Volatile Oil in Cardamom Seed

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Cardamom seed has been highly valued in India as a spice, masticatory, and aphrodisiac for thousands of years (Guenther, 1952). During the Middle Ages and the Renaissance in Europe, cardamom became one of the valuable and rare Indian spices. At the present time cardamom seed is a relatively expensive item of commerce, 100,000 kg. being imported into the United States annually (Ramstad, 1955).

Cardamom seed, the dried ripe seed of *Elettaria cardamomum* (L.) Maton (Family *Zingiberaceae*), is recognized by most pharmacopeias of the world and is included in the National Formulary of the United States. The seed, and preparations made from it, are used most extensively as a flavoring agent for medicinals, although it has additional pharmacological properties. Other than in pharmacy, "cardamom is used to flavor curries, liqueurs, sauces, pickles, and baked goods" (Encyclopedia Britannica, 1961).

Most of the cardamom seed used in the United States is shipped while still enclosed in the dried fruit. This fruit (capsule, hull, or shell) must be removed before the whole seed is used. According to the National Formulary cardamom seed "should be recently removed from the capsule." A search of the literature revealed that cardamom oil is lost from the exposed seed but failed to indicate the length of time after removal beyond which cardamom seed can no longer be accepted as "official." Wallis states that "the seeds of fruits which have partially opened are less aromatic, and such fruits ("splits") are less esteemed" (Wallis, 1960). According to Clevenger "the loss of volatile oil in cardamom seed removed from the shells is considerable, amounting to approximately 30 per cent in eight months" (Clevenger, 1934). Ground cardamom seed which had been on the stockroom shelves at the School of Pharmacy for several years was extracted for volatile oil. Only a trace was obtained and this did not appear to have the same odor as official cardamom oil.

Cardamom seed may be purchased on the drug market in the ground form labeled as "Cardamom Seed, N.F." While the seed may have been official when it was first ground, it would appear that prolonged storage of the ground seed would result in an inferior product which should disqualify it as an official drug. The following material is a first report in the evaluation of cardamom oil from the seed stored under different conditions.

PROCEDURE

A quantity of cardamom fruit was purchased from S. B. Penick and Company and divided into three portions: whole fruit, whole seed, and ground seed. Each was placed in a large evaporating dish and exposed to the air at room temperature until the volatile oil was extracted.

At the start of the experiment and at various times following the exposure of the spice, the percentage of volatile oil in the seed was determined. For those samples, whenever necessary, the removal of the capsules and the grinding of the seed was done immediately prior to the analytical determination.

A Clevenger apparatus for the extraction of volatile oils lighter than water was used (Clevenger, 1928). Approximately 60 gm of ground seed was placed in a one-liter flask which was partially filled with distilled water and then heated to boiling. The water vapor and volatile oil were condensed by the use of a cold water condenser and dropped into a tube calibrated to read the quantity of oil to tenths of milliliters. Excess water flowed back into the boiling flask containing the cardamom seed. The process was complicated by the boiling cardamom seed forming a thick "mush-like" mixture which readily stuck to the bottom of the flask and burned. It also formed a foam which ran over into the oil. For these reasons boiling chips were placed in the flask and several drops of G. E. Antifoam 66 were used. The extraction was continued for five hours.

Because the oil in the Clevenger apparatus could not be read closer than 0.1 ml, it was decided to wash the oil out with ether and weigh the oil after the ether had evaporated. This resulted in some loss of oil in the process.

RESULTS

The results of the experiment are included in Figure 1.

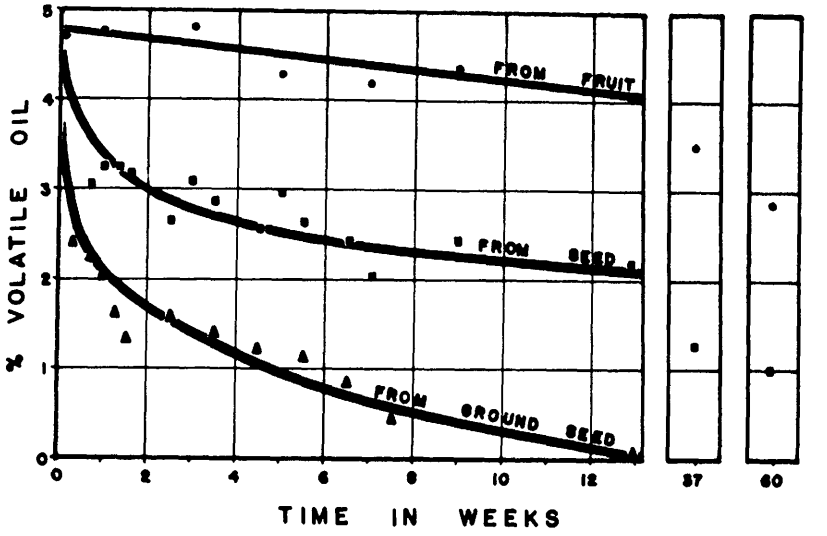

Figure I. Loss of Cardamom Oil

The yield of volatile oil from cardamom seed which had been removed from the capsule only a few minutes before extraction was 4.8 per cent on a weight basis. When the fruit was exposed to the air, the yield of volatile oil slowly declined and after fourteen months was 2.9 per cent. The volatile oil yield from seeds which were exposed to the air dropped to half the original quantity in six weeks, after which the decline was more gradual. After fourteen months there was still one per cent volatile oil. The volatile oil yield from the ground seed dropped rapidly during the first few days of exposure, and after one week less than half of the original yield was collected. After thirteen weeks only a trace of oil could be obtained.

SUMMARY

The results indicate that volatile oil is slowly lost from cardamom fruit exposed to the air at room temperature. Cardamom seed loses volatile oil more rapidly under the same conditions and ground cardamom seed loses volatile oil so rapidly that after several months' exposure, only a trace of oil may be obtained.

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