A Simple Method to Enrich Phospholipid Content in Commercial Soybean Lecithin

Sir:

Commercial soybean lecithin is an important co-product of soybean oil processing obtained during the degumming step. Soybean lecithin is a complex mixture comprising phospholipids, triglycerides, and minor amounts of other constituents like phytoglycolipids, phytosterols, tocopherols, and fatty acids. The composition and molecular structures of this heterogeneous mixture of compounds define a product that is low in apparent polarity and that has a strong tendency to promote water-in-oil emulsions (1). Lecithin has potential as a multifunctional additive for food, pharmaceutical, and industrial applications (2). The phospholipid content of commercial soybean lecithin varies depending on the processing conditions of degumming of soybean oil. But lecithin used for specific applications requires a definite content of phospholipid (3). Well-defined methodologies can lower the phospholipid content of commercial lecithin, for example, intermixing of soybean, peanut, cottonseed or partially hydrogenated soybean oil where the application demands lower content of phospholipids (4). Alternatively, there is no method available in the literature to enrich commercial lecithin to a higher content of phospholipids. In the present study a simple method was developed to enrich phospholipid content to a required percentage in commercial soybean lecithin.

The commercial lecithin (dried gums) used for the present study (procured from M/s Alpine Industries Ltd., Indore, India) was found to contain 50% phospholipids (acetone insoluble matter) as determined by standard AOCS method Ja 4-46 (5). The additional amount of phospholipids required to enrich 100 g of commercial lecithin to 60 and 70% phospholipid content was theoretically calculated, and about 25 and 67 g of pure phospholipids respectively, are required. Accordingly, commercial soybean lecithin (50 g) was dissolved in acetone (20 mL) and slowly added to chilled acetone (230 mL). The contents were kept in a refrigerator for 60 min at 4.5°C and centrifuged. The acetone layer, containing neutral lipids, was decanted; and the acetone-insoluble material was extracted with chilled acetone (2 × 50 mL) followed by centrifugation. The wet acetone insolubles, obtained as a light yellow crystalline precipitate, were added to commercial lecithin (100 g) to adjust the phospholipid content to 60%. The contents were homogenized at 70°C for 30 min, and residual acetone was removed from the homogenized mass under reduced pressure (yield, 125 g). In a similar way lecithin with 70% phospholipid content was prepared from acetone insolubles obtained from 134 g of commercial lecithin and homogenized with 100 g of commercial lecithin (yield, 167 g). The commercial and the enriched lecithins were then subjected to bleaching with a mixture of hydrogen peroxide (30% in water) and benzoyl peroxide (1.5 and 0.5%, respectively, on the basis of lecithin) at 70–75°C for 90 min to obtain a light yellow lecithin. The bleached lecithin was dried under reduced pressure at the same temperature. As it is very difficult to homogenize commercial lecithin with dry acetone-insoluble powder, the present method using powdered wet acetone insolubles for the enrichment is simple and practical. The residual acetone present in wet acetone insolubles helps in homogenization. In using this methodology, commercial lecithin can be enriched to any required percentage of phospholipids for various applications.

The color (Gardner scale) of lecithin samples was determined using a Lovibond 3000 comparator unit. Acid, peroxide and iodine values were determined by the standard AOCS methods, Ja 6-55, Ja 8-87 and Ja 14-91 respectively (5). Viscosity was determined at 35°C using a Brookfield Synchro-electrical Viscometer (model RVT; Brookfield Engineering Laboratories Inc., Middleboro, MA). Methyl esters of fatty acids were prepared from commercial and enriched lecithins by treating them with 0.5 M sodium methoxide in methanol for about 30 min at 50°C (6). The analysis of methyl esters was carried out with Agilent 6850 Gas Chromatograph (Palo Alto, CA) equipped with a flame-ionization detector using a stainless steel column (1.8 m × 6 mm) packed with 10% Silar

TABLE 1
Physical and Chemical Characteristics and Fatty Acid Composition (wt%) of Lecithin with Different Contents of Phospholipids

Phospholipid content[a] in lecithin (wt%)	Color (Gardner scale)	Acid value (mg KOH/g sample)	Iodine value	Peroxide value (meg peroxide/ 1000 g sample)	Viscosity (cP) (at 35°C)	Fatty acid (wt%)				
						16:0	18:0	18:1	18:2	18:3
50	13	22.1	92.1	45.6	901	18.0	2.7	22.1	51.6	5.6
60	13	22.1	82.7	50.1	3,372	17.3	2.8	21.4	52.9	5.6
70	13	22.1	73.7	48.1	15,801	18.1	2.8	20.7	53.1	5.3

[a]Determined by American Oil Chemists' Society method Ja 4-46 as described in Reference 5.

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10 C on Chromosorb W-HP (100–120 mesh). The oven temperature was programmed from 180 to 220°C at 5°C per minute and flow rate of the carrier gas, nitrogen, was 35 mL/min. The injector and detector temperatures were maintained at 220 and 250°C, respectively, and the area percentage was recorded using HP Chem Station data system.

The color, acid value, and peroxide value of all the samples were found to be similar irrespective of their phospholipid content (Table 1). Iodine value decreased with increase in phospholipid content as the oil content in the respective samples decreased. Viscosity of the enriched lecithins increased with increase in the phospholipid content. There was not much variation in the fatty acid composition of commercial and enriched lecithins (Table 1).

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