Food Science: Pickles (Fermentation)

DESCRIPTION: Teams will be tested on their knowledge and skills of fermentation processes related to food with an emphasis on chemistry content associated with pickles and other fermented foods.

A TEAM OF UP TO: 2 **EYE PROTECTION:** C **IMPOUND:** Yes **APPROX. TIME:** 50 min.

1. EVENT PARAMETERS:

a. Each participant must bring safety equipment and a writing implement.
b. Each team may bring two stand-alone non-programmable, non-graphing calculators and one 8.5" x 11" sheet of paper, in a protector or laminated, with information on both sides in any form and from any source.
c. Each team may bring any or all of the items listed as Recommended Lab Equipment for Division B Chemistry Events, posted on soinc.org. Teams not bringing these items will be at a disadvantage.
d. Event supervisors will provide for each team: all required reagents and test solutions, any needed probes or other instrumentation, chromatography materials, and the answer sheet. The event supervisor may provide additional items or instructions if necessary but will not provide Recommended Lab Equipment.
e. Participants must bring and wear goggles, an apron or a lab coat, and have skin covered from the neck down to the wrist and toes. Gloves are optional; but if a host requires a specific type, they must notify teams. Shoulder length hair or longer must be tied back. Participants who unsafely remove their safety clothing/goggles or are observed handling any of the material or equipment in an unsafe manner will be penalized or disqualified from the event.

3. THE COMPETITION:

Part I: Written Exam

The competition will consist of a written exam covering the following topics: types of fermented foods and pickles, food preservation processes, types of fermentation processes (aerobic respiration, homolactic fermentation, heterolactic fermentation, ethanol fermentation), types of sugars, enzymes, citric acid cycle, standard of identity of acidified foods, nutrition labeling regulations, food safety of fermented and acidified vegetable products, health benefits of fermented foods, production of chemical feedstocks and yeast and bacteria identification and behaviors, water activity, density.

Part II: Laboratory Activity

The competition will include at least one laboratory activity. Activities could include hands-on activities, interpretation of experimental data (graphs, diagrams, etc.), microscopes, and/or observation of a running experimental setup. Laboratory activities may include the following topics of fresh cucumbers and a wide range of pickles: pH, density of brine, density of pickles, moisture content, salt content, sugar content. At Regional 1 activity will be chosen, at State 2 activities will be chosen, and at Nationals teams will do all 3 activities.
At the tournament, teams will be provided with commercially produced pickles and fresh cucumbers. To extract liquid from fresh cucumbers, the cucumbers will be sliced, frozen and thawed prior to the competition. To extract liquid from frozen-thawed cucumbers or pickles, place the slices of product in a ziplock bag pressing out as much air as possible. Using a rolling pin to exert even pressure, