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Oxidative Stability of Methyl and Ethyl Microalgae Biodiesel with Synthetic Antioxidants

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Abstract : Microalgae can be considered a potential source of oil for biodiesel synthesis since this microorganism can grow rapidly in either fresh or salty water, not competing with food production. There are several favorable conditions in Brazil for this type of culture due to the country's great amount of water. Another very positive aspect of this type of culture is its ability to fix atmospheric CO2, contributing to the reduction of greenhouse gases and their effects on global warming. Despite this biodiesel environmental advantages it degrades resulting in changes in its physical and chemical properties. In this work, the methyl and ethyl microalgae biodiesel oxidative stability was studied in the absence and presence of a synthetic antioxidant. The synthetic antioxidants used were propyl gallate (PG) and tert-butylhydroquinone (TBHQ), at a 0,12% (w/w) concentration. The biodiesel mixture was kept in a sealed glass flask, sheltered from light, and at room temperature (about 25 ºC) for 180 days. During this period, aliquots from this biodiesel were subjected to induced degradation by the Rancimat method, which determines an important quality parameter, provided in the current methods, and is used to monitor the degradation processes that occur in the biodiesel over time. The induction period (IP) expresses the biodiesel oxidative stability. It was stablished that the minimum accepted IP value for biodiesel is 8 hours. The results show that ethylic biodiesel increased its IP value from 7,6 hours to 31 hours when using PG, and to 67 hours when using TBHQ, exceeding the minimum accepted IP value. When the antioxidants were added to the methylic biodiesel samples, the IP was raised to 28 hours when using PG, and to 62 hours when using TBHQ. These values were maintained throughout the entire period of study (180 days). On the other hand, the biodiesel samples without additives maintained an IP above the allowed value for only 30 days. Therefore, in order to preserve microalgae biodiesel for longer periods of time, it is necessary to add antioxidants to both derivatives, i.e., the ethylic and methylic.

Keywords : biodiesel, microalgae, oxidative stability, storage, synthetic antioxidants
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