Physical properties of foods-Lab 3

NUTR 45300
Food Chemistry

First written up lab

- They will require more hand holding for this one than for later ones, when they know what to expect
- Deliverables for Exp 1
  - 6 tables, 5 graphs (TA vs. A_v)
- Deliverables for Exp 2
  - Corn syrup and catsup tables
  - Consistometer plot
  - Linespread plot
  - Brookfield plot

First written up lab (cont.)

- Deliverables for Exp 3
  - Tables for specific gravity and refractive index
Exp 1-Water activity

- \( A_w = p/p_o \), where \( p \) is the water vapor pressure over a food and \( p_o \) is the water vapor pressure over pure water
- \( A_w = ERH/100 \), where ERH is equilibrium relative humidity
- Samples are already prepared and have been in the desiccators for 2 weeks
- Make sure your lab doesn’t use up all of a particular food

Water activity machines

Older model

Newer model

Sample cups and sample
Ready to measure

Desiccators in which food samples are stored at different water activities

Food assessment
- Soda crackers-TA, knife probe (Room G52)
Food assessment (cont.)

- Fig Newtons and cream cheese-TA, cone probe (Room 227)

Food assessment (cont.)

- Ripened Cheddar cheese- TA, cone probe (Room 227)

Food assessment (cont.)

- Carrots-TA, knife probe (Room G52) or shear press (Room 227)
Food assessment (cont.)

- Hard candies: Visual inspection only

Exp 2-Viscosity

- Measuring viscosity (thickness) several different ways
  - Brookfield viscometer
  - Consistometer
  - Linespread apparatus

Brookfield viscometer

- Digital viscometer
Consistometer
- Measures flow under gravity in a given length of time

Linespread apparatus
- Measures flow under gravity in a given length of time

Newtonian Flow
- Viscosity is independent of shear rate
A ketchup poem

You shake and shake the ketchup bottle.
First, none will come; and then, a lot 'll.

Some messy guy

These are called shear thinning fluids.
These are known as shear thickening fluids.

Note the hysteresis loop -- a characteristic of thixotropic flow.

- These are characterized by an increase in viscosity at constant shear rate.
- Examples: beaten egg white or whipping cream
Food Rheology -- Examples

- **Newtonian**: Corn syrups, broths, skim milk, chocolate, butter
- **Bingham plastics**: Chocolate, butter
- **Pseudoplastics**: Gelled desserts, puddings
- **Thixotropic**: Honey, mayonnaise
- **Dilatant**: Honey containing dextran impurities, beaten egg whites, whipping cream
- **Rheopectic**: Beaten egg whites, whipping cream

Brookfield results for corn syrup and catsup

- Here is what the data for corn syrup and catsup should look like
- Catsup is a Bingham (shear thinning) plastic and corn syrup is a Newtonian fluid

Exp 3 Specific gravity and refractive index

- Specific gravity is the ratio of the density of a material to the density of water
- Thus it is unitless
- Measured using a hydrometer
- Using a hydrometer means you need a lot of sample, usually about 400-500 ml
Hydrometer

Using a hydrometer

Refractometer
- Used with small samples for very accurate measurements
- One scale reads refractive index, the other one is % soluble solids
Older refractometer

The reading you get will look something like this.
The top scale is refractive index and the bottom one is percent soluble solids.

Refractometer reading