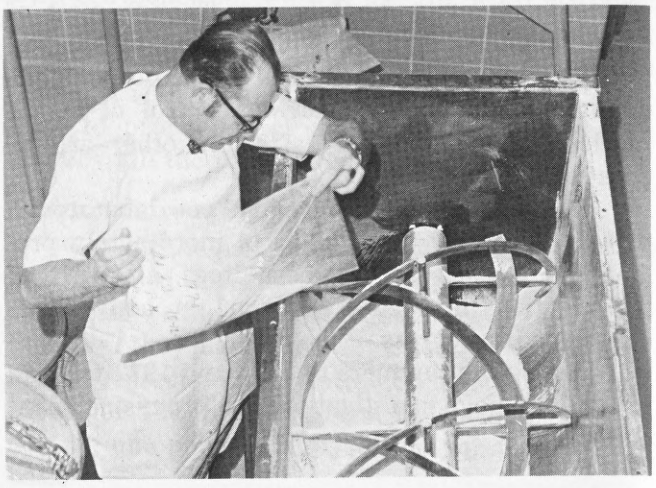
Generally Recognized As Safe



To add preservatives in the necessary minute amounts (parts per million), Dr. Shuey first dilutes them in a premix.

William C. Shuey

The word "grass" has many different connotations, dependent upon the background of the individual; to those who smoke it, the potential trip from reality to fantasy; to those who feed it to their livestock, the potential growth from malnutrition to healthiness; to those who use it as a preservative in food, the potential retarder from soundness to putrefaction.

The GRAS discussed in this article is a term coined by those associated with the food industry to denote compounds "Generally Recognized as Safe" for use in foods by the Food and Drug Administration (FDA). These compounds are referred to as preservatives, antioxidants, and flavorings. However, a compound declared as GRAS does not imply its approval for indiscriminate use in amount and application.

The difficulty of segregating chemical compounds as to whether or not they are strictly food preservatives does not offer a definite line of demarcation for classifying such compounds. For example, insecticides and fumigants are not generally considered as food "preservatives." However, a food "preservative" is usually defined as a chemical compound or mixture of compounds which is applied to raw materials or products for the specific purpose of preventing spoilage due to the growth of bacteria, yeasts, or molds. Anti-oxidants are a special type of compounds used in food preservation that help check the oxidation of fats. But because of the wide use of various other compounds for preventing rancidity, there is a broad group of so-called antioxidants.

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Many of the GRAS compounds may be obtained either as a natural component of a plant or animal or as a product of biosynthesis. Tocopherol (Vitamin E), an antioxidant, is an example of the former, while acetic acid, the sour component of vinegar, is an example of the latter, but both compounds can be artificially made. Such compounds as sodium propionate, sodium benzoate, butylated hydroxy anisole (BHA), and butylated hydroxy toluene (BHT) are acceptable and often used synthetics.

The manner in which a compound acts as a preservative or antioxidant is varied. Not only does the compound itself play a role but also the food to which it is being applied. Some compounds may destroy chemical linkages, others membranes of cells, and still others block metabolic pathways of growth or synthesis by inactivating enzymes. In the case of antioxidants, some compounds have a synergistic action; that is, a cooperative effort in preventing oxidation of fats, and others a protective action for the antioxidant.

The method of applying preservatives is almost as varied as the number used and the kinds of foods to which they are added. The preservative may be in a gas, liquid, or solid phase. It may also be in a solution or an emulsion. The product may be sprayed with the compound, immersed in the compound, or mixed with the compound, depending on their states. Variation in application also may influence the effectiveness of the preservatives and the amount which may be applied. Not only may it be applied to the food itself but also to the food container.

The need for these preservatives is to destroy the microorganisms (molds, yeasts and bacteria)

which may be found in food. This not only will reduce spoilage and increase shelf life of the product, but also will prevent formation of highly toxic substances called mycotoxins. Antioxidants retard autoxidation of fats to form free fatty acids. Excess amounts of fatty acids are associated with oxidative rancidity, the cause of unpleasant odors and unpalatability in food.

