Viscosity Analysis as an Alternative Test to Detect Adulteration in Biodiesel

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Abstract

The tests to analyze biodiesel purity are laborious, so we propose the use of viscosity analysis to detect adulteration.

Introduction

Products and technologies which address sustainable energy production are the greatest challenge to sustainability.[1] Until the present, the alternatives are based on solar, wind, biomass and crop based energy. Biodiesel can be synthesized using diverse catalyzers[2] and from different crops i.e. from oleaginous to palms. Although oil from different crops can be used to biodiesel production, little is known about the combustible physico-chemical properties obtained from them. Despite of the source, the purity of the bio combustible is a major concern in biodiesel production and distribution[3]. Adulteration not only increases environmental pollution but also harms the con-sumer, since the adulterated product can cause severe damage to car engines and since it has also been used to tax-evasion.
In this context, the objective of this work was propose an alternative method of biodiesel purity analysis as well as to understand the yields' physicochemical properties.

Results and Discussion

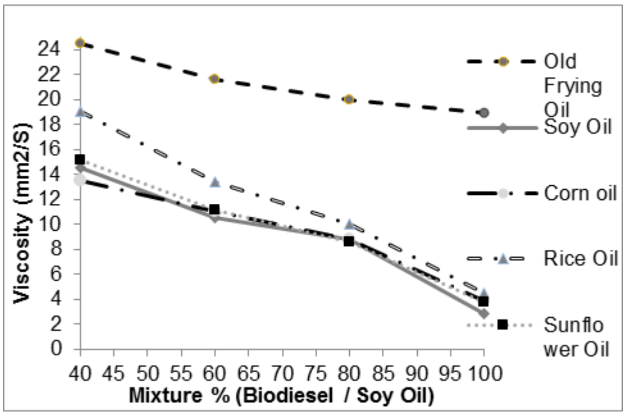
Biodiesel from soybean, rice, corn and sunflower seed oil were manufactured using alkaline-acidic two stage protocol.[4] The physicochemical pro-perties analysis was performed according to Mazzini & Pereira.[4], The viscometer (Quimis® Q288SR24, Brazil) was used for the viscosity analysis.
The Viscosity and Acidity Index of the bio combustible produced were according to the National Agency of Petroleum and Bio combustible (ANP), see Table 1. The Iodine Index of our samples, however, were not under the National Health Surveillance Agency requisite (103-128g I_2/100g). Nevertheless, Corn Biodiesel with 122 g I_2/100g has been reported[5], however in their study they used a different protocol for biodiesel synthesis. Our group, then hypothesized that the difference on the iodine index can be due the different protocol used.
The added triglycerides (from the adulterant source) have a higher molecular weight than the methyl ester (product from the transesterification). The longer chains increase molecule interaction throughout Van der Waals forces.

Table 1. Physicochemical Properties of Biodiesel Produced From Different Source and Commercial Oil, Viscosity (h), Acidity (AI) and Iodine (II)

Source	h Comercial (mm^2/s)	h Biodiesel (mm^2/s)	AI mg KOH/g	II mg I_2/100g
Soy	18,5	2,8	0,06	145
Corn	30,2	3,9	0,04	147
Rice	37	4,5	0,08	111,5
Sunflower	33,8	3,8	0,06	142
Old frying	-*	18,9	-*	-*

*under investigation

Figure 1. Different Source Biodiesel Viscosimetric Behavior when Pure (100%), 20, 40 and 60% adulterated with Soy Oil.



In summary, the more fatty acids added to the bio combustible the more viscous it get (Fig 1). This property give us the possibility to use the viscosity analysis as a purity test for Biodiesel.

Conclusions

Biodiesel produced from different source have distinct physicochemical properties. The viscosity analysis has great potential to be used as purity test for biodiesel. More in depth investigation is needed to establish this innovative test

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