

BIODIESEL PRODUCTION PROCESS STARTING FROM ALOE VERA

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Abstract — *The concern with the impact in the activities that require the use of non-renewable fuels and the increase on the demand for clean energy have made biofuels research become more notorious, thus began the search for oilseed plants that are the base for biodiesel derived from plant. To that end, priority has been given to the study of aloe vera, a plant originally found in arid or tropical regions. The raw material necessary in order to produce this biodiesel in obtained by extracting a colorless and viscous gel coming from the leaf of the aloe vera, which adapted to the transesterification process like other oils regularly used to produce biodiesel, making this work simple and feasible.*

Index Terms — Clean Energy , Biodiesel , Aloe Vera, Gel, transesterification.

INTRODUCTION

The large scale consumption of non-renewable fuels has caused throughout the years countless damages to the environment as well as social and economic variations. Due to environmental pollution caused by the emissions of polluting gases and the exacerbated economical dependency with petroleum derivatives, leading to the regular oscillation of its fuels prices at a global level, began start the search for renewable and sustainable energetic alternatives, in this context biofuels have stood out. [1]-[2]

Biofuels are produced from organic matter (biomass) i.e. from vegetable or animal, considered to be source of clean and renewable energy, and have been gaining more and more space. Among the main biofuels there is the biodiesel, which is the alternative of choice to reduce or even to replace the usage of diesel derived from petroleum; its raw materials consist of animal fat or plant oil, due to oily plant diversity it is possible to produce biodiesel from a wide range of plants. The search for oily plants in each location varies with climate and soil, to that end it has been sought to explore the aloe vera's potential when it comes to biodiesel production. [3]-[4]

There are countless advantages in the use of aloe vera as raw material for biodiesel production. One of which is the fact that it is native to arid and tropical regions, do not need an immense amount of water for its irrigation, which justifies the choice of the aloe vera for this work, confirming its economical viability on a future large-scale process. The

product extracted from the leaf of aloe vera consists of a viscous gel, known as aloe's gel, which is used as fundamental raw material in the transesterification process. [5]

From this study's initial data, this work's goal is to perform a review of the art and evolution study through aloe vera properties analysis, also including its extraction and behaviour regarding transesterification, displaying this biodiesel's possible functionality.

BIODIESEL

The biodiesel was developed to replace/reduce the use of regular diesel because it is a biodegradable and renewable fuel and it can be derived from animal fat, disposed oil or plant oil. Its chemical composition is made up of methyl or ethyl esters of long chain fatty acids, depending on the type of alcohol used during transesterification. This reaction occurs in the presence of an oil (raw material), a basic catalyst and an alcohol, as mentioned before. Biodiesel is a fuel for internal combustion engines with compression ignition, is miscible with regular diesel and the mixture is widely utilized in many countries. B5 is a typical example, it signifies that it is a mixture containing 5% of biodiesel and 95% of diesel. This way the pure biodiesel is called B100. Aside from replacing diesel in many properties, biodiesel shows advantages of the fossil fuel, the main one is the reduction of the core polluting gases emissions such as carbon monoxide, carbon dioxide and sulphur oxide. [7]-[6]

Many biodiesel researches have been developed throughout the past years, aiming to find new renewable raw materials for its production. The use of plants stands out compared to other types of raw materials due to the existing diversity of oily plants with good biodiesel production potential. Amongst these, we can highlight: soy, palm, canola, cotton, castor and corn. The choice of plant derived raw materials varies according to geographical factors such as climate and soil, considering this fact, an approach was made on the study of aloe vera aiming to unleash its biodiesel production potential. From aloe vera is extracted a colorless viscous gel known as Aloe's gel, it is the raw material for the transesterification process, the gel is found within the leaves, after performing some tests, it was found out that this gel has a great potential when it comes to biodiesel production. However, using Aloe's gel to produce biodiesel involves two problems similar to those of castor

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oil derived biodiesel production, the first one is it's high viscosity and the second is it's rapid oxidation, nevertheless it's extraction and storage method, as well as the process of transesterification itself can contribute to solving these two problems. [3]

Aloe vera is an easy plant to be cultivated, it adapts with ease to arid and tropical regions, large scale production would be presented as economically viable due to the fact that it does not need great amounts of water to irrigate. Another advantage when compared to other plant derived raw materials is its adaptation in sandy soils. These are clues that the product meets the requirements of today's market such as to reduce water consumption as well as to prevent deforestation in large scale..[5]