It is almost impossible today to take from the grocery shelf a packaged food that does not contain a food preservative. In baked goods, especially bread, calcium propionate or sodium propionate are common preservatives. For the packaged dry cereals such antioxidants as BHA and BHT are listed as additives. In fruit juices, jellies, preserves, syrups and similar products, sodium benzoate or other benzoates are used as the preservative. Over 100 different compounds could be added to the list of preservatives, as well as several thousand products. The benefits a consumer derives from these additives should not be overlooked.

Rope, at one time a dreaded infection in a bakery, is almost unheard of in our modern clean plants. Ropy bread, a rarity today, is caused by the action of a bacteria converting bread ingredients to a semi-solid state. The consumer no longer sees the unappetizing, discolored appearance of a slimy and gummy slice of bread with a sickening sweet odor of overripe fruit. Preservatives have helped to bring about this change.

BHA, BHT Preserve Chips

What would be the fate of the ever popular potato chip today, if it were not for BHA or BHT? Who enjoys a snack that has become rancid? Not only are cereal products or snacks unattractive when they become rancid, but also the odors are repulsive. The antioxidants have assisted in arresting the formation of the fatty acids which cause rancidity; therefore, a palatable product is maintained for a longer time.

Today the concept of GRAS (generally recognized as safe) food ingredients is under attack. Consumerism has made the public more aware of the use of the preservatives in our foods than ever before. Klis (1) entitled a recent editorial "GRAS at the Crossroads," and pointed out some steps being taken by the food industry in making a complete review of GRAS.

Hall and Oser (2) reported on the recent progress which has been made in reviewing food flavoring ingredients by a committee of the Flavors and Extract Manufacturers' Association (FEMA). Between 1958 and 1964, 267 natural or synthetic ingredients were dropped after a review of 1,124 flavor additives. Screening ingredients for toxicity and suitability is an endless but continually more reliable task because of new and more precise technology.

A virgin area of investigation is that of supplanting the preservative as an additive in the raw material. The ideal food would be one which contains a sufficient quantity of a natural preservative to be effective. If such a goal could be attained, the need for an additive would be eliminated.

Tocopherols as Antioxidants

It is not inconceivable that such an objective could be obtained. For example, tocopherols are important as antioxidants. Four have been identified in wheats—both hard red spring and durum. Their role as a vitamin in human nutrition has had considerable attention but little so far as natural occurring antioxidants in wheat. However, in the case of durum wheat, tocopherols could be very much involved in inhibiting lipoxidase activity and therefore protecting semolina color which is an important factor in durum quality. Durum wheats with higher tocopherol content may produce pasta products that have a more desirable color and would therefore be in greater demand.

Whole wheat flour, another example, is usually ground from hard red spring wheat. However, whole wheat flour will become rancid after a short time (4-8 weeks), especially in warm, humid areas. If a spring wheat could be developed with a tocopherol content high enough to inhibit the production of fatty acids, it would extend the safe storage period of the whole wheat flour. Spring wheats possessing this attribute would demand a premium price.

In both of these examples, however, all other quality factors must be retained. Investigations have been started to determine the actual role of the tocopherols in wheats as an antioxidant. If indeed, they do exert the influence as hypothesized, the study could be expanded to determine if, by breeding, the tocopherol content of wheat could be increased enough to be effective.

The field of food preservatives is not static but dynamic; continued investigations and re-evaluations are improving the product both as to the raw material as well as the additives. Such an approach will spawn palatable and healthier foods.

REFERENCES

1. Klis, John B. 1970. **GRAS at the crossroads.** Food Technology, 24:9.
2. Hall, Richard L. and Oser, Bernard L. 1970. **Recent progress in the consideration of flavoring ingredients under the Food Additives Amendment. 4. GRAS substances.** Food Technology, 24: 25-28, 30-32, 34.