Food Science MSO Coaches Clinic

Maiya Yu
MSO Board

What will we cover?

Event Overview

What is Food Science?

Hands On Activities

An overview of the hands on lab component

Content Overview

An overview of the kinds of knowledge your students should try to have

Coaching and Resources

Tools available to support you

Zoom Guidelines

Please keep yourself muted until there is time for questions

Raise hand and wait for acknowledgement to talk

Ask questions after appropriate category

Don’t panic if I don’t get to your question! I will put together a typed document with answers to all questions and link it in the materials!

1.
Event Overview

What is Food Science?

Materials Allowed

- One 8.5x11 sheet of paper, front and back, which may be in a sheet protector
- Non-programmable, non graphing calculator
- Writing utensil
- Recommended lab equipment
- **Hydrometer**
- **Goggles, apron/labcoat**

Event Format

Two part event: written test and hands-on activities

Focus this year is on sugars/carbohydrates

Two aspects to focus on:

New content

New hands on activities

2.
Hands on Activities

This Year: Three hands-on activities

1. Determine sugar concentration using participant-made hydrometer
2. Determine cold water stage of sugar solution
3. Determine whether or not sample has reducing sugars

We'll go over all three

1. Determine sugar concentration of samples

Hydrometer: uses density to measure dissolved solids

Could potentially recalibrate salinometers from past years

Use sugar solutions to calibrate

Scale, granulated sugar, distilled water

mass/volume solutions, limited to 1-10%

Accuracy requirements at different levels (within 1% at invitationals and regionals, 0.5% at states and nationals)

2. Determining cold water stage of sugar solution

Students should be aware of safety -- sugar solutions used for this type of test are hot!

Might have students drop solutions, could also have solutions pre-dropped into cold water (although these would probably need to be remade frequently to avoid the stages dissolving)

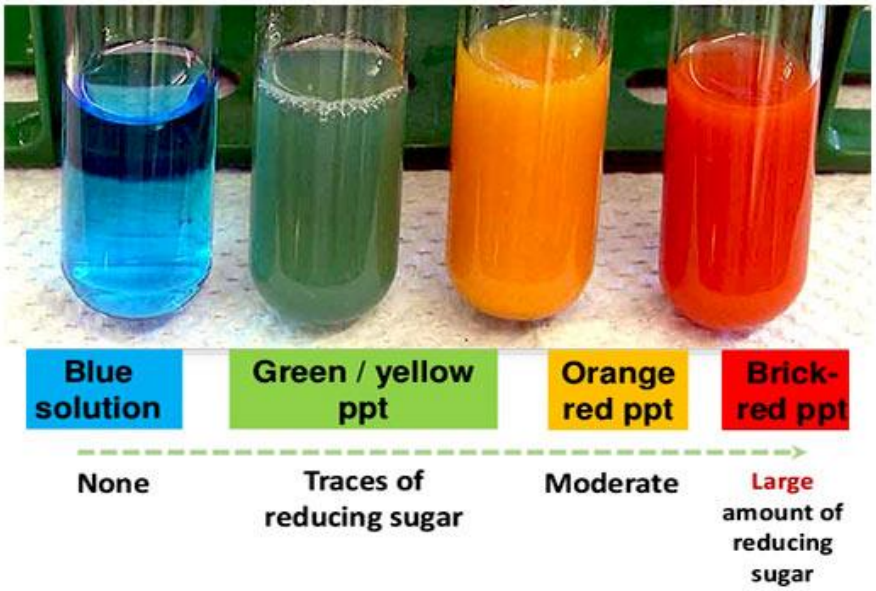
3. Determine whether or not solution has reducing sugars in it

3 aspects to success

- ➔ Know what a reducing sugar is
- ➔ Know reagents that allow you to identify whether or not there are reducing sugars (most likely Benedict's, but others exist)
- ➔ Know what these reagents look like

Benedict's Reagent

Add sample, swirl, heat in cup of hot water for a bit, observe color change



3.

Content Overview

A non-exhaustive list of things to consider

Types of sugars, sweeteners, enzymes

Sugars: monosaccharides vs polysaccharides

Aldose vs ketose

Number of carbons: triose, tetrose, pentose, hexose…

Structure -- can you identify monosaccharides?

Can you identify polysaccharides? What are common polysaccharides made of?

Ring form vs Fischer projections

Types of sugars, sweeteners, enzymes

Non-sugar sweeteners: modified sugars, sugar alcohols, peptide-based

Enzymes: class of proteins that catalyze reactions, know what enzymes are and know ones that are relevant to sugars (e.g. amylase, lactase, sucrase/invertase)

Food preservation processes

- Drying: Jerky
- Solutes-salt, sugar, acids: Jams, Fermenting, Acidifying
- Freezing: Frozen foods
- Combination: Freeze drying, salting & drying fish

Know why they work!

Testing of foods (sugars, starches, fats, proteins)

Most common:

- Sugars: Benedict’s, Tollen’s, Fehling’s
- Starches: Iodine test
- Fats: Paper test
- Protein: Biuret’s

How cooking changes foods chemically

Protein denaturation

Hydration levels -- evaporation

Maillard’s reaction -- browning

Heat-accelerated reactions -- leavening

Citric acid cycle

How sugars are broken down/how we get energy

Lots of enzymes involved!

Generation of ATP

Citric acid cycle in context: glycolysis, electron transport chain

Essential fats, vitamins, and proteins

What does it mean to be essential?

What can our bodies make?

What do we need to consume because our bodies can’t make it?

Where are these found (food sources?

New nutrition labeling requirements

What is required?

What is different?

Why were these changes made?

Allergens in foods

8 major food allergens

Types of allergies and insensitivities -- how do they work?

E.g. nut allergies vs lactose intolerance

Statistics on population allergies

Requirements on labeling

Crystallization and nucleation

Solubility

Crystals -- how do they form? What is special about them?

Forming crystals from supersaturated solutions

Nucleation -- what is it? How does it happen?

Leavening agents

Baking soda: sodium bicarbonate

Baking powder: sodium bicarbonate + tartaric acid

Yeast: it’s alive! Fermentation-based leavening

Cold water candy tests

Function of both temperature and solute concentration

Water activity

Measure of amount of available water:

- Free water
  - Held inside cells
  - Can be removed by pressure
  - Maintains properties of free water
- Bound water
  - Bound to molecules
  - Loses freedom to move
  - Does not retain properties of free water

Density

Mass/Volume

Ways to determine (take mass and volume, divide; immerse in different density solutions, etc.)

4.

Coaching and Resources

Challenges

Topics are fairly biochemistry oriented -- many materials assume high background in chemistry, and focus on more medical applications of biochemistry

Breadth vs depth -- what extent to focus

Things to consider

Some aspects may be more or less difficult to self study (giving a student a college level biochemistry textbook right off the bat might be hard)

Hands on activities -- practice for required ones, but also explore other activities as a way for students to understand concepts

Scioly.org

Event pages often have practice tests, good summaries

Forums can be useful for asking questions of other teams/staff elsewhere

Clinic Resource Document

Links to other resources

Where to find materials

Ideas of biochemistry resources to adapt

Ideas for hands on activities

Contact

Maiya Yu

MSO Board

Stanford Structural Biology PhD student

mshyu@umich.edu

msh24@stanford.edu

Please feel free to email me with any questions!