Chalcones: An Alternative Antioxidants to Stabilize Biodiesel

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Abstract

In this work, oxidation of oils and application of chalcones as antioxidants in biodiesel of soybean was evaluated.

Introduction

Chalcones are class of molecules produced from renewable sources and have many benefits attributed to its use. These include antibacterial, anti-inflammatory and antifungal potencial.[1,2] This chemical species is an α-β-unsaturated ketone wherein the carbonyl group and olefinic moiety are linked to aromatic rings.[3]

Biodiesel and its properties have been widely described in the literature, so that this product is gaining more space on the market.[4] However, large-scale production requires adequate storage to maintain its physical-chemistry properties. Thus, biodiesel carbon chain must be free from any kind of oxidation, which can be analyzed through oxidative induction time (OIT).[5]

Therefore, chalcones can be useful tools to preserve oils and its derivatives properties since they have antioxidant potential and are easily synthesized in organic laboratories.

Results and Discution

Samples of edible soybean, rice, corn and sunflower oils were purchased in the supermarket in the city of Pelotas, Brazil. The biodiesel was prepared conform literature using glycerol as solvent.[6] A mixture of oil and glycerine was carried out with potassium hydroxide (KOH) and methanol under reflux at 65 °C during 60 min. After the reaction, the products were purified and put up for analysis.

The composition and distribution of fatty acids (FAs) in triacylglycerol molecules is what determines the quality of oil in soybeans. Unsaturated fatty acids in this oil accounted for 86% of the total FAs. Among these, linoleic acid had the highest concentration. This was also observed for rice, corn and sunflower oils. In general, higher proportions of linoleic acid (C18:2) torn an oil susceptible to oxidative degradation. As it can be seen in Fig. 1, corn and rice oils had higher OIT than soybean oil and sunflower. Moreover, the addition of chalcones (E)-1-(2-hydroxyphenyl)-3-(3-hydroxyphenyl)prop-2-en-1-one in the biodiesel of soybean oil provided an increase of about 60% in OIT, proving it to be a good antioxidant agent to be added in the biodiesel production process.

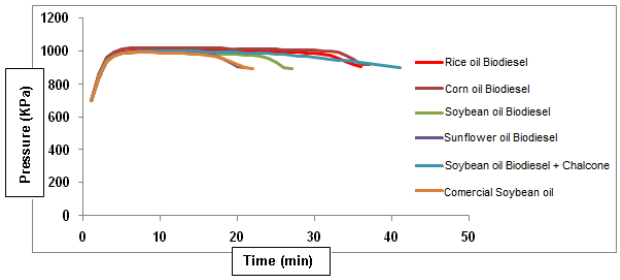

Figure 1. Oxidation profile of oils and biodiesel after OIT analysis from PetroOxy.

According to the results as mentioned before the use of chalcones as antioxidants is a viable alternative to biodiesel conservation. Besides, the OIT observed for the commercial soybean oil was 20.1 min., while for soybean oil biodiesel, the OIT was 25.11 min. The soybean oil biodiesel added with chalcone 2% (w/w) showed an OIT of 39.8 min. Based in the obtained OITs for soybean oil and biodiesel, the antioxidant action of the chalcone used in this study was proven to be effective.

Conclusions

According to the results, chalcones are potential anti-oxidizing agents for biodiesel soybean oil. Considering this, further studies will be performed to evaluate the use of other chalcones and establish the best combination of biodiesel and chalcone in order to maintain the biodiesel stability.

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