

Electrocatalytic Hydrogenation of Vegetable Oil

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An emulsion of vegetable oil and distilled water prepared by the addition of didodecyl diethyl ammonium bromide (DDAB) was subjected to electroreduction in the presence of a suitable electrocatalyst and nickel catalyst. Reactions were carried out at temperatures equal to or lower than 60 °C under ambient pressure.

Industrial hydrogenation of vegetable oil is carried out at temperatures corresponding to 150-200 °C and pressures ranging between 10 to 60 psig in the presence of hydrogen gas. The hydrogenated oil is found to be rather high in trans fatty acid concentration. The amount of trans fatty acid is directly related to the temperature of hydrogenation.

In the electrocatalytic process described above, the amount of trans fatty acid is found to be more than 80% lower than that observed for the commercial gaseous hydrogenation processes for the same extent of hydrogenation. The extent of hydrogenation is measured by calculating the iodine value. Lower the iodine value, greater is the extent of hydrogenation. Trans fatty acids are suspected to enhance plasma cholesterol risk factors for heart diseases and therefore it is desirable to reduce their content in cooking oil.

Figure 1 is a comparison of the trans fatty acid content of soybean oil hydrogenated by the electrocatalytic and commercial gaseous hydrogenation processes. The data show the amount of trans fatty acid content increases only slightly with iodine value for the electrocatalytic process in relation to the increase in trans fatty acid observed for the commercial gaseous hydrogenation process. Figure 2 shows the influence of temperature on iodine value, stearic acid and trans fatty acid content of the soybean oil hydrogenated via the electrocatalytic method.

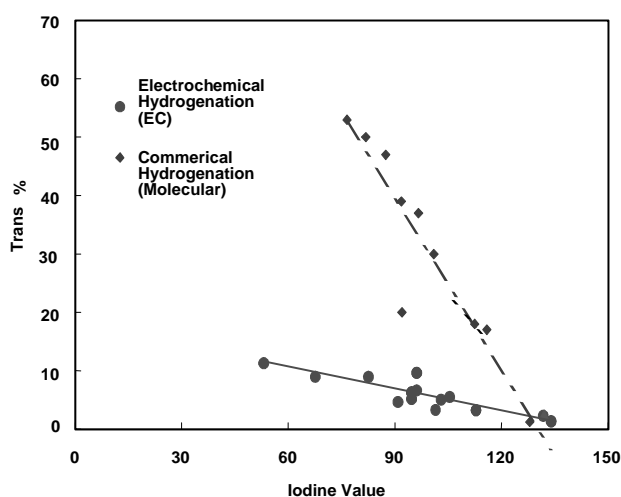


Figure 1. Comparison of the trans fatty acid content of soybean oil hydrogenated by the electrocatalytic and commercial gaseous hydrogenation processes

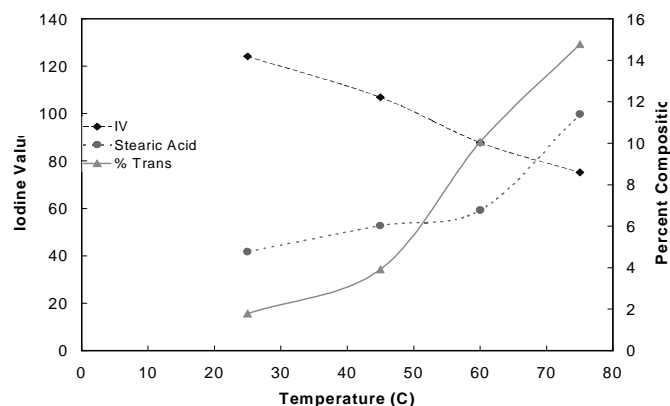


Figure 2. The effect of temperature on iodine value, stearic acid and trans fatty acid content of the soybean oil hydrogenated via the electrocatalytic method