

Nutritional Aspects and Safety of Modified Food Starches

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The term "modified starches" covers a wide variety of starch-derived products. A number of techniques, such as those involved in bleaching, enzymic digestion, dextrinizing, and hydrolysis, have either no effect on the starch or are used to reduce the size of the starch molecule. The latter process is similar to the digestive process, as well as such common food-processing techniques as toasting or baking bread. Starch modifications in these categories are widely accepted as being similar to unmodified starches for use in foods. For this reason, no further attention will be given to this type of modification.

Chemical Starch Modification

This paper is devoted to those modified starches made by treating starch with agents that introduce substituent chemical moieties into the starch granule through reaction with hydroxyl groups in the starch molecule. These chemically modified starches have been used as food ingredients for over 45 years. All are cleared for use in the US, Canada, and the UK, and have been accepted by the Joint Expert Committee on Food Additives of the FAO/WHO. They impart to food systems valuable functional properties that cannot be realized with unmodified starches. They provide texture, thicken, suspend solids, stabilize emulsions, facilitate processing by protecting foods during processing, or protect finished foods during distribution and storage.

Within the broad category of chemically modified starches there are wide variations in

the extent to which the starch has been chemically altered. Many such starches contain only infinitesimal amounts of substituent groups and might be considered 99.9 percent pure starch. The presence of the added chemical groups is not readily detected except by sophisticated analytical methods or by physical characterization. Others contain sufficient amounts of substituent chemical moieties to be easily detected.

There are two major ways to modify starch chemically: crosslinking, and introduction of monosubstituent groups. Most of the modified food starches used in the food industry are made either by crosslinking or by combining crosslinking and introducing monosubstituent groups. Limited amounts of starches containing only monosubstituent groups are used in foods.

Unmodified or native starch occurs in the form of minute granules that are insoluble in cold water. They owe their integrity to crystallites formed by hydrogen bonds between hydroxyls on adjacent molecules. When heated in the presence of water, the hydrogen bonds holding the granule together weaken, permitting the granules to imbibe water, swell, and thicken to form colloidal dispersions. Such dispersions have limited value in most food systems because of the sensitivity of the hydrogen bonds responsible for the integrity of the swollen granule to thermal and mechanical breakdown.

Crosslinking as a Chemical Modification

Crosslinking reinforces starch granules with intermolecular chemical bonds that keep the swollen starch granules intact after the hydrogen bonds have been ruptured. The technique

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