Reduction of Green Color from Soybean Oil

ABSTRACT

The green color in a refined bleached soybean oil extracted from green soybeans was removed substantially by partially hydrogenating the oil with 1% copper chromite catalyst at 175 C and 30 psig. Hydrogenating the same oil to the identical IV (110) with 0.1% nickel at 150 C and 15 psig was ineffective.

INTRODUCTION

Soybean oil extracted from green soybeans has a greenish color because of the chlorophyll and related compounds that are present. In years when some areas of the U.S. have freezing weather before beans are mature, oil from these beans causes a problem to refiners who must prepare edible products essentially free of green color. A green oil must be treated with considerably more than normal amount of bleaching agents, and, on occasion, green and normal oils are blended to obtain an acceptable color.

DISCUSSION

In the course of studies on the partial hydrogenation of soybean oil with copper chromite catalysts at the Northern Laboratory, we hydrogenated some samples of refined, bleached oil that were visibly green. After the oil was hydrogenated (1% Cu-Cr Harshaw 1106P catalyst, 175 C, 30 psig) from an initial IV of 132 to a final IV of 110 (estimated from refractive index) and after the oil was cooled and filtered, the green color was no longer visible. By contrast, when this same oil was hydrogenated to the same degree with a nickel catalyst (0.1%, 150 C, 15 psi), the green color in the original oil was only slightly reduced. Hydrogenation time was ca. the same for both reactions.

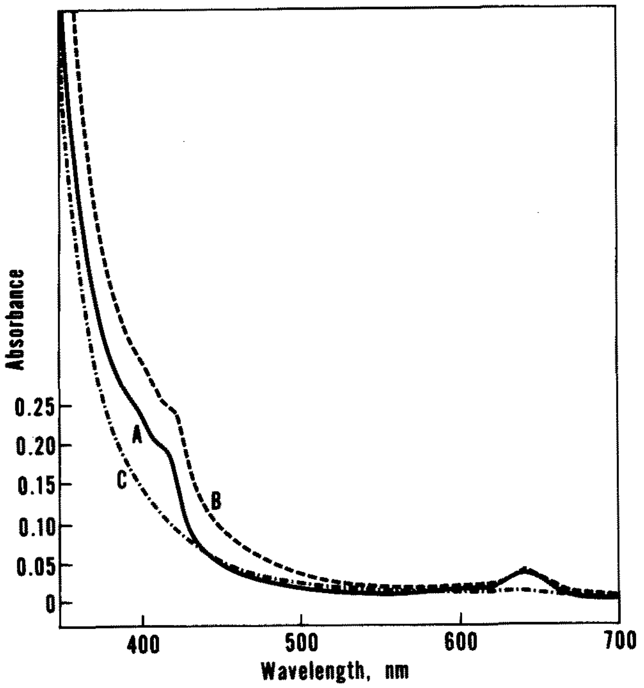

FIG. 1. Absorbance curves for unhydrogenated (A), nickel hydrogenated (B), and copper-chromite-hydrogenated (C) oils from green soybeans.

Absorbance curves were obtained with 1 cm cells and a Carey recording UV spectrophotometer on undiluted oils (Fig. 1). Curve A is for a refined, bleached green oil used as control in the tests; curve B is the nickel-hydrogenated oil; and curve C the copper-chromite-hydrogenated oil. Swern (1) reported green oil with peaks at 660 nm. Curves A and B show the typical absorbance peak at ca. 650 nm, whereas absorbance is nearly zero in this area of curve C. Absorbance maxima in the 650 nm region are 0.047, 0.043, and 0.008 for the unhydrogenated, nickel-hydrogenated and copper-chromite-hydrogenated oils, respectively.

It is not known whether green color was removed by adsorption on the copper catalyst or by reduction of unsaturated double bonds of chlorophyll. However, if adsorption is involved, no loss of catalyst activity was observed. Also, heating the green oil in contact with 1% copper chromite catalyst in a nitrogen atmosphere did not remove the color. When hydrogen replaced the nitrogen in the convertor, the green color was essentially removed in 15 min.

It has been shown that a hydrogenated winterized oil of improved organoleptic stability can be produced with the copper-chromite catalyst (2). Our results indicate that green oils can be improved greatly in color during the same operation.

R.E. BEAL
K.J. MOULTON
L.T. BLACK
Northern Regional
Research Center
ARS, USDA
Peoria, Illinois 61604

REFERENCES

1. Swern, D., in "Bailey's Industrial Oil and Fat Products," Third Edition, Edited by D. Swern, John Wiley & Sons, New York, N.Y., 1964, p. 132.
2. Cowan, J.C., C.D. Evans, H.A. Moser, G.R. List, S. Koritala, K.J. Moulton and H.J. Dutton, JAOCS 47:470 (1970).

[Received April 15, 1974]