Guidelines for MAFMA Final Report

Final Reports due 3 months after completion of project
(4-5 pages)

Project Title **Functionality of Egg Yolk Lecithin and Protein and Functionality Enhancement of Protein by Hydrothermal Cooking**

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Award Date **2005**

Please complete all questions below and attached form

1. Objective Summary (1-2 sentence summary)

The overall objective of the research was to develop value-added egg products. The specific aims were (1) to fully characterize functional properties of yolk lecithin, and (2) to study the functional properties of yolk protein and to improve its functionality.

2. Objective Accomplishments
   (If objectives were not met, what extenuating circumstances contributed to that factor?)
   Convey all of your progress on this project including that obtained with the industry and other matching funds.

All objectives are met.

1. **Emulsification Properties and Oxidative Stability of Egg Yolk Lecithin:** Egg yolk lecithin (EYL) is a good source of phosphatidylcholine (PC) and phosphatidylethanolamine (PE), and it is different from soy lecithin (SL) in both fatty acid and phospholipid class composition. These differences may lead to different oxidative stability and emulsification properties in food systems. Therefore, these characteristics were investigated in this study. Emulsification properties were evaluated at two oil-to-water ratios, two emulsifier concentrations, two pHs, and with the addition of xanthan gum. The results showed that low concentration of EYL (2.5% in oil) gave poorer emulsion stability than did 5.0%, whereas emulsions with oil-to-water ratio of 50:50 were more stable than with a 20:80 ratio. Under neutral pH, EYL gave poorer emulsion stability than SL at both oil-to-water ratios and emulsifier concentrations. However, under acidic condition, EYL created a more stable emulsion than did SL. Adding xanthan (0.05%) increased stability of EYL emulsions and minimized stability differences caused by lecithin concentrations. Oxidative stability of EYL was determined in bulk and in emulsion. EYL showed better oxidative stability in both bulk and emulsion systems than did SL. Cupric ion did not accelerate oxidation of EYL in an emulsion system, but it did accelerate oxidation of SL.

2. **Effect of Controlled Enzymatic Hydrolysis on Functionalities of Egg Yolk Protein:** Delipidated egg yolk protein (EYP) is produced as a co-product of egg yolk lecithin extraction. This EYP has poor functionality because of the protein denaturation caused by ethanol treatment during lecithin extraction. Two food grade endo-proteases were used to produce EYP hydrolysates (EYPh) with two degrees of hydrolysis (DH), 3% and 6%. Protein solubility was improved as DH increased, and both solubility profiles for EYP and EYPh were relatively less pH-dependent compared to soy protein. Except for foaming capacity, EYPh showed improvement in foam stability, foam speed, and foam density. Emulsion stability was improved for all EYPhs. Treatments at DH of 6% showed significant increase in emulsification capacity. Overall, controlled enzymatic hydrolysis can be applied to ethanol-treated lipid-free EYP to increase the solubility, and improve the foaming and emulsification properties.

3. Unexpected findings, if any

Hydrothermal treatment of the alcohol denatured egg yolk protein did not improve functionality. However, the newly designed partial protease hydrolysis of the protein did improve the foaming and emulsification properties of such yolk protein.

4. Practical impacts of research efforts. Include: implementation of accomplishments by industry partners (if any), identification of economic impacts, and any further pursuit by PI of research in area of this project whether MAFMA or not.
   a. Short Term Impacts
   b. Long Term Impacts

Further pursuit by PI in related research area: ***Modification of Egg Yolk Protein for Improved Iron Bioavailability*****, a proposal was submitted in June 07 to Iowa Egg Council for consideration of 07/08 funding. Our own preliminary research indicates that dephosphorylation treatment of the yolk protein can decrease iron binding and increase dietary ion bioavailability significantly.**

5. If you are also making reports to other funding agencies in the course of this research work, please include a copy of that report.

Similar report will be submitted to Iowa Egg Council shortly.

6. If any publications resulted from the research, a copy must be included. Please note we were notified by the USDA/CSREES National Program Leader for the Midwest Advance Food Manufacturing Alliance (MAFMA) that all publications resulting from research that was funded by MAFMA must include the following wording **"The project was supported by the USDA Cooperative State Research, Education and Extension Service, special research grant number 200X-34328-xxxxx.**

Two manuscripts attached.