Olive Oil Substitutes and Their Preparation

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Between 1937 and 1940 the United States imported an average of 60,000,000 pounds of edible olive oil per year whereas California produced an average of 5,000,000 pounds in the same period.

Although the production of olive oil in California increased to 8,000,000 pounds in the 1941 to 1942 season, with only negligible quantities being imported, the finding of satisfactory substitutes for olive oil presents a major problem. Furthermore, the cost of olive oil has risen from about $1.50 per gallon to $4.00 and more per gallon within the past three years.

It is estimated that only about 10 per cent of all olive oil consumed goes through drug channels, 90 per cent being sold in grocery stores. Of this 90 per cent, about 30 per cent is sold to the American grocery trade and 60 per cent to the Italian and other foreign grocery trades.

For drug trade distribution, the olive oil substitute should carry the glyceride structure and non-drying characteristics of olive oil and the flavor of the substitute is of little consequence. For these reasons and also because price fluctuations are not so very important in the drug trade, there is but little substitution.

For grocery trade distribution, however, the acceptability of an imitation olive oil or of an olive oil substitute depends almost entirely upon its olive flavor and aroma.

The words "Olive Oil" to the buying public imply quality, high value and uniformity. Most people fail to realize, however, that for salad oil purposes a refined olive oil has no advantage over a well refined corn or cottonseed oil. Furthermore, there are fully 25 major varieties of olive oil having markedly different flavor characteristics one from the other, the flavors being determined by the variety of olive, soil and climatic conditions, freedom of the olive from fermentation at time of expression, and type of expression used.

The olive oil which reaches the buying public is in the large part a blend of virgin or natural olive oil and refined olive oil. Some varieties of olive oil and particularly the solvent extracted and heat expressed oils have strong objectionable flavors so that blending of the strong flavored olive oil with refined olive oil must be resorted to in order to modulate its objectionable flavor.

The preparation of a satisfactory olive oil substitute depends therefore upon obtaining a maximum of *desirable* olive flavor and aroma at a minimum of cost. This necessarily implies the use of as large as possible a proportion of lower cost refined vegetable oils such as corn, cottonseed, or soya oil as the basic carrier for the olive flavor.

By far the largest olive oil substitute is produced by blending a major proportion of refined corn or cottonseed oil with a minor proportion of olive oil using generally whatever olive oil happens to be available to the oil blender. It is estimated that 40 to 45 million pounds of these blended oils have been sold largely to the Italian trade within the past year.

Up to 8 or 10 months ago these blended oils were labeled as containing 80 per cent refined vegetable oils and 20 per cent olive oil. But within the past few months, with the increasing cost of olive oil, the proportion of olive oil in the blend has been omitted in label declarations and it is estimated that the presence of olive oil ranges from no more than 1 to 5 per cent with a consequent reduction in total olive oil flavor.

Packers of these substitutes are specifying for blending wherever possible those olive oils which carry a maximum of flavor and color in order to develop in the blended oil at least some positive flavor and green color characteristics.

One type of olive oil that is in demand is that made by expressing green olives using principally green olive culls or damaged fruit which is left after the selection of sound green olives for the pickling, fermentation or canning vats as in the manufacture of Spanish style, Sicilian style or canned ripe olives.

There is a very limited supply of this green olive oil available, however, because only the culls or damaged fruit is used. This is due to the fact that the grower allows his olives to ripen on the trees whereby there is obtained upon expression of the ripe olives between 35 and 45 gallons of olive oil per ton as against only 10 to 20 gallons per ton when green olives are expressed.

In order to obtain an adequate olive flavor and aroma in a blend of olive oil and refined vegetable oils so that the olive flavor is recognizable in a salad, even where oil from these green olives is used, between 20 and 25 per cent of olive oil is required and where a mildly flavored olive oil is used from 25 per cent to 40 per cent may be needed.

Care in the selection of the olive oil must be exercised. The olive oil should not be chosen merely because it has a strong or carrying flavor, but the flavor must be a desirable and pleasing one. Some oil blenders fail to realize this and will frequently spoil a good refined corn or cottonseed oil with a strong and objectionably flavored olive oil merely to give the finished blend some positive flavor characteristics.

One recent development is of interest in a study of olive oil for blending (1). It has been found that where green olives are held in a brine solution of at least 50 per cent salt saturation for a period of 20 to 30 days and then expressed, the olive oil thus obtained has greater strength and carrying power for blending purposes than olive oil produced from ordinary ripe or green olives which have not been brined. Furthermore, the green color and bitter flavor of the green olives are fully retained in the brined green olives.

Apparently there is some flavor development during the brining period which enhances the olive flavor, the mechanism of which is not well understood. The green olives must be brined and cannot be dry salted. If layers of green olives are held between alternate layers of dry salt, moldiness may develop because the

(1) Musher, S. U. S. Patent 2,282,779, May 12, 1942.

skin of the green olive is extremely tough and penetration of the dry salt does not readily take place.

