

1H-NMR Spectra of Diesel-Biodiesel Blends to Evaluate the Quality and Determine the Adulteration of Biodiesel with Vegetable Oil

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Abstract : The use of biodiesel has been diffused in Brazil and all over the world by the trading of biodiesel (B100). In Brazil, the diesel oil currently being sold is a blend, containing 7% biodiesel (B7). In this context, it is necessary to develop methods capable of identifying this blend composition, especially regarding the biodiesel quality used for making these blends. In this study, hydrogen nuclear magnetic resonance spectra (1H-NMR) are proposed as a form of identifying and confirming the quality of type B10 blends (10% of biodiesel and 90% of diesel). Furthermore, the presence of vegetable oils, which may be from fuel adulteration or as an evidence of low degree of transesterification conversion during the synthesis of B100, may also be identified. Mixtures of diesel, vegetable oils and their respective biodiesel were prepared. Soybean oil and macauba kernel oil were used as raw material. The diesel proportion remained fixed at 90%. The other proportion (10%) was varied in terms of vegetable oil and biodiesel. The 1H-NMR spectra were obtained for each one of the mixtures, in order to find a correlation between the spectra and the amount of biodiesel, as well as the amount of residual vegetable oil. The ratio of the integral of the methylenic hydrogen H-2 of glycerol (exclusive of vegetable oil) with respect to the integral of the olefinic hydrogens (present in vegetable oil and biodiesel) was obtained. These ratios were correlated with the percentage of vegetable oil in each mixture, from 0% to 10%. The obtained correlation could be described by linear relationships with R² of 0.9929 for soybean biodiesel and 0.9982 for macauba kernel biodiesel. Preliminary results show that the technique can be used to monitor the biodiesel quality in commercial diesel-biodiesel blends, besides indicating possible adulteration.

Keywords : biodiesel, diesel, biodiesel quality, adulteration

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