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CHARACTERIZATION OF BIOFUEL PRODUCED BY METHYL TRANSERSTERIFICATION OF RESIDUAL SOYBEAN OIL VIA BASIC CATALYSIS

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Summary

The objective of this work was to characterize the biofuel produced by the methyl transesterification of post - frying residual soybean oil in a laboratory scale, comparing the results obtained with the specifications of ANP Resolution 042/2004. The transesterification reaction to obtain the biofuel occurred on a laboratory scale with methanol being the transesterifying agent and catalyzed by an alkaline solution of sodium hydroxide dissolved in methanol. The biofuel produced met the requirements of the ANP demonstrating the possibility of synthesizing an alternative source for energy production and eliminating the environmental problem generated by the inadequate disposal of the post-fried oil residue.

Key words: technology; energy; fuel

Introduction

The potential of biofuels is showing promise worldwide, highlighting itself as a fast-growing market due to several factors such as its contribution to the environment and being a strategic source of renewable energy instead of diesel oil (MELO, 2010). Law 11,097 of 01/13/2005 defines biofuels as: "Biofuel derived from renewable biomass for use in internal combustion engines with compression ignition or for the generation of another type of energy that can partially or totally replace the use of fuel of fossil origin "(ARAUJO, 2008). The National Program for the Production and Use of Biofuels, which allowed biofuels I has been used in addition or substitution to diesel in the country's liquid fuel matrix (KNOTHE et al., 2006; BARUFI et al., 2007). The requirement for a blend of 2% biofuels in all diesel marketed in Brazil (B2) was imposed in 2008, this percentage increased to 5% (B5) in 2010, 7% (B7) in 2014, 8% (B8) in 2017 (ANP, 2017) and is currently 10% (B10). Diesel engine manufacturers certify that their engines can operate without adaptation with mixtures up to 20% biofuels (B20) (KNOTHE, et al., 2006). ANP Resolution No. 45 of 08.25.2014 determines quality parameters for biofuels and among them, standards are specified for the kinematic viscosity, acidity index and water content which are the parameters analyzed in this work. The use of residual frying oils for the production of biofuels corresponds to a destination of a social residue, which when released into the sewage network causes clogging of pipes and, consequently, municipalities' expenses with maintenance of the system (HOCEVAR, 2005; SABESP, In this paper, In addition, it pollutes water bodies if the frying oil is released into the environment without treatment (SABESP, 2009). The used oil is unwanted waste to the environment, its transformation into biofuel is an alternative for generating an alternative source of energy and eliminating the environmental problem generated by its inappropriate disposal. The objective of this work was to characterize the biofuel produced by the methyl transesterification of residual soybean oil after frying .

Methodology

The raw material used for biofuel production was purchased from restaurants in the municipality of Paraíso do Tocantins. The residual oils were and stored plastic containers and sent to the Food Laboratory of the Federal Institute of Science and Technology Education of Tocantins IFTO Campus Paraíso do Tocantins. The physicochemical analyzes of biofuels were carried out from January to June 2018. The biofuels production process started with the transesterification reaction to obtain the biofuel from the oil after the frying occurred on a laboratory scale with methanol. transesterifying agent and catalyzed by an alkaline solution of sodium hydroxide (NaOH) dissolved in methanol. The reaction route consisted of a 10: 1 methanol / oil molar ratio and 1% of the catalyst solution relative to the oil mass. The reaction was heated in the range of 55 ± 5ºC, addition of methanol and catalyst solution. The mixture was subjected to homogenization for 10 minutes followed by standing for 48 hours for phase separation. The biofuel obtained was analyzed according to the physical parameters, visual aspect, acidity index, free fatty acids (FFA), density and humidity following the recommendations of the physicochemical analysis of ANP Resolution No. 45 of 25.08.2014 determines quality

parameters for the biofuels and, among them, standards are specified for kinematic viscosity, acidity index and water content, which are the parameters analyzed in this work. (ANP, Resolution No. 45, 2014).

Results and discussion

Table 01 shows the physical and chemical characteristics of the biofuels produced.

Table 01. Characteristics of biofuel produced with oil after frying

Parameters	Biofuel	ANP
Visual aspect	Clear	Clear
Acidity level (%)	0,50	0,5 mgKOH/Kg
Moisture (%)	2500	200 mg/Kg
Kinematic viscosity	5,5	3 a 6 mm^2/s

The parameters investigated for the biofuel, produced with the oil fried, are in accordance with limits specified by the ANP, except for the humidity that presented a value higher than the one recommended by the ANP. These results are important because high levels of these parameters can make biofuel production difficult or even impossible. Thus, it is preferable to use oils with low levels of acidity and moisture. For the production of biofuels through homogeneous alkaline catalysis, it is known that acid values higher than 0.5 mgKOH / Kg affect the production process (DOMINGOS, 2009). The acidity index is directly related to the amount of free fatty acids present in the lipid material (CANDEIA, 2008) and represent the amount of sodium or potassium hydroxide in milligrams needed to neutralize the free fatty acids of the material. (SILVA, 2008). When the amount of free fatty acids is greater than 0.5 mgKOH / kg, the oil transesterified by a homogeneous basic catalyst leads to saponification, in addition to promoting the deactivation of the catalyst and the formation of water molecules during the process. This transforms fatty acids into soap instead of biodiesel (CANDEIA, 2008).

Conclusions

The research carried out characterized biofuel generated from the transesterification of the oil after frying. The biofuel produced meets the requirements of the ANP demonstrating the possibility of synthesizing an alternative source for energy production and eliminating the environmental problem generated by the inadequate disposal of the post-fried oil residue.

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