SORENSEN

foodlines

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*Lord of the far horizons,*
*Give us the eyes to see*
*Over the verge of the sundown*
*The beauty that is to be.*
*--Bliss Carman*

## Shelf Lives

When you buy a food product and like it, you will probably buy it again expecting to repeat the pleasant experience. If the product does not meet your expectation on this second trial, it may be due to one of these reasons:

- Inconsistent ingredients, processing or handling procedures (lack of control)
- Natural changes occurring in the product during proper storage and distribution (shelf life effects)

Although over thousands of years, the major advances in food technology have been to preserve food for long-term storage, there is still no such thing as perfect preservation. The food always changes during storage. The question is during what period is the product sufficiently unchanged to be offered to consumers.

| PREPARATION<br>PROCESSING<br>(AGING) | STORAGE<br>DISTRIBUTION<br>CONSUMPTION | UNTASTY<br>UNSAFE<br>DETERIORATED |
|---|---|---|
| A | B | C |
| ← ---------------------------→ | ←-----------------------------→ | ←---------------------------→ |

The transition from A to B is abrupt (unless aging is involved). The demarcation of B and C is less clear. Although many, many factors affect the length of B (shelf life), most effects fall into two categories.

## Chemical Changes

Both flavor and structural components of foods are continually subject to chemical reactions which alter their molecular structures and consequently their flavor, texture, etc. Examples include the reaction of unsaturated fats with air to produce rancid flavors and the slow breakdown of starch to produce a mushy texture. The speed of reactions of this type is directly related to the temperature.

A rule of thumb is that increasing the temperature 15°F will double the rate of reaction. Or stated another way, for every 15°F increase in storage temperature, the shelf life will be cut in half. This, of course, ignores the effects of light, air, enzymes, freezing/thawing, etc. Nevertheless, the rule is sometimes useful in estimating shelf lives. For example, if it is important for your new product to have a one-year shelf life but you can't afford to wait a year to verify that it does, an accelerated shelf life test is possible. Suppose that the usual warehouse storage is at 70°F . Then storage of your product at alternate temperatures will give varying rates of aging.

| **Description** | **Storage Temperature** | **Actual Age** | **Apparent Age** |
|---|---|---|---|
| Delayed aging (x¼) | 40°F | 2 months | ½ month |
| "normal aging" | 70°F | 2 months | 2 months |
| Double aging (x2) | 85°F | 2 months | 4 months |
| x4 aging | 100°F | 2 months | 8 months |
| x8 aging | 115°F | 2 months | 16 months |

After two months of storage, apparent ages will vary from two weeks to 16 months (depending on storage temperature). This means that in two months, we can have samples that appear to be "16 months old."

These samples can then be analyzed chemically (acids, peroxide rancidity, etc.), by a small group of trained tasters (triangle tests, etc.) or by a full consumer panel (hedonic scaling, attribute rating, preferences, etc.)

## Biological Changes

These types of changes depend on the growth of living organisms such as bacteria, yeasts, molds, etc. There is, in general, no way to speed up the growth of these living things so as to simulate an accelerated shelf life. It is true that if you raise the temperature of a refrigerated item, it will spoil more rapidly. However, the spoilage is usually due to a different type of bacteria which grow at a different temperature and may be completely unrelated to normal shelf life aging.

An alternate approach is to do a complete microbiological profile of the fresh product. From the amounts and types of the various microbes and knowledge of the nutrients in the food, an estimate can be made of the potential damage (with age) by each type of microbe.

## Proof of the Pudding

All of the methods discussed above give at best an approximate idea of shelf life. Only time and controlled experience can definitively answer the question, "What is the shelf life of this product?" After all, the benefits of both freshness and aging are arguable.