

PERFUMER & FLAVORIST

Flavor R & D at a Consumer Products Company

By Colin Ringleib,

Pepsico Research & Technical Services, Valhalla, New York

The difference in perspective between a flavor supply company and a consumer products company has a large effect on the day to day activities of flavor development or research chemists; therefore, I would like to discuss these differences and how they affect our growth and development within the flavor profession. I would also like to talk about the process of developing a flavor for a new beverage product for our company, Pepsi, and to give a feeling of what issues regarding the flavor selection and commercialization are critical, which may help others to understand what happens when a flavor is tested for use in a new product.

Pepsi-Cola Beverages is a major division of Pepsico Inc. This beverage division is composed of three subdivisions including Pepsi-USA, Pepsi International, and Pepsico Wines and Spirits. Our Flavor Group at Pepsi-Cola supports these three beverage groups exclusively. The other



Pepsico Divisions handle their own Research and Development needs independently. Pepsi-Cola is a franchise business and our product is a flavor concentrate which we sell to our own bottlers exclusively. Our concentrate component contains not only the flavor, but any color, acidulate and juice necessary for the product. The bottler adds sugar and carbonated water, packages, and distributes the product in a franchised territory.

Pepsi-Cola Company is more than just Pepsi Cola. Although colas are our major product, we also make a wide range of flavor products both in the United States and internationally. We manufacture Mountain Dew, Slice (including apple, orange, lemon-lime, and cherry-cola) and the Patio line of flavored sodas for use primarily in the United States.

We make products for use in over 140 countries worldwide. These include Mirinda Orange, Teem Lemon-Lime and 7-Up as well as a wide range of other flavors. Last year sales of Pepsi-Cola products amounted to over 4.5 billion gallons of beverage. Pepsi's sales of products are equal to about 20% of the total market for carbonated beverages worldwide. The key element in all of these products is the flavor. It must be pleasant, unique and fulfill the consumers expectation for refreshment.

In-House Flavor

Why should a consumer products company have its own flavor group? One of the primary benefits evolves from the close interaction of the flavor staff and the product developers. They can interchange information quickly on the flavor properties required for the product.

Another benefit, a high degree of confidentiality can be maintained about the flavors and the products being developed or modified. By controlling the entire formula, the purchasing department can use a combination of market forecasts for the final product sales and an understanding of the necessary ingredients to develop an inventory policy to protect the product. This control of the formula also helps to assure that the proper regulatory review is given in whatever markets the product may be employed.

Last but not least, cost containment can be a considerable advantage. But this can be a two-edged sword. Since consumer products companies often have large overhead, only products with significant volume can be justified for production in-house. The many hidden costs of purchasing, inventory, quality control, and manufacturing may make an in-house produced flavor



more expensive than a purchased flavor. At Pepsi, our major brands enjoy significant cost advantages due to in-house production, whereas some relatively small volume products might be more economical if purchased elsewhere.

- **Flavorist—Product Development Interface**
- **Fast Turnaround**
- **Confidentiality**
- **Control**
- **Cost**

Another important consideration to Pepsi and many other consumer products companies is the legal or regulatory issues surrounding their marketplace. Since the single most important attribute of our products is the flavor, it is important in defining our trademarks. The protection of the flavor formula as a trade secret is critical to maintaining this trademark. The franchise type

agreements we have with our bottlers are dependent on us being the sole source of the products we supply.

The correct labeling of products is also critical since bad publicity regarding a consumer product such as Pepsi could have a devastating effect on its marketplace. By exercising this high level of control, we minimize our vulnerability to these issues.

Concept Development

A new product requires three major steps. The first step involves determining what type of product is desired and what market exists for it. Often, no actual product will exist during this phase. Marketing and R&D each feel out what opportunities exist for a new product. Interviews with consumers and discussions of product preference and attitudes are evaluated to define new product opportunities. Often preliminary products may be used to allow the consumer to evaluate the product concept against a potential implementation. This initial phase of the new product process is often the most frustrating.

- **Definition**
- **Development**
- **Commercialization**

The actual product development phase will begin when a clearly defined product concept is accepted. This product concept may change several times during the development process. The evolving product is challenged through a variety of consumer tests to evaluate the concept fulfillment as well as to test if the product concept will generate the desired market. Many technical difficulties will need to be overcome before a product can move to the commercialization phase.

The successful product commercialization really begins with the conception of a new product idea. The flavorist needs to think about how the flavor will be produced throughout the project cycle. It does not matter how good a new product is unless it can be produced in an efficient manner at a price the consumer will be willing to pay.

