SHORT COMMUNICATION

Bleaching of Cottonseed and Soybean Oils by Hydrogen Generated *in Situ*

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Bleaching of cottonseed and soybean oils has been effected by hydrogen generated *in situ* by the action of aqueous copper sulfate solution on zinc dust. Yellow color bodies are bleached more readily by this process than the red bodies. Color reduction up to a level of 70–74% is attainable by this method.

KEY WORDS: Bleaching of oils, color reduction, nascent hydrogen.

It is well known that oils are partially decolorized during hydrogenation through saturation of reducible pigments (1). Hydrogen for reducing purposes may be liberated in neutral (aqueous) solutions by the copper-zinc couple. Hot water is rapidly decomposed by the copper-zinc couple (prepared by depositing copper on zinc from copper sulfate solution) (2). In the present investigation this reaction has been utilized to study the bleaching effect of nascent hydrogen on vegetable oils.

EXPERIMENTAL PROCEDURES

A mixture of zinc-dust, water and oil (25 g) in a conical flask was heated over a water bath (70–80°C), and saturated copper sulfate solution was then added slowly from a separating funnel, whose stem was dipped into the lower aqueous layer. After completion of the reaction (at different time intervals), the separated oil layer was washed successively with 1 N HCl, 0.1 M EDTA and hot distilled water (70–75°C), and finally dried with anhydrous sodium sulfate. The quantity of saturated $CuSO_4$ solution required per gram of zinc-dust was determined from a blank test in the absence of oil; the appearance of greenish blue color in the aqueous layer indicated the end point.

The experiments were conducted at first with cottonseed oil at time intervals of 15, 30 and 45 min, and the optimum color reduction of the oil was found to be 30 min. Accordingly, the experiments on soybean oil were performed in a 30-min time period. Color values of oils were determined by Lovibond Tintometer by using 0.25-, 0.5-, 1.0- and 2.0-inch cells depending on color intensities of the oil. For the sake of comparison, the values are calculated (Table 1) on the basis of a 1-inch cell. Percentage color reduction of bleached oils has been expressed on the basis of color of the unbleached oils.

DISCUSSION

It is evident from Table 1 that color reduction in cottonseed and soybean oils increased with increasing amounts of zinc-dust and saturated copper sulfate solution. Optimum color reduction for both the oils was achieved with 0.5% (w/w) zinc-dust and 14 mL saturated copper sulfate solution. The data reveal that there was greater reduction of yellow color than of red color. This indicates that yellow color bodies are easily bleached by nascent hydrogen, presumably through saturation of carotenoid pigments. Heat bleaching of oils is quite unlikely as the bleaching operation was conducted at a considerably low temperature (70–80°C). Results demonstrate that cottonseed and soybean oils could be bleached by this method to the extent of 70% and 74%, respectively.

It was also ascertained that peroxide, acid and iodine values remained practically unaltered after processing of both oils. Results thus indicate that nascent hydrogen generated *in situ* (by the action of water on the zinc-copper) is capable of bleaching oils to an appreciable extent. It is expected that such bleached oils could be further upgraded by other processing stages for various end uses.

REFERENCES

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TABLE 1

Reduction Bleaching of Cottonseed and Soybean Oils with Zn-Dust and $CuSO_4$ Solution[a]

Reduction conditions		Cottonseed oil[b]						Soybean oil[c]					
		Color of bleached oil (1-inch cell)			Reduction in color (%)			Color of bleached oil (1-inch cell)			Reduction in color (%)		
Zn-dust (%) (w/w)	Saturated $CuSO_4$ mL	Y	R	Y + 10R	Y	R	Y + 10R	Y	R	Y + 5R	Y	R	Y + 5R
0.20	6.0	14.0	2.2	36.0	65.0	45.0	55.0	11.0	2.15	21.75	60.7	32.8	50.6
0.30	8.5	12.0	2.0	32.0	70.0	50.0	60.0	10.0	1.95	19.75	64.3	39.1	55.1
0.40	11.0	10.0	1.7	27.0	75.0	57.5	66.2	8.0	1.50	15.50	71.4	53.1	64.8
0.50	14.0	10.0	1.5	25.0	75.0	62.5	68.7	6.0	1.20	12.0	78.6	62.5	72.7
0.60	16.5	9.0	1.5	24.0	77.5	62.5	70.0	6.0	1.10	11.50	78.6	65.6	73.9

[a]Fixed conditions: Reaction time, 30 min; pressure, atmospheric; temperature, 70–80°C.
[b]In cottonseed oil Y = 40.0; R = 4.0; Y + 10R = 80.0. Initial color of neutralized cottonseed oil (Lovabond 1-inch cell).
[c]In soybean oil Y = 28.0; R = 3.2; Y + 5R = 44.0. Initial color of neutralized soybean oil (Lovabond 1-inch cell).

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