**COMPARATIVE STUDY OF OXIDATIVE STABILITY OF BIODIESEL FROM OIL AND BABASSU COCONUT OLIVE OIL**

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**Abstract**

Our aim was to produce biodiesel from babassu coconut oil and olive oil (*Orbignya speciosa* Mart.), fulfilling the National Petroleum, Natural Gas and Biofuels Agency (ANP) parameters to be used vehicles and diesel cycle engines as fuel. The continuous increase in world population causes the growth in energy demand, generated mainly by non-renewable, fossil and non-biodegradable sources, which contributes to the increase of global pollution. Therefore, the use of renewable, biodegradable and non-toxic energy sources, such as oil and olive oil of babassu coconut (*Orbignya speciosa* Mart.) has both economic and environmental advantages. Babassu coconut oil and olive oil in natura, was obtained in the Ciriaco Reserve, Municipality of Cidelândia - MA and in the Petrolina community, Municipality of Imperatriz - MA. The biodiesels were produced through alkaline transesterification, using potassium hydroxide and methanol catalyst. The oxidative stability (Rancimat) of the samples was in accordance with the European standard of the European Committee for Normalisation 14112. The biodiesel from babassu coconut oil showed resistance to oxidation of 6.23 h and the biodiesel from olive oil 6.19 h. Due to the biodiesels produced being pure, they did not present sufficient resistance to oxidation to exceed the minimum limit of 12 h defined by ANP 798/2019, however they are within the parameters established by ANP 45/2014, which defines results between 6 and 8 h. The biodiesels of babaçu coconut oil proved to be viable option for use in diesel cycle engines.

**KEYWORDS:** Biodiesel. Transesterification. Babassu coconut. Renewable.

**Introduction**

The increase in world population results in energy demand growth, generated mainly by non-renewable conventional sources such as methane, coal and oil [1], contributing to the increase in CO2 emissions. According to the International Energy Agency (IEA) [2], in the last 41 years fossil fuel consumption has increased 43.33%.

The need to find unconventional renewable energy sources to replace conventional non-renewable ones becomes ever greater. Therefore, biodiesel proves to be an appropriate solution to replace diesel, due to its non-toxic, renewable and ecological origin. The use of vegetable oils for the production of biodiesel, such as babassu coconut oil (*Orbignya speciosa* Mart.), has both economic and environmental advantages [3, 4, 5].

The babassu coconut is known among traditional brazilian populations, being also called coco-palmeira, coco-de-macaco, coco-pindoba, baguaçu, uauaçu, among others. Its physical structure consists of epicarp (11%), mesocarp (23%), endocarp (59%) and almond (7%), from where the oil is extracted. The babassu is used both in the pharmaceutical industry, chemical, cosmetics, veterinary, food and fuel production [6].

Our aim was to produce biodiesel from babassu coconut oil and olive oil (*Orbignya speciosa* Mart.), within the parameters of the National Petroleum, Natural Gas and Biofuels Agency (ANP), in order to be used as fuel for vehicles and diesel cycle engines. The biodiesel produced was characterized by oxidative stability (Rancimat).

# Methodology

* 1. *Place of work*

 The research was performed in the city of Imperatriz-Ma, in the tocantina region of Maranhão.

* 1. *Procedure*

 Materials

 Babassu coconut oil (*Orbignya speciosa* Mart.) in natura (OCB), obtained in the Ciriaco Reserve, Municipality of Cidelândia - Maranhão (Brazil) and babassu coconut oil (*Orbignya speciosa* Mart.) in natura (ACB), acquired in the community of Petrolina, Municipality of Imperatriz - MA (Brazil).

 Preparation of biodiesel

 To produce biodiesel, the samples of oil and babassu coconut olive oil were divided into four volumes of 1 litre. The initial stage of the process was to obtain the methylated potassium catalyst (1% potassium hydroxide and 30% methanol). Shortly after this, the catalyst was heated in a glycerine bath (60 ºC, 60 min), then added to the oil and babassu olive oil. The reactions were performed in a system with reflux, agitation and heating (60 ºC). The reaction time was 90 minutes, soon after, the reaction means were transferred to separation funnels, in which the phases were separated by density difference, obtaining: upper phase, biodiesel and lower phase, glycerine. In the next step, the upper phases were washed with distilled water at 50 ºC, until the pH was neutral. In the final stage, the biodiesels of oil and babassu coconut oil was taken to the oven for drying, for 60 minutes and posteriorly stored.

* 1. *Characterization*

The oxidative stability was determined through the Rancimat technique, a method of indirect analysis, considering that the sample induction index is given from the water conductivity.

The analyses were performed on Methron's Rancimat equipment, model 873 and the results, expressed in hours, were treated in the software 873 Biodiesel Rancimat, following the EN 14112.

**Results and Discussions**

Figures 1 and 2 presents, respectively, the results of the oxidative stability test for biodiesel of babassu coconut oil (BOCB) and biodiesel of babassu coconut olive oil (BACB).

# Figure 1. BOCB sample Rancimat TestUma imagem contendo mapa, texto  Descrição gerada automaticamente

**Source:** Authoral

# Figure 2. BACB sample Rancimat testUma imagem contendo mapa, texto  Descrição gerada automaticamente

**Source:** Authoral

By analysing BOCB and BACB, the Rancimat curves of the samples our results demonstrate that both are out of the parameters stablished by ANP 798/2019, which determines minimum of 12 h, being the samples BOCB and BACB pure and free of antioxidants, which may have affected the results.

However, ANP 45/2014 establishes values between 6 and 8 hours, with BOCB and BACB samples within such parameters, even if they are free of antioxidants, demonstrating potentiality in their use in diesel cycle engines.

**Conclusions**

It is concluded that the bio-diesel proved to be suitable for the production of biodiesel, according to ANP 45/2014.

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