Extraction of Aflatoxins From Cottonseed and Peanut Meals With Ethanol

Abstract

Cottonseed and peanut meals containing aflatoxins were extracted with 95.6% and 90.0% aqueous ethanol at 75 C to lower the level of aflatoxins. These solvents removed 93–96% of the aflatoxins in the cottonseed meal and 96–98% of the aflatoxins in peanut meal.

The removal of aflatoxins from contaminated agricultural commodities by means of solvent extraction has been reported by numerous investigators (1–7). In general, polar solvents such as methanol, acetone, chloroform, benzene or aqueous isopropanol have been suggested as effective agents to reduce or eliminate the levels of aflatoxins in these materials. Theodossiades (8), reported that extraction of peanut meal with "96°" ethanol did not remove aflatoxins from the meal. The conditions of extraction with ethanol, however, were not described.

The following data indicate that hot, aqueous ethanol is an effective solvent for reducing aflatoxin levels in contaminated cottonseed and peanut meals.

The cottonseed meal used was especially selected because of its atypically high aflatoxin content of 802 μg/kg total aflatoxins. Other compositional data include: nitrogen, 5.9%; lipids, 0.54%; crude fiber, 14.8%; moisture, 8.9%.

The peanut meal was similarly selected because of its high aflatoxin content of 554 μg/kg total aflatoxins. Other compositional data include: nitrogen, 8.07%; lipids, 1.17%; crude fiber, 8.09%; moisture, 8.4%.

Extractions were carried out in a glass Büchner-type funnel having an inside diameter of 9.5 cm and fitted with a coarse fritted glass bottom. A stopcock in the stem portion was used to regulate liquid flow. The funnel was further modified with an insulated metal jacket having inlet and outlet ports to provide for circulation of heating fluid around the funnel. The circulating fluid was maintained at 85 C and meal temperatures averaged 75 C during extraction. A loose fitting glass covering retained solvent vapors during operation.

The cottonseed or peanut meal (200 g) was placed in the preheated extraction funnel and slurried with an equal weight of heated (75 C) aqueous ethanol azeotrope (95.6% ethanol w/w) or 90% aqueous ethanol (w/w). A 15 min meal-solvent residence time was allowed for each pass. Vacuum was applied to facilitate the removal of miscella between passes. After six passes were completed, the meal was drained thoroughly, removed from the extraction funnel and spread in a glass tray to air-dry at ambient temperature for at least 24 hr before it was assayed for aflatoxin content.

Meal samples were assayed for aflatoxin content by the improved objective fluorodensitometric assay procedure of Pons et al. (9). The percentage of meal solids extracted in each procedure was determined by stripping solvent from the miscella in a rotary evaporator under reduced pressure (1 mm Hg) at 100 C until a constant weight was attained. Table I presents the data obtained in this study.

TABLE I

Reduction in Aflatoxin Content of Cottonseed and Peanut Meal Extracted with 6 (1:1 Solvent/Meal Ratio) Passes of Aqueous Ethanol at 75 C

Ethanol concentration % (wt)	Oilseed meal	Aflatoxin content of original meal μg/kg	Aflatoxin content of extracted meal μg/kg	Aflatoxin reduction achieved %	Solids extracted %
95.6	Cottonseed	802	57	93	7.8
95.6	Peanut	554	21	96	10.5
90	Cottonseed	802	31	96	9.9
90	Peanut	554	14	98	12.4

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[Received July 8, 1969]