It is important to keep in mind estimates of the market potential and what raw materials will be required as well as what processing techniques and equipment will be used. The availability of



each raw material must be estimated at both the anticipated market as well as the potential upside market. The cost estimates are often based on current costs of raw materials. New demand or the combined market demand may exceed supply which will obviously affect cost and availability. Even rumors about a new product can sometimes affect the market for a new ingredient. During the whole project the flavorist must be aware of all factors needed to produce the flavor.

Product Definition

As I mentioned before, the product definition phase is often critical if a successful product is to be developed. The effort devoted to clearly defining what market to enter and what consumer need to fulfill is well spent. Many different ways define what product opportunities exist. During the last five years, the developments within the United States are most familiar to us, but Pepsi has been actively developing new products for worldwide markets. I would like to use some examples of Pepsi's new products as they relate to these development concepts.

Market research is the use of consumers to define how they view a current or new market. It can be strictly opinions or perceptions or it can be done using real or prototype products. It can

presence of a competitive product required a new product to vie for the same consumers. The presence of juices allowed Cherry Cola Slice to be distinguished from other similar products.

Apple Slice is an example of new technology making a new product introduction move forward. We had been exploring an apple concept for some time, but no one seemed to be very enthusiastic. Our new technology, although certainly not earth-shattering, was the development of a new natural apple flavor which caught the attention of product development, marketing, and the bottlers. Suddenly, a product no one was very interested in became a new product in national distribution. There are many examples of new technology making new products possible. Flavor development often plays an important role in making new ideas work and the creativity of flavorists can have a significant impact.

The changing environment of the marketplace is constantly making new products possible or practical. The desire for reducing the intake of caffeine created a whole new category of caffeine-free products such as Pepsi-Free. The current success of seltzers and bottled water is a

- **Market Research**
- **Competitive Review**
- **New Technology**
- **Changing Environment**
- **Tag-a-long Brands**

utilize advertising claims or product descriptions. It is clear that market research can be used to test product ideas, but it is not always apparent how it can actually originate a new product concept. The original Lemon-Lime Slice is an example of this type of product idea. During interviews with consumers, it became clear that many people assumed lemon-lime sodas contained juices. It was apparent that added juice in a soft drink would be highly acceptable to consumers. The technical challenges of making the added juice taste good required not only flavor development but unique juice processing.

Cherry Cola Slice is an example of the influence of competition at work. The successful



combination of water quality concerns and the negative image of alcoholic beverages in some social situations. Again the marketplace is changing due to changes in the way consumers view their world.

My last example of product definition is to add a new product which is a natural extension of an established segment. Orange Slice followed the success of Lemon-Lime Slice as an obvious choice due to the market's familiarity with orange soda. The high quality of this product is necessary since the consumer will often have a ho-hum attitude to such an obvious market extension. The flavorist needs to keep in mind what the consumers expect and to look for new ways to interest them with flavor.

Product Development

The development of a new product, and in particular a new beverage, requires a high quality flavor. With our beverage products, the characteristic most important to the products' success is the flavor. Other attributes such as juice, appearance or vitamins do not compensate for a poor flavor. The consistency of the flavor is also important since the consumers expect the flavor to be the same each time they use it. This may be critical in a natural flavor where the raw materials may vary widely. Our flavorists work hard to assure that the flavor ingredients we use can be obtained consistently.

- **Target Selection**
- **Prototype Formulation**
- **Consumer Testing**
- **Concept Refinement**
- **Competitive Testing**

We work closely with the product development team to fine tune the products we will present in consumer tests which can cost from \$1,000-\$50,000 per variant, depending on the type and size of the test. Careful screening of proposed products can significantly improve our chance of identifying a new product quickly and inexpensively. Because the flavorists' major involvement is early in each development cycle they can suggest product changes and is in a position to identify flavor notes which are out of balance.

When a new flavor is selected for consumer testing, it may take 4-8 weeks to get the results back. If negative results are obtained, the flavorist can quickly incorporate whatever diagnostic information was obtained and create a new set of flavor prototypes.

If a successful flavor is defined, much must be done before the product is introduced. We will need to determine the stability of the flavor and the final product under a variety of packaging and storage conditions. This stability testing phase can take up to six months or longer.

A new product will need to be further tested by marketing to confirm the products positioning, purchase intent and concept fulfillment. We will also be concerned about how potential competitor products will be perceived. We must also test if the new product will alienate our current users or erode share from similar products that we may already have in the market.

