
Botanicals: Interesting new tools for the flavorist

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Originally, all flavors were natural, derived from plant and animal sources through thousands of years of experience. Some of these materials were very simple collections of spices used in local foods. Others resulted in some very sophisticated processes such as wine and cheese making. These natural flavors and flavor processes proved entirely satisfactory until relatively recent times. It was only since the development of large cities and heavy industrial development that natural foods and flavors became totally inadequate to provide an adequate diet to a rapidly expanding population.

It was the growth of the food processing industry that provided the initial impetus to developing synthetic flavors. As processed food took ever larger proportions of our total diet, the demand for large amounts of flavors that are stable to heat, cold, vacuum and other food processing conditions created the development of synthetic flavors, primarily based on the synthesis of chemicals that occurred naturally in our traditional foods.

A few years ago, it was generally assumed that the use of synthetic flavors would continue to

grow and eventually almost entirely displace natural flavors because of their lower costs, increasing quality and unlimited availability relative to natural flavors.

A profound change has come over the world economy in the last 10 years and the assumptions of the inevitable superiority of synthetic materials has been rudely shattered. For the first time in many years, the production of natural rubber will be greater than the production of synthetic rubber. The natural fibers of cotton and wool have been taking a larger percent of the textile business for the last several years, at the expense of the synthetic fibers.

It is quite possible that the use of natural flavoring materials has increased its share of the total flavoring market in the last year or two, although there is no definite way of proving this. While part of this reason may reflect the current popularity of "natural foods" it is at least equally due to the sophisticated processing and utilization of natural materials that take better advantage of inherent flavor qualities and minimize the traditional problems associated with these materials. Our experience indicates that the use of natural flavor extracts has increased significantly in the last year which we assume extrapolates to the entire flavor industry.

All photos are courtesy of Meer Corporation.

One of the greatest shocks to the industry over the past 10 years has been the forceful recognition that synthetic materials based on petroleum were certainly not either stable in price or dependable in supply. This assumption that had underlined the rapid increase in the use of synthetic materials forced a dramatic change in the attitude of many industrial users. In contrast, the growing agricultural expertise in developing countries has provided a much more stable and dependable supply of natural materials. In addition, the greater technical ability of the importing and processing companies now provide natural materials in the form of extracts, absolutes, and other derivatives of natural materials that are far more uniform in flavor, as well as cleaner and with a remarkable degree of supply dependability.

The continuous effort of importing and processing companies has resulted in recent years in the creation of new and more useful forms of botanical extracts which include natural flavor blends and bases for the food, beverage and flavor industries, as well as concentrates and ab-

solutes which can be utilized in unique ways to impart additional flavor notes to natural flavors.

Botanical flavor extracts differ from essential oils functionally in that they represent the "taste" or "mouthfeel" component of the flavor rather than only the aroma or essence. They are, therefore, important constituents to use to add natural character and body to flavors, and we at Meer are constantly trying to make them more useful. Most flavorists are aware of such extracts as:

Foenugreek: As a basic extender and/or substitute for Maple flavor.

Kola: As the astringent component of the Kola beverage giving it more flavor retention.

St. John's Bread: As a versatile flavor ingredient to be used for or with Vanilla and Caramel and many other flavors.

Apart from these, there exist an armory of Natural Flavor Extracts that add a new horizon and dimension to be exploited by flavorists as "vistas" for their flavor creations.

There is often a problem using relatively lower flavor strength of normal botanical extracts

Botanicals stacked in warehouse. Huge inventories assure a steady supply of botanicals, helping to alleviate problems caused by short crops or other economic conditions.

versus the essential oils. Realizing this need for more concentrated flavor extracts and the necessity of new approaches to obtain different grades of flavor extracts innovative extraction techniques have been used to produce concentrates which are not only significantly stronger in flavor strength, but also have uniquely different flavor characteristics from standard extracts. Hence these products can add another dimension to the flavor profile available.

These extracts are botanical absolutes for the most part soluble in alcohol. One example is Foenugreek absolute which when tasted at 0.01% versus a solid extract Foenugreek at 0.1% has both a characteristic Foenugreek aroma and a bitter somewhat protein-like taste. This flavor concentrate is more suitable as a spice for curry seasonings as opposed to the full-bodied, round, brown maple characteristic of the solid extract. Additional concentrates in this category may be classified as:

Green Fruity Types:

Alfalfa has a green, leafy, full-bodied mouthfeel suitable for flavors such as green, melon, cucumber, tomato and green vegetable flavors. Also certain berry types and Virginia type tobacco flavors.

Chestnut Leaves has a fresh, green character suitable for flavors such as green, melon and cucumber.

Astringent-Nutty Types:

Black Walnut Hulls has a woody, astringent, warm character suitable for flavors such as coffee and nut.

Kola Nut has a smokey astringent, animalic-meat character suitable for such flavors as coffee, nut and meat.

Oak Chips has a woody, smiley character suitable for flavors such as wine and whiskey blenders.

