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FURTHER APPLICATIONS FOR THE
HEAT SHOCK PUFFING OF FOOD GELS

A Thesis presented in partial fulfilment of
the requirement for the degree of Master of
Food Technology in Food Processing at Massey
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S U M M A R Y

Factors governing the puffability of food gels were studied in detail. Some experiments were conducted and results discussed on the effects of soluble solids, changes of pH and pretreatment of food gels on their water holding capacity. The effects of the soluble solids, fat and fibrous texture on the thermoplasticity of food gels were also examined.

The application of a puffing technique was directed toward two main types of food, i.e. non-protein foods which include carrots and bananas and protein foods which include three types of cheese, fish and meat. Different techniques were necessary to manipulate each product to puff. Carrot slices may be puffed raw but the product characteristics may differ widely from those of blanched and leached slices. Some foods such as bananas with high sugar content and cheese with high fat content may not puff without the addition of sufficient amount of a puffing agent. Fish and meat as fibrous protein foods need similar physical and chemical modifications, before their products can puff, such as the destruction of their fibrous structure and the adjustment of their pH to alter their water holding capacity to a suitable level.

The food gels may be puffed by other heat-shock

techniques other than deep-fat frying. Radiant heat was applied successfully to puff food gels such as sodium caseinate gel, starch gel, and fish product. The products could be puffed to the comparable volumes achieved by deep-fat frying techniques, yet they were superior in some respects. They were free of fat pick-up problems. They could be rehydrated very quickly and the rehydration rate of the radiant heat puffed fish product, for example, was comparable to that of the dehydrated products of the highly sophisticated processes such as freeze-drying, and vacuum contact plate drying.

I N T R O D U C T I O N

In recent years a great deal of interest has been displayed concerning ways by which aid can be given, or development can be undertaken in food production and consumption in developing countries. It has been realised that there are two major problems these countries are facing in their food situation, viz. the inadequate supply of food, and the nutritional inferiority in the food they consume.

Aid from the developed countries have been given to these nations in essentially two ways, materially and technologically. Materially, millions of tons of basic foods, which may be merely a surplus in the developed countries, are given or sold at a give-away price to the needing countries. Technically, they are taught the modern scientific knowledge concerning the more efficient methods to produce more food in their own countries to meet the demand and also the technology of food processing to upgrade their food nutritionally, with the realisation of the importance of balanced diets and how to obtain it in the foods they consume.

The imbalance in diets or malnutrition widely prevalent among children belonging to low-income groups of the population in many developing countries (3) is the

subject of great concern. The shortage of protein foods comes largely from the way their animal husbandry is operated (73) and the lack of relatively modern technology of food preservation and preparation results in seasonal shortage of food in general (40).

In Southeast Asia one of the most important sources of animal protein is fish (81). It is generally consumed in both fresh and preserved forms. Most of their preservation methods are simple. Fish is generally preserved by salting or processing it into products e.g. fish pastes, fish sauces, dried-salted fish, or a more refined product such as fish slices which puff in hot fat. The last product is prepared from starch gel which constitutes some 60 - 70% of the product, mixed with about 20 - 30% fish flesh and some other ingredients such as spices and flavourings.

Perreau (60) studied, in considerable detail, the phenomenon of puffing and concluded that this phenomenon relied not on the presence of starch but on the formation of gel. So all food gels possessing suitable properties such as moisture content and thermoplasticity should puff.

Realizing that these puff-products are the readily acceptable form of food and that the consumption of more protein should be encouraged in the developing countries, the puffing technique and its application was further examined. The techniques by which the gel structure could

be induced in various types of food especially protein food were investigated. The protein-based gelling agents were studied in further details and it was hoped that these studies will provide some knowledge of how to produce the Asian traditional foods containing high protein content, or how to present high-protein foods to the needing people in their own traditional forms. The studies were also conducted on the puffing techniques other than deep-fat frying to provide a porous texture to the foods thus improving their rehydratability.

The Thesis is presented in three sections. The first section deals with the study of the factors governing the puffability of food gels. The second section concerns the application of puffing techniques to various types of food and in the third section, various heat-shock techniques for puffing are reviewed. The application of the radiant heat shock techniques and the rehydration of puffed products derived from this method are also described.