Unless at least a 50 per cent salt saturation is maintained in the brining of the green olives, fermentation may occur and the fermented flavor which is characteristic of the Sicilian or Spanish style olives proves to be objectionable in the olive oil. During the brining period, the green olives become shriveled and are dehydrated from about 70 per cent moisture to about 55 per cent.

As a second means for producing imitation olive oil and olive oil substitutes there have been developed several synthetic flavors which are added to refined oils in amounts between 0.02 and 0.04 per cent. These synthetic materials are labeled as containing ethyl butyrate and other organic esters, butyric and other organic acids, nutmeg and other essential oils. Although they have met with some commercial success, there is considerable question as to whether the synthetic flavor is characteristic of an olive flavor and also as to the strength, carrying power and retention of those flavors in the treated oils.

Another means for developing olive flavors is by "infusing" a refined vegetable oil with a macerated paste made from salted olives (2). Since the olive flavors are closely held within the olive cells and not fully removed upon ordinary expression, and since these olive flavors are intensified and developed upon salting of the olives, it has been found that by grinding the salted olives, including their pits, into a fine paste and putting that paste through a colloid mill such paste may be added to a refined vegetable oil in amounts of as little as 10 to 15 per cent followed by agitation and filtration of the undissolved olive solids to obtain a good carrying and desirable olive flavor and aroma. At the same time, the infusion procedure imparts an antioxygenic effect so that the olive flavor developed in the infused oil is quite stable.

For this purpose both salted ripe olives and brined green olives are used. The ripe olives can be dry salted since they have a soft skin that can readily be penetrated by salt. For example, layers of ripe olives are placed in wooden bins with alternating layers of salt using an average of 70 pounds of salt to each 100 pounds of olives. Every second or third day the olives are shoveled to another part of the bin and after a thirty day period the olives will have lost between 35 and 45 per cent of their total moisture content, becoming black and shriveled.

These dry salted olives are then rubbed with oil in order to prevent moisture from accumulating at their surfaces and offering an opportunity for mold development. The salted ripe olives are then ready for storage and subsequent grinding. Where green olives are used, however, they are placed in a substantially concentrated brine rather than dry salted.

By grinding these salted olives and following this infusion procedure the maximum of olive flavor is extracted from the cells of the olive, and at the same time advantage is taken of the fact that during the salting of the olives the olive flavor and aroma intensity are considerably increased.

(2) Musher, S. U. S. Patent 2,199,364, April 30, 1940.

During the salting of the ripe olives the green color which is characteristic of olive oil made from unsalted ripe olives is materially reduced. The color of olive oil expressed from green olives that have been held in a concentrated brine, however, appears to be fully retained.

It is therefore desirable to use a combination of both salted ripe and brined green olives to adjust the flavor and color of the olive oil substitute.

TABLE I

Series *	Treatment	Color (Lovibond Scale)	F.F.A. (Expressed as Oleic)
A	Olive oil expressed from unsalted ripe olives	50Y 2.9R 2B	1.37%
A	Olive oil expressed from salted ripe olives	20Y 0.4R 2B	1.68%
B	Olive oil expressed from unbrined green olives	100Y 20R 12B	0.70%
B	Olive oil expressed from brined green olives	100Y 20R 12B	0.78%

* The olives used in Series A and B, respectively, were as nearly uniform as possible but minor differences are to be expected.

Table I shows the color and free fatty acid of California olive oils prepared by different treatments and particularly shows the effect of salting on ripe olives and brining on green olives.

When infusing a refined vegetable oil with 10 per cent of ground salted ripe olives, the infused oil will contain only about 3.5 per cent total olive oil, as the salted olives used in the treatment contain an average of 35 per cent olive oil. This 3.5 per cent of olive oil present in the infused oil will generally give as much flavor and aroma as 20 per cent or more of olive oil when added directly to produce a blended oil, even where olive oils of pronounced flavor characteristics are used for blending purposes.

The olive flavor and the olive oil aroma may be further intensified by including between 20 and 35 parts per million of benzaldehyde in the olive flavored oil (3). This may be accomplished by adding to the olive paste between 1 and 2 per cent of finely ground bitter almonds or similar products in the drupe family (4). Since the olive paste contains 15 to 25 per cent total moisture, sufficient benzaldehyde is developed from the amygdalin contained in the bitter almonds to intensify the olive flavor without giving the oil any noticeable benzaldehyde aroma.

With respect to the future of these olive oil substitutes, it is believed that the sale of olive oil in the future and the importation of olive oil in a post-war economy will certainly have to reckon with a large proportion of olive oil substitutes. The continued sale of these olive oil substitutes will depend largely upon whether they meet the needs of the consuming public in supplying a sufficiently intense and desirable olive flavor to serve in replacement for olive oil in the American diet. This in turn will depend upon the quality of the olive oil substitutes made available by oil manufacturers and producers during the present war period.

(3) Musher, S. U. S. Patent 2,282,782, May 12, 1942.
(4) *Ibid.* U. S. Patent 2,282,781, May 12, 1942.