Q 2: Why Controlled or Modified Atmosphere Packaging?

A 2: The package requirements are often determined by the nature of the product to be packaged. If the product is sensitive to atmospheric conditions such as oxygen, carbon dioxide, acidity, or moisture, then it is often desirable to create an artificial environment around the product, which will be maintained within the package in order to avoid changes in the quality or appearance of the product.

Generally, "controlled atmosphere" (CA) is automatically assumed to be low in oxygen. While this is often the case, it is not necessarily the only atmosphere modification desirable. For example, moisture control to prevent corrosion or mold growth might in some instances be more important than presence or absence of oxygen. In all instances, however, it is assumed that the atmosphere provided in the package remains essentially unaltered for the shelf life period of the product. Thus the package must provide an adequate barrier to maintain the specifically designed atmosphere within the package, permitting no component to escape from or to invade the inner sanctum.

A few examples of controlled atmosphere are cited to illustrate the importance of this concept.

OXYGEN

The beneficial biological functions of oxygen are well known. These same biochemical properties may, however, work to the detriment of the packer.

For example, oxygen promotes not only macro but also micro life. Thus, microorganisms will grow within the package provided adequate oxygen, moisture, and nourishment are available. This phenomenon is most promi-
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nently found in moist food products, but could also be found in clothing or industrial products which are by nature moist and provide a nutrient such as a starch coating. The exclusion of oxygen may diminish this problem.

Oxygen may also contribute to the deterioration of the product by chemical means. Oxidation of fats and oils leads to rancidity of many an edible product. Oxidation of ferric metals gives rise to rust and corrosion. The chemical action of oxygen on pigments and dyes (normally in the presence of light) is responsible for fade.

Yet there are occasions when high concentrations of oxygen are desirable. For example, in the packaging of fresh meat, the bright red color depends on the chemical reaction between oxygen and myoglobin. According to one theory the meat is best packed in an oxygen enriched environment.

Packaging of various vegetative products are best carried on in a controlled atmosphere containing some oxygen. Since produce, fruits, and flowers are living, they do inhale oxygen and exhale carbon dioxide during their life cycle. To package such a product in an atmosphere totally devoid of oxygen would just suffocate it.

MOISTURE

Many products to be packaged are extremely moisture sensitive. It was mentioned earlier that the moisture content of the product may regulate its susceptibility to microbial decay. A favorite method of old, still practiced today, involves drying the product in order to increase its shelf life. The process of moisture removal has been improved in recent years through freeze drying and vacuum drying. One finds a great array of dried products in the supermarket which can be reconstituted by addition of water. In packaging such products the most important factor is the exclusion of moisture. Thus the atmosphere in the package must be as dry as possible.

There are instances when a high moisture content is most desirable. For example, in the packaging of baked products, low moisture content within the package may cause rapid evaporation of moisture from the surface of the product into the air space of the package and thus dry its contents. Consequently the baked goods stale prematurely. Packaging such an item as a gas pack would require the deliberate injection of moisture in order to maintain the relative humidity within the package at a reasonably high level.

CARBON DIOXIDE (CO₂)

This gas is often employed to replace oxygen. CO₂ would certainly inhibit the growth of microorganisms and is thus a suitable replacement atmosphere for protective packaging.