

Think Break 5.5

Product testing: fruit drink powder development

Fruit drink powders are dissolved in water to give a refreshing drink. These drinks are popular with children, and are also used as cheap drinks for large parties.

1. Identify the ingredients in fruit drink powders by reading the labels on some powders available in the supermarket or by searching in the internet e.g. ‘Ingredient manufacturers turn powder into health gold’ by David Feder.

<http://www.foodprocessing.com/articles/2008/370.html> Sighted 14/11.2008.

2. Identify the important product qualities in such powdered drinks, and suggest how you might test these product qualities with laboratory testing, with trained sensory panel testing and with consumers.

3. Fruit drink powders are produced by mixing the ingredients so that they are evenly dispersed and then they are packed into sachets. Identify important factors in this processing and packing.

Outline the method you would use to develop a fruit drink powder, combining Figures 5.1 and 5.2 in one diagram.

There are three important general activities in product design: product formulation, packaging development and processing development.

5.5 Product formulation

Many food products are made by combining raw materials in specific proportions in a formulation, and research on the effects of various formulations on product qualities is common in product design.

In systematic formulation there are five steps:

- Set the product qualities required,
- Find data for the raw material compositions, qualities and costs,

- Determine limits on the raw materials and the processing variables,
- Use quantitative techniques: linear programming, experimental designs, mixture designs,*
- Use product profile tests and technical tests to relate product qualities to changes in formulations.

(*there are many useful computer software packages to use these statistical techniques.)

The raw materials can be divided into two groups: the basic product raw materials and the 'top' or aesthetic raw materials. This does not mean that the basic raw materials do not give aesthetic qualities to the product - in fact in modern food design this is recognised as a fundamental factor. But sometimes there is a need for the addition of colours and flavours to improve the aesthetic effect. The important properties of the raw materials in relation to the product qualities are recognised in the product design, as shown in Example 5.2.

Example 5.2 Raw materials for Thai Fermented Sausage (Nham)

1. Meat System: fresh lean pork and pork-skin, held at ambient Thai temperatures for three hours after killing.
2. Curing agents: sodium chloride, sodium nitrate, sodium tripolyphosphate.
3. Seasonings: white pepper, fresh garlic.
4. Carbon sources for fermentation: jasmine rice (cooked), glucose.
5. Starter cultures: *Lactobacillus plantarium*, *Lactobacillus brevis*, *Pediococcus cerevisiae*, *Micrococcus varians*.
6. Sausage casings: cylindrical tubes, 22.5 mm diameter, 30 cm long, made from laminated 15 micron uncoated nylon and 50 micron linear low density polyethylene.

Limits on raw materials

Meat system was set at 80% ground meat 20% sliced pork skin.

The low and high levels for the other ingredients and starter cultures were:

Raw materials	% meat system	Starter Cultures	cfu/g meat system
sodium chloride	1, 4	<i>Lactobacillus plantarium</i>	0, 10 ⁶
sodium nitrate	0.01, 0.03	<i>Lactobacillus brevis</i>	0, 10 ⁶
sodium tripolyphosphate	0, 0.5	<i>Pediococcus cerevisiae</i>	0, 10 ⁶
minced garlic	3, 7	<i>Micrococcus varians</i>	0, 10 ⁶
white pepper	0, 0.05		
cooked rice	5, 8		

Screening experiments

A Plackett and Burnam experimental design was used to screen these raw materials. From this, the important raw materials affecting the qualities of the Nham were identified as the four starter cultures and the rice, and in further experiments these were studied at different levels and under different processing conditions. Glucose as another carbon source was also studied. The other ingredients were fixed: sodium chloride 3%, sodium nitrate 0.02%, sodium tripolyphosphate 0.3%, garlic 7.0%, white pepper 0.05%.

Wiriyacharee, P., (1990) *The systematic development of a controlled fermentation process for Nham, a Thai semi-dry sausage*, Ph.D. thesis, Massey University, New Zealand

In formulation studies, the important development in the last ten years has been the use of the computer. First, there is the raw material database on the computer; this started by detailing the chemical and nutritional compositions of different raw materials but has expanded to other properties such as microbiological quality, sensory qualities and to the effects of raw materials in processing, where this information is available. For companies

with a narrow range of products, this raw materials database can be used in all product development projects as a starting point for formulation; in other companies with a wide-ranging product mix there may be need for two or three databases. The database is only useful if it is kept up-to-date and is also related to the company's buying policy.

The database can be used to build and analyse various formulations to see how they fit the criteria for the product qualities, the costs and the processing. This can be done quite simply using computer spreadsheets. There are also expert systems available which provide a decision support framework made up of two parts: a task part containing the distinct problem-solving steps involved in creating a formulation, and a physical part with the specific knowledge about the properties of the raw materials and the processes involved. As more information is obtained from factorial experimentation, mathematical relationships between the raw materials in the formulation and the product qualities are developed and these can be used in such techniques as linear programming.

Think Break 5.6

Product formulation: natural fruit ice-cream

For developing a formulation for natural fruit ice-cream, identify the important raw material variables and the important product qualities.

Relate each raw material to a product quality(ies); for example, lecithin, an emulsifying agent, stabilises the oil/water emulsion and gives smoothness to the ice-cream.

See: *The Science of Ice Cream* by Chris Clarke, 2004 Published by the Royal Society of Chemistry.

5.6 Packaging development

Packaging design at this stage concentrates on the packaging of the individual product; the outer packaging research is only related to decisions regarding size and to the protection required during distribution. The design of the packaging for the individual product is based on the needs of the consumer and the requirements of product preservation and protection in the product design specifications, but it also considers the process and the distribution, as well as the needs of retailers and the environment.