Commercializing the Product

If all of the development goals are met, the product will move into the commercialization stage. As I mentioned before, flavorists need to be thinking about commercialization from the very beginning. We often start this phase before a final product formulation is determined. The time pressure of bringing a new beverage product to market means that we need to take risks and start product scale-ups on a variety of prototypes. Since we often require large amounts of raw materials in a new product, we must fully evaluate the market for each of our raw materials. Alternatives, second suppliers, political instability, and cost estimates are all factored to yield an inventory position and an assessment of the risk to maintain a new product in the marketplace.

The scale-up of the flavor may involve approving commercial lots of raw materials where only samples were used before. Many raw materials will need to be scaled-up by our suppliers if they are new products for them.

We will need to prepare the documentation necessary to maintain a trouble free manufacturing process. Most of our flavor products are produced in 500-5,000 gallon lots. This can involve \$5,000-\$100,000 worth of product in each batch. A mistake can be costly and it may not be possible to utilize it anywhere. We hope that production problems will surface now rather than during our market launch. But the cost of production makes it prohibitive to produce a large number of experimental runs.

We also begin the process of defining the raw materials, intermediates, and final product spec-

ifications. We need to address the testing methods to be used. The flavorist must assess what variation is acceptable for each raw material. The flavorist's role in the development of a new product is very important but the overall

- **Raw Material Sourcing**
- **Flavor Scale—up**
- **Manufacturability Testing**
- **Quality Assurance**

team effort is what makes a new product get to market. The efforts of marketing, product development, engineering, packaging, quality assurance, and production when combined with a quality flavor can lead to a successful new product.

Flavor Research

As flavor developers we spend a large amount of effort on flavor research issues. It is virtually impossible to undertake a flavor development program without the research support. Our major focus in flavor research efforts is on raw materials, not from a control process, since we have another group to handle this, but to aid the developers in selecting ingredients. We characterize our new ingredients to determine what flavor active components are present and how consistent the composition remains lot to lot. We are very interested in assuring that our natural ingredients are correctly labeled. We feel it is our responsibility to go beyond supplier certification and some of the newer test methods such as carbon-14. Although they are important criteria, it is often possible to fool any analytical test.

The highly visible nature of our products make it necessary for us to do whatever is possible to assure that our ingredients are properly labeled. During the last several months, we have seen several so-called natural ingredients which were obviously mislabeled. These include a mango essence containing ethyl maltol which does not occur in nature. A peach essence contained added synthetic linalool; this was determined by the presence of dihydrolinalool which is an impurity of the synthesis and does not occur in nature. We have also seen a so-called raspberry distillate which was supposedly derived only from raspberries. One major volatile was anethole which has not been previously reported as a major component of raspberries.



Our Flavor Research Group is also used to study the flavor composition of our competitors' products. When a new product is introduced, one of the first questions involves what flavor ingredients may have been used. We use our competitor products to aid our flavorists in understanding how different ingredients may interact.

- **Raw Material Characterization**
 - Authentication
 - Alternatives
 - Troubleshooting
- **Competitive Product Analysis**
- **Flavor Stability**

We also spend a lot of time looking at the composition of our own products. The effects of time, temperature, pH, and light, as well as the interaction of flavors with the package and other non-flavor ingredients contribute to the flavor of the final product. Our products can take 2-20 weeks to get to the consumer, and it is critical to understand the chemical stability of our flavor systems.

Since we sell a flavor concentrate to the bottlers, and we must inventory flavor ingredients, we have an interest in the stability of these materials as well. It would be foolish to assume that no flavor change occurs in these items which may affect the final product acceptability. The more we understand the chemistry of our flavor materials, the better we can formulate improved products.

In conclusion, the flavor industry was born out of a need for flavors to add interest to our foods and beverages. The flavor industry exists in many forms today which is a natural extension of the cost, quality, and creativity requirements of our clients. We consumer products companies often have our own creative flavor groups, but still need the innovation and creativity of our friends in the traditional flavor industry. Although we all have different business responsibilities, we have a common goal of producing high quality flavors.

Acknowledgement

This paper was originally presented at a symposium, Advances in Flavor Research and Technology, Cook College, Rutgers, The State University of New Jersey, in New Brunswick, NJ on April 22, 1987.

Address correspondence to Colin Ringleib, Manager, Flavor Development, Pepsico Research & Technical Services, 100 Stevens Avenue, Valhalla, NY 10595.

