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Manned Spacecraft Center



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The Deterioration of Intermediate Moisture Foods

A recent study of the mechanism of intermediate moisture foods has disclosed some significant facts which will be of interest to the food processing and packaging industry.

The value of intermediate moisture foods lies in their stability over protracted periods of time without their being canned, refrigerated, or frozen. Fabrication is accomplished by reducing and maintaining the normal water content of the foods to levels below which micro-organisms can grow. But the process which requires humectants to be added can produce a chemical environment which provides increased deteriorative reactions - lipid oxidation and non-enzymatic browning being among them.

For this study, which concentrated on finding means of preventing these reactions, model systems were developed having the same water activity/water content relationship of intermediate moisture foods. Models were based on a cellulose-lipid and protein-lipid system with glycerol added as the humectant. Experiments with both systems indicated that significant lipid oxidation is promoted in the intermediate moisture range. As the rates of oxidation increased when the amount of water in the system reached a level where capillary condensation occurred, the oxidation effect appears to be related to the increased mobility of either the reactants or the catalysts. With glycerol the increase in oxidation rate occurs at a lower relative humidity. One important factor in the design of stable food items derives from the evidence that the oxidation rates were maximized at 61% RH; the latter effect was probably due to dilution.

No significant non-enzymatic browning occurred in the protein-lipid systems. Prevention of oxidation by the use of metal chelating agents was enhanced in the cellu-

lose system. On the other hand, with protein present, the lipid soluble chain terminating antioxidants (such as butylated hydroxy anisole, BHA) worked equally as well. Preliminary studies of foods adjusted to the intermediate moisture range confirm the results of oxidation in the model systems. It appears that the reaction which will set the limit on the stability of an intermediate moisture food will be rancidity. However, water soluble chelating agents will delay the development of rancidity, improve the stability of the foods and give them a longer shelf life. Phenolic antioxidants also have good activity especially in high protein systems. Although non-enzymatic browning may also cause some deterioration if the foods are protected from oxidative rancidity, it is predicted that this may not occur until after the normal shelf life.

The conclusion of this study is that good quality will be ensured if the intermediate moisture content of a food is held at a water activity of 0.6 to 0.75.

Note:

Requests for further information may be directed to:

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No patent action is contemplated by NASA.

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