ALOE VERA'S PROPERTIES

"the history of aloe vera is ancient and it is present in many cultures literatures. Its name is probably derived from the arabic word *alloe*, which means bitter and shiny substance. The first record of the use of aloe vera was made on a Mesopotamian clay sign plate dated 2100 b.c. (Atherton, 1997)", it has been utilized since the very first civilizations having its attributes explored towards the medical area.. [5]

It is a herbaceous plant that grows on any kind of soil, but it is best suited to light and sandy ones and does not require a lot of water. Its leaves are green, thick, juicy and are about 30 to 60 centimeters long. Popularly known as babosa, aloe, barbado's aloe and curaçao's aloe, according to Lorenzi & Matos, 2008; WHO, 1999. [5]

After performing a cross-cut (transversal cut) of its leaf, it is possible to identify the presence of the gel along with a yellow resin, this resin appears in very little amount and is originated from the skin, called aloin. On the other hand, the gel existing in big amount in the interior of the leaf is transparent and viscous, comes from the parenchymatous tissue of the inner side of the leaf and presents vitamins and polysaccharides. After performing laboratory tests of pH analysis it was found that the pH was acid, which varies between 4.0 and 4.5. This gel is widely used in the pharmaceutical and cosmetic industries and is now being utilized in as raw material for biodiesel production in this study. [5]

EXTRACTION AND STORAGE OF THE ALOE'S GEL

While performing the first test, the extraction was made manually, using tools such as a knife and a spatula, the following way: a longitudinal cut was made on the leaf, splitting it in two parts, the spatula was then used to shave off the the inner part containing the gel. However this procedure displayed errors, the gel was contaminated by fibers and by aloin, yellow resin, and this fact generated a lot of waste in the transesterification process, so that the samples were invalidated (Figure 1). With the goal of reducing the waste a new method was searched for, one that could be simple and more effective, thus a medium size manual press started to

be used for the extraction by squeezing the leaf and extracting its gelatinous juice, this way the fibers contamination was drastically reduced. After using the press, the gel was submitted to a filtration process for few minutes, which eliminated the contamination visible to the naked eye (Figure 2).

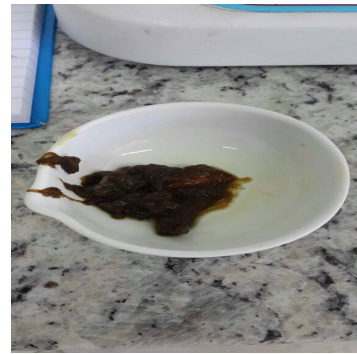


FIGURE. 1

RESIDUAL SAMPLE COMING FROM ALOE VERA'S FIBERS



FIGURE. 2

GEL EXTRACTED USING THE PRESS

After the extraction, the storage was done in a way that the gel would not be exposed to light and heat, because this would speed up the oxidation, therefore after the product is extracted it must be stored in dark containers and kept where there is sufficient ventilation. The samples must be used within twenty to thirty minutes after extraction in order to reduce as much as possible the storage time so that no early oxidation occurs. The extraction methods contribute a lot to the success of the transesterification, the lower the contamination rate by solid particles, the better is the reaction performance, as this study is still at a development stage, it is intended to improve the way the gel is extracted. Aiming for even better future results.

RESULTS

As the reaction of transesterification is done in the majority of biodiesel production process, this reaction consists, in short, of oils (plant or animal derived) that react with an alcohol (methanol or ethanol) in the presence of a basic catalyst, resulting in biodiesel and glicerine. During the initial tests using manual extraction, the result obtained after the transesterification process was a sample with great amount of waste from fibers, which made its appearance fade away from biodiesel parameters, aside from causing glassware clogging. After improving the extraction method using the press, a better result was obtained, without considerable amounts of waste visible to the naked eye, however these results are not yet considered to be ideal with smaller solid particles. Thus began the search for new methods for purifying the raw material to a better compliance with the process. [3]

CONCLUSION

The physico-chemical properties of the biodiesel and the regular diesel are similar to each other, however the biodiesel has an advantage which is the fact that it is biodegradable.

This work presented an impulse in its initial researches through constant search for new sources of raw materials to produce biodiesel aiming to achieve the appropriate composition to reach the quality required by the existing legislation. The study, which is still on an initial stage, aims to utilize aloe vera as raw material to produce bio-diesel.

With the improvements proposed in every process of biodiesel derived from aloe vera production, it is ensured that in the future the aloe vera can be a viable raw material for biodiesel production.

The aloe vera has many advantages such as its ability to adapt to sandy environments and high temperatures. This details, in a large scale production, can benefit regions containing these geographical characteristics, bringing economical development to its location, justifying this choice for research.

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