Seafood Types:

Kelp has a marine, amine character suitable for flavors such as clam, shellfish and other seafood types.

Characteristic Types:

Foenugreek has a strong, aromatic, bitter somewhat protein-like character suitable as a spice for curry seasonings.

Cocoa has a characteristic, strong, aromatic cocoa character with a slightly astringent taste suitable for chocolate flavors and in artificial flavors in coatings.

Rye has a cereal like, grainy character suitable for coffee flavors and whiskey blenders in cordials.

One drawback which has limited the use of botanical flavor extracts is that their characteristics are not well known to today's flavorists. In

the case of essential oils, the name often suggests the aroma and flavor character. On the contrary, the names of certain botanical extracts may even be misleading in terms of their flavor and areas of usefulness. It is a real challenge to the flavorist to learn (or re-learn) the character and flavor profile of each of these natural products, and to find a place for their unique flavor qualities in more sophisticated and complete flavors.

The recent development of our flavor blends-enhancers for fruit WONFS is particularly interesting to flavorists. These do not contain any fruit juices or essences but strictly represent the so-called "ONF" constituent of natural flavors. In terms of flavor character, they do not represent any specific flavor type. Therefore, they are versatile tools in the hands of a flavorist to create a variety of fruit WONFS.

A "berry type" has a subtle, fruity, berry type character; a "dried fruit type" has a woody, fruity character reminiscent of raisins, figs, dried currant, etc. and a "green note" has a fruity, green character reminiscent of green apples, pears, etc. and is suitable as a natural counterpart of "leaf alcohol" to give the touch of "green" to fruit WONFS.

In addition, flavor blends which represent specific flavor types rather than "flavor building blocks" are available. These blends can be used as a basis for complex natural flavors as well as a total flavor system: such flavor blends as coffee, root beer, maple, chocolate, vanilla, licorice, pistachio and tea.

Another area of interest to the flavorist is the increasing use of flavors in the tobacco industry. The emphasis on low tar yet flavorful tobacco products has required higher flavor levels of botanical flavor blends and concentrates as extenders and enhancers particularly to improve the taste and aroma of reconstituted leaf, low quality tobaccos and tobacco stems.

Another major source of natural flavors that has become widely popular in the past few years is herb and herbal products. Although herbs have been used for centuries as both a beverage and a tonic, their applicability to today's market place has been newly recognized throughout the world. They have been seen as a source of vitamins, a medicine suitable for a variety of ailments, as well as a good tasting beverage. Many of these herbs also have the advantage of not containing caffeine, present in coffee and both green and black teas. The types of herbs most often seen in teas are Hibiscus Flowers, Rose Hips, Chamomile, Lemon Grass, Orange Peel, and both Spearmint and Peppermint Leaves, although other herbs are frequently used to add flavor or to alter the scent.

In addition instant herb extracts have been developed which are free-flowing powders soluble in both hot and cold water. They allow a

An integrated large milling facility. The processing of botanicals requires large cutting, cleaning, milling and blending facilities using air to convey from one operation to another automatically.

Tanks and extractors in extract department are shown above left; some of the equipment required for the processing of natural flavor extracts. Aerial view of Meer Corporation plant at North Bergen, New Jersey, is shown above right with 10 acres of warehouse storage and processing facilities within the radius of greater port of New York.

This is a quality control laboratory. Quality control is perhaps the most important function in the procurement and processing of natural flavor extracts using the latest technology.

beverage to be prepared quickly and easily while retaining their flavor and consistency even as iced drinks for summer refreshment. These herbs can also be blended together to create punch-type and other flavors. While they were originally developed for the instant herb tea market, they also lend themselves beautifully to the flavor industry as a raw material in flavor compounds. Natural colors such as Annatto, Paprika and deflavored Turmeric also lend themselves for use as flavor raw materials.

The use of natural products in the field of medicine included natural flavorings and colors used to mask the flavor or appearance of the medicine. Both Kola and Ginger Ale sodas began as tonics known for their ability to soothe the body's digestive system. Then, slowly, soothing became associated with good-tasting and these beverage flavors with all their variations have achieved wide acceptance.

The development and processing and standardization of these botanicals for industry requirements has been an important contribution to their use. The quality control function is a most important part of the entire procedure of procurement.

The Flavor Extract Manufacturers Association (FEMA), recognizing the adverse publicity spices and other botanicals have received over the cleanliness issue, have deemed it both necessary and worthwhile to create a Sanitation Committee of Botanicals under the chairmanship of Dr. William A. Meer. This committee has worked to coordinate sanitation procedures with members of the flavor industry and the Food and Drug Administration.

This combined effort prevents the imposition of arbitrary guidelines by the FDA on defect action levels and keeps sanitation procedures uniform throughout the flavor industry. This collaboration between the FDA and FEMA will eventually establish defect action levels which are appropriate to the raw materials and that will enable the industry to have a continuous supply of necessary raw materials.

