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Study of Oxidative Stability, Cold Flow Properties and Iodine Value of Macauba Biodiesel Blends

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Abstract : Biodiesel physical and chemical properties depend on the raw material composition used in its synthesis. Saturated fatty acid esters confer high oxidative stability, while unsaturated fatty acid esters improve the cold flow properties. In this study, an alternative vegetal source - the macauba kernel oil - was used in the biodiesel synthesis instead of conventional sources. Macauba can be collected from native palm trees and is found in several regions in Brazil. Its oil is a promising source when compared to several other oils commonly obtained from food products, such as soybean, corn or canola oil, due to its specific characteristics. However, the usage of biodiesel made from macauba oil alone is not recommended due to the difficulty of producing macauba in large quantities. For this reason, this project proposes the usage of blends of the macauba oil with conventional oils. These blends were prepared by mixing the macauba biodiesel with biodiesels obtained from soybean, corn, and from residual frying oil, in the following proportions: 20:80, 50:50 e 80:20 (w/w). Three parameters were evaluated, using the standard methods, in order to check the quality of the produced biofuel and its blends: oxidative stability, cold filter plugging point (CFPP), and iodine value. The induction period (IP) expresses the oxidative stability of the biodiesel, the CFPP expresses the lowest temperature in which the biodiesel flows through a filter without plugging the system and the iodine value is a measure of the number of double bonds in a sample. The biodiesels obtained from soybean, residual frying oil and corn presented iodine values higher than 110 g/100 g, low oxidative stability and low CFPP. The IP values obtained from these biodiesels were lower than 8 h, which is below the recommended standard value. On the other hand, the CFPP value was found within the allowed limit (5 ºC is the maximum). Regarding the macauba biodiesel, a low iodine value was observed (31.6 g/100 g), which indicates the presence of high content of saturated fatty acid esters. The presence of saturated fatty acid esters should imply in a high oxidative stability (which was found accordingly, with IP = 64 h), and high CFPP, but curiously the latter was not observed (-3 ºC). This behavior can be explained by looking at the size of the carbon chains, as 65% of this biodiesel is composed by short chain saturated fatty acid esters (less than 14 carbons). The high oxidative stability and the low CFPP of macauba biodiesel are what make this biofuel a promising source. The soybean, corn and residual frying oil biodiesels also have low CFPP, but low oxidative stability. Therefore the blends proposed in this work, if compared to the common biodiesels, maintain the flow properties but present enhanced oxidative stability.

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