

## LIPID AND SURFACE CHEMISTRY RESEARCH PROGRAM

The mission of the program is to address basic and applied research problems relating to food oils/fats and related products. Studies involve investigation of lipid changes affecting food quality and developing improved analytical techniques to address commercial and basic research needs. We are also developing new value-added materials with desirable surface and structural properties from food industry co-products.

Areas of study include:

### Lipid Chemistry and Food Quality

Investigations are focusing on the understanding and control of deleterious lipid changes during food processing. Changes affecting lipid hydrolysis, oxidation, subsequent off-flavor formation and human health, are of particular interest. We are also developing novel lipid based food systems. Recent and current work supported by the food industry and state commodity boards includes:

- Understanding how rice free fatty acid changes affect brewing quality
- Predictive modeling of rice free fatty acids during storage
- Rapid wet-chemistry milled rice surface oil and free fatty acids analysis
- Impact of milled rice lipid oxidation on flavor development
- Comparative lipid chemistry of head and broken rice kernels
- Novel natural food emulsions from rice bran

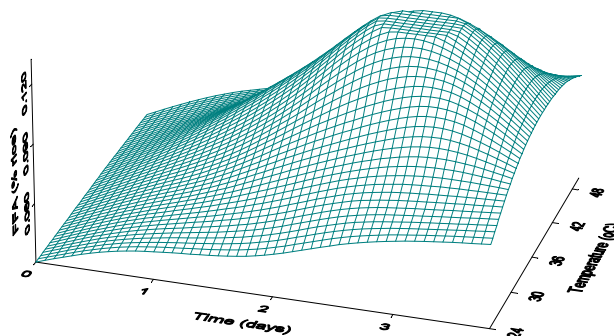


Flavor analysis by GC/MS

### *Lipid analysis by HPLC*



### *Prediction of surface free fatty acid development on milled rice, as a function of time and temperature*



## Fourier Transform Infra-red Spectroscopy Analysis for Lipid Quality, Food Safety and Health Applications

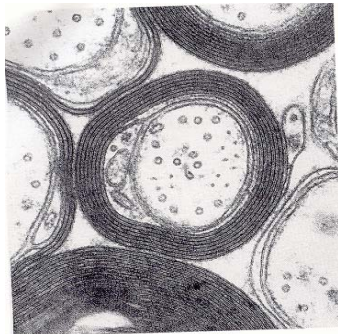
Rapid, non-destructive methods are being developed, using Fourier transform infrared spectroscopy (FTIR), for evaluating food quality and safety. The FTIR spectra provides a 'chemical fingerprint' of food components that, with the aid of statistical modeling, produce a new analytical method. Recent and current work supported by the food industry and state commodity boards include:

- Milled rice surface oil of determination
- Surface free fatty acid content of milled rice method
- Prediction of novel antioxidant performance
- Nerve tissue adulteration of ground beef
- Meat conjugated linolenic acid determination
- Analysis of lipid interaction with adsorbents during vegetable oil adsorption processing



*FTIR surface analysis of milled rice*

*High magnification of nerve fibers showing the thick layer of unique nerve lipids surrounding the nerve that is identified by FTIR to measure nerve tissue in adulterated beef*



Evaluation of a novel adsorbent  
For use in vegetable oil processing  
under low pressure, high temperature  
conditions, as is used commercially

## Rice Hull Utilization to Develop Value Added Products

Hulls are a major rice industry co-product that rice mills burn to generate energy. The residue is a high quality amorphous silica ash. In contrast to conventional silica, such as sand, this bio-silica is readily soluble and easy to manipulate.

We are working with hull ash producers to understand the structure various commercial ashes available and optimize ash surface and structural properties to exploit specific markets and new business opportunities.

Federal funds are supporting public research to generate new materials and surfaces from rice hull ash. This is done by a low energy ash conversion of ash to sodium silicate which then can be used to make a variety of silica based products. Materials developed include:

- High purity silica
- Silica gel
- Low density ceramic insulation material
- Flexible sodium silicate based plastics



*X-ray diffraction to observe ash quality and material structure*



*Silica gel produced from rice hull ash*



*Plastic film prepared from rice hull ash silica*

*Light weight insulation material from rice hull ash silica*



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