The basic procedure utilized since 1977 in order to facilitate the preparation of these guidelines was for a company laboratory to perform tests analyzing the macro-sanitary filth of a product and then to submit duplicate samples to each of two qualified member companies for collaborative testing. If any discrepancies resulted, a referee laboratory would then further verify the results.

Currently sanitation procedures only encompass macroscopic sanitary tests on botanicals, as valid micro analytical procedures have not yet been developed for these materials. Nevertheless, through the efforts of this committee and the individual member companies, research is being done on various ways to uniformly inspect the cleanliness of materials imported from

Laboratory technician using a microtome to prepare a histology section to be used for positive botanical identification. Cleanliness of botanicals received a big boost with the formation by Flavor & Extract Manufacturers Association of a Sanitation Committee of Botanicals chaired by Dr. William A. Meer.

around the world and guidelines will be developed in collaboration with FDA through the FEMA Botanical Committee.

The processing of a botanical usually begins with the availability of the "whole" botanical. This means the part of the plant that is useful commercially, whether it be the root, the herb, the leaf, the seed, the bark or the fruit of a plant. Depending on the product that is to be produced, the botanical can be cut, ground, ground for percolation (GFP), cut and sifted, tea bag cut and powdered.

Upon arrival at its warehouses, and even beforehand, quality control must make certain that these goods meet FDA sanitation guidelines. When the material is received at the warehouses it must be quarantined while subject to various testing procedures. All the warehouses are sealed and fumigated with methyl bromide gas

Gas sterilizing unit using ethylene oxide. Microbial counts are kept in check with a treatment cycle using gas sterilization, another modern processing development.

on a periodic basis, and incoming raw material containing live insects are, of course, fumigated upon arrival. Statistical sampling for inspection of these goods is done on the square root plus one of the number of containers received.

The GFP product is used to extract the raw material usually with a solvent such as alcohol, or water, but sometimes more exotic solvents such as hexane or ethylene dichloride are used. The percolate is collected and filtered into a vacuum still which is heated with steam. The temperature is maintained at as low a temperature as possible, consistent with the boiling point of the solvent at high vacuum. The material is reduced to a "solid extract" which has the heavy consistency of a molasses-like product. The extract must then be stripped under high vacuum to remove residual solvents, and it is then standardized for flavor strength or appropriate drug strength if it is to be used in the pharmaceutical industry. The material is packed and sealed under partial vacuum to insure that it retains its properties and to allow it to maintain a long shelf life of at least two years.

The basic extract might be spray dried or vacuum oven dried with a suitable carrier to produce a "powdered extract" that has generally the same flavor strength as the solid extract. Botanicals are not very volatile and do not oxidize as readily as essential oils. Therefore, there is less flavor loss or degradation.

Of course, there can be many intermediate steps needed in the preparation of a particular product to obtain further purification and/or concentration. This can include liquid-liquid

extraction, precipitation, crystallization and other processing techniques. The flavor extracts are then tested and standardized for taste as well as for their physical properties which include color, total extractives, refractive index, specific gravity, volatile oil content and other chemical methods as well as by gas-liquid chromatography where appropriate. The drug extracts are standardized for their active ingredients using the classic alkaloid assay procedures and/or the current techniques which include spectrophotometers and high pressure liquid chromatography and thin-layer chromatography.

The botanical industry has seen increased emphasis by its customers as well as by the FDA through their official compendia such as the USP, NF, and FCC regarding microbiol counts and in particular the pathogenic microorganisms. This is a particular problem for botanicals which are for the most part collected rather than cultivated. Generally, the microbiological counts are quite high and in order to reduce these figures dramatically it is necessary to use gas sterilization. A treatment cycle for each product must be established . . . time, temperature, amount of gas and the proper gas (ethylene or propylene oxide). Of course, there are guidelines and specifications for gas residues, glycol residues and chlorohydrin residues which must also be monitored. Generally as a guideline one can expect a 90% kill ratio based on the count in the starting raw material, but of course this will vary depending on the actual product.

A more recent innovation which is having a great deal of publicity is irradiation using cobalt 60 which is also used to reduce microbiol counts. This is primarily a preservation technique that has been under development for a long period of time for use in foods. The recent impetus was caused by the notice of the Food and Drug Administration of a proposed rulemaking on irradiated foods. The procedure is available commercially and it has been used successfully on spices, enzymes and botanical pharmaceutical products. There is no reason to expect that it would not be useful on the processed botanicals for flavors as well. The current guidelines are 100 krad, but 1000 krad would seem to be a more appropriate level for sterilization purposes. The advantage of using this procedure is that there are no residues to be concerned about and the fact that the procedure can be run at atmospheric conditions and without any heat. The entire matter is still under review.

Based on the above, it should be recognized that the botanical industry has matured in its production procedures, processes and controls. It has achieved a level of sophistication and expertise that makes it and its products a valued partner with the flavor and fragrance industries.