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Conversion of fruit kernels of Algerian date palm (*Phoenix dactylifera* L.) into biodiesel

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Abstract

Today, renewable energies have become one of the most important concerns of the countries of the world as a result of the negative effects we have reached on the environment from our use of fossil fuels and the resulting emissions of toxic gases. It is no secret that the fields of renewable energies are very diverse, including those derived from biomass. Researchers in this field seek to diversify bioenergy sources from ethanol, biodiesel, and fuels. Biogas. Accordingly, we conducted this study using date kernel oil as a new source for biofuel extraction, and the results were as follows: oil content of 4 to 5 percent, with a very high acid number of 8.9776, which imposes on us make a reaction of esterification and transesterification.

Biodiesel has a 91 percent yield and its properties are close to recognized standards compared to previous studies.

Keywords: Biodiesel, Oil extraction, Date kernels, Transesterification, Valorization.

1. Introduction

Today, renewable energies have become one of the most important concerns of the countries of the world as a result of the negative effects we have reached on the environment from our use of fossil fuels and the resulting emissions of toxic gases. It is no secret that the fields of renewable energies are very diverse, including those derived from biomass [1,2]. The Algerian phoenicol potential has marked an important progress of date palm, which reaches 18 million palms covering 350 hectares, more than 11 million trees are productive with a very large tonnage of around 492 thousand tons of dates. According to these statistics from [3] Algeria is the fourth largest producer in the world.

In addition, the region of Adrar produces a large tonnage of dates each year, approximately 935 thousand quintals per year [4]. This region is rich with its 305 varieties of dates [5].

No industrial processing of date stones installed in Algeria except the case of artisanal production such as coffee from date stones, what to encourage to do a project on the valorization of these nuclei in bioenergy based on the quantity of oil that they contain. These oils are extracted using a soxhlet extractor with a solvent volatile.

Biodiesel is an alternative fuel produced, in the present work, by a transesterification process directly or through the esterification reaction of oils from date stones extracted, following by a transesterification reaction according to the value of the vegetable oil acid number used.

2. Definition and general description of the date

Dates, fruit of the date palm, are the staple food for the populations of the desert [6]. It is an elongated, oblong or rounded bay, containing a single seed, commonly known as drowna. It is made up of two parts:

- An inedible part of the date, formed by the seed or the stone, having a hard consistency [7]
- An edible part called flesh or pulp consists of:
 - A pericarp or thin cellulose envelope called skin.
 - A generally fleshy mesocarp, of varying consistency depending on its sugar and deep color.
 - A lighter colored endocarp with a fibrous texture, sometimes reduced to a parchment membrane surrounding the nucleus [8].

The dimensions of the date vary widely, from 2 to 8 cm in length and eight from 2 to 8 grams depending on the variety. Its color ranges from yellowish white to black passing through more or less dark amber, red, brown colors [6].

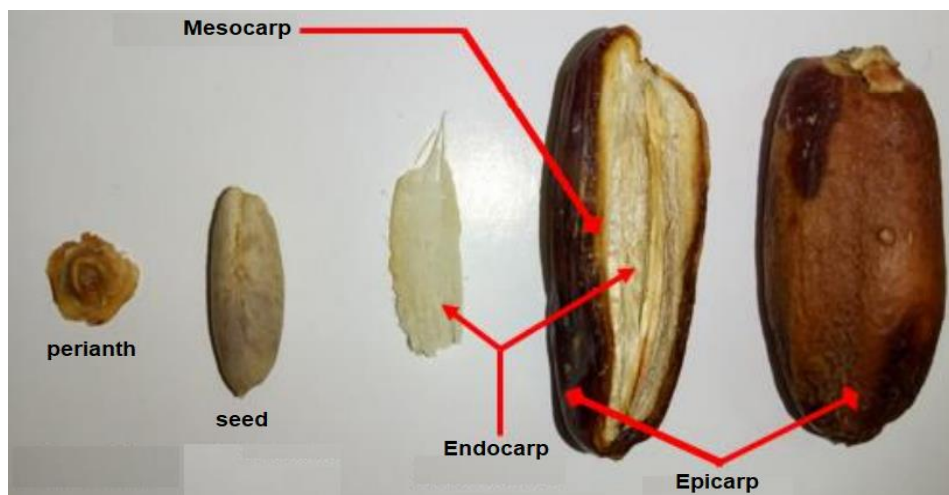


Fig 1: Morphological presentation of date

3. Materials and methods

3.1 Organic material

The sample collection is carried out in the region of Mraguen, one of the ksours of the municipality of Adrar which is located north of the city of Adrar.



Fig 2. Grinded date kernel.

The high acid number of date stone oil (IA = 8.97mg KOH / g of oil), low volatility and excessive amount of polyunsaturated free fatty acid (FFA) content caused unwanted formation soap [9,10]. Therefore, these decrease the yield of biodiesel during the transesterification process [11, 12]. The analyzes performed are density, viscosity, pour point, flash point and calorific value [13].

3.2 The analyzes carried out

- The refractive index (AFNOR T 60-212),
- Density (ASTM D941-55),
- Viscosity (ASTM D445)
- Infrared (IR) absorption spectroscopy (Type IR CARY 660 FTIR ATR).
- Acid index and acidity - NF EN ISO 660, 1999)

4. Results and discussion

In order to verify the compliance of the properties of our synthesized biodiesel with international standards, Table 1 presents the results of the comparative study of synthesized biodiesel. The physical and chemical properties of date kernel oil biodiesel are interesting except for the density which was acceptable (0.8777) and the kinematic viscosity which was higher than ASTM standards, but it remains lower than that of the oil which is (41mm² / s), this problem can be solved by performing a Biodiesel / fossil diesel mixture. This result is considered positive because the problem posed so far for the production of biodiesel is the very high viscosity value of the oils. There are other parameters and analyzes to be carried out and which can provide more information on this biodiesel product, it will be the subject of other

studies on the nuclei in order to specify the physicochemical characteristics of this product and to expand this project on an industrial scale.

Table1. The physico-chemical characteristics of biodiesel.

Property	Biodiesel	ASTM standard D6751 of biodiesel
Viscosity 40°C (mm ² .s-1)	21.01	1.9-6
Calorific value (Mj/kg)	27.432	-
Flash point (°C)	170	≥ 93
Pour point (°C)	-6	-12 -7
Distillation (°C)	356	≤ 360
Density a 15°C (g/m ³)	0.8707	0.86-0.90
Refractive index	1.441	-

5. Conclusion

The present work has shown that the valuation of date kernels of low value merchant of the wilaya of Adrar, with a view to their possible transformation into biodiesel is possible. This substrate contains fat matter, the transformation of which seems promising. With this in mind, a valuation test of an oily extract of the kernels of biofuel dates was produced, of which 1kg of date stones gives a minimum 81.74% fat.

From the results obtained, it appears that the date stones represent 53.34% of the total mass of the whole date. Studies on these nuclei show that they are characterized by: humidity 57.22, fat content 5.722%, with a production of 1177.507 quintals per year, which in a way justifies the valuation of this biomass.

6. Acknowledgements

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