25	63.8
40	8	1	9	5.6	3.2	64.4

Table (6) Ethanol wt. percentage 27% and temp.67.5^{o}C.

The productivity of the 5th experiment is 70.8%, but quickly frozen it also clear from the attached picture with table (5).

Time (min)	Sample (ml)	Glycerol (ml)	Total	bio	fat	Product(%)
10	8	1	9	5.45	3.55	60.55
20	8	1	9	5.45	3.55	60.55
30	8	1	9	5.2	3.8	57.77
40	8	1	9	5.45	3.55	60.55

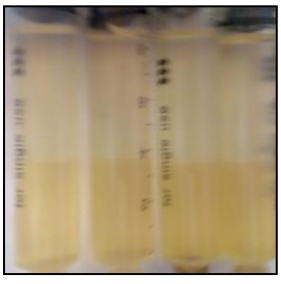

Table (7) Ethanol wt. percentage 35% and temp.67.5^{o}C.

The 6th sample the productivity was 64.1% with 27%wt ethanol and 67.5^{o}C.

Properties Results	Bio-Diesel
Density at 15.6 ° C	0.8626
Viscosity at 40 °C	4.014
Water content %	Trace
API	32.5
Cetan number	51.5

Table (8) Ethanol wt. percentage 40% and temp.67.5°C.

The 7th experiment, the ethanol wt. percentage was 35% and the productive was 62.2% with no freeze.
The 8th experiment with no freeze the productivity was 59.85%.
During the comparison between the 32 experiments we find the following cases;

1- The sample was frozen due to the evaporation of percent of ethanol from the hole distillation flask while adding materials and the high temperature caused ethanol evaporation as we know the boiling point of ethanol is 78.°C.
2- Due to the quantity and quality of bio-diesel production, the highest yield was obtained through an experiments did not happen any freeze is the third of experiment that yield was 66.66% with 35%ethanol and temperature 57.5°C.
3- The optimum sample of bio-diesel it has the following analysis;

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