

Efficiency of Synthetic Antioxidants on the Stabilization of Purified Sunflower Oil Methyl Esters

Natalia Martínez Gadea, Iván Jachmanián.

Laboratorio de Grasas y Aceites , Facultad de Química, Universidad de la República,
Av. Gral. Flores 2124. 11800-Montevideo, Uruguay.

Due to the high vulnerability to oxidation of biodiesel compared to petroleum diesel, most quality specifications include the evaluation of this property. Although at present most of the specifications consider a minimum induction period (IP, obtained by Rancimat method at 110 °C) of 6 h as sufficient, revisions are being made in order to increase this minimum to 8 h. Although the degree of unsaturation of the fatty acids is the major factor affecting the oxidative stability, many others like the nature and concentration of several minor components can be determinant. Among these, the more relevant are the natural antioxidants and the hydroperoxides in the starting oil. Although much research has been conducted on the efficiency of different synthetic antioxidants on biodiesel stability, most was done using commercial esters or esters that were not previously refined, thus containing all the minor components mentioned above.

This work studied the efficiency of several phenolic antioxidants on the stabilization of sunflower oil methyl esters obtained from purified sunflower oil (PSFO). Purification was performed by passing the oil through a column packed with activated alumina, process that efficiently stripped off all the antioxidants and the hydroperoxides.

Purified sunflower oil methyl esters (PSFO-ME) analyzed by Rancimat method at 110 °C showed an IP of 1.1 h, and after the addition of antioxidants at 500ppm the IP were: 2,6-di-tert-butyl-4-hydroxymethylphenol 4.6 h, BHT 5.9 h, BHA 7.8 h, Lauryl gallate 8.5 h, Octyl Gallate 10.4 h, Propyl gallate 12.9 h, Nordihydroguaiaretic acid 13.7 h and TBHQ 26.7 h. According to results antioxidants showed a different efficiency in stabilizing PSFO-ME, resulting in IPs under the limit of 6 h, over this limit, and well above 8h, with TBHQ as by far the most efficient. Antioxidants were compared also at different concentration and results were related with antioxidants properties like the characteristics of their phenolic group, molecular weight and volatility.