

2003 MAFMA Final Report

Project Title **Wheat Gluten Modification for Value-Addition**
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1. Objective Summary:

1. To modify wheat gluten by hydrothermal treatment to induce enhanced foaming, emulsification and gelling properties
2. To use hydrothermal treatment to incorporate sugar moieties into gluten proteins to enhance functionality
3. To characterize wheat gluten-soy protein blends for functional properties

2. Objective Accomplishments

(1). Cross-linking of gluten proteins by hydrothermal treatment.

Vital wheat gluten and a modified gluten (Arise 5000) were subjected to hydrothermal treatment using water bath, autoclave and jet cooker. The modified proteins were characterized by Size-Exclusion HPLC (SE-HPLC) and the functional properties by foaming, emulsification and gelling properties. SE-HPLC showed that heat caused cross-linking of protein through disulfide bonds. Glutenin proteins, the wheat proteins with molecular weights in the millions, cross-linked at temperatures below 100°C evidently by oxidation of the thiol groups. On the other hand, gliadins (proteins of molecular weight 30,000 to 70,000) were incorporated into the glutenin structure evidently through sulfhydryl-disulfide interchange reactions and this only occurred at measureable rates above a temperature of 100°C. Cross-linking increased the viscosity of the gluten dispersions, as would be expected, and, under certain conditions, led to good gelling properties.

(2). Incorporation of sugar moieties

Modification of wheat gluten has been a challenge because of its low solubility, ascribed to a low charge/mass ratio and the high molecular weight of its glutenin component. The aim in this part of the project was to investigate if solubility (and functionality) could be enhanced by introduction of hydrophilic groups, specifically sugar moieties, into the gluten structure. Vital wheat gluten was subjected to jet cooking in the presence of corn syrup under a range of conditions. The products were spray-dried, characterized by SE-HPLC and examined for changes in solubility, foaming and emulsification.

Hydrothermal treatment at 121°C gave a product with altered SE-HPLC pattern and improved functional properties of solubility, foaming, emulsifying and rheological properties. There was a shift in the functional properties towards lower pH which may have application in beverages and fruit juices.

(3) Characterization of wheat gluten-soy protein blends for functional properties

Gluten proteins have relatively low amounts of some essential amino acids, especially lysine. The use of soy protein in combination with gluten could improve the nutritional value. The functional properties of these blends were investigated. Different ratios of Arise 5000 (a modified gluten) and Solae Ex38 (a soy protein isolate) were studied for functionality. A mixture of Arise 5000 and Solae Ex38 in the ratio of 60:40 was found to give enhanced emulsion stability above other mixtures as well as high emulsion capacity.

Practical Impacts

The combination of sterilization and enhanced functionality achieved by the jet cooker has potential for producing modified glutes with commercial prospects as ingredients in the food industry. In particular, improved emulsification and gelling properties are what are required for texturized meat substitutes. A combination of gluten and soy proteins show promise for enhanced functional and nutritional properties in food systems. It is intended to continue the work with the aim of developing marketable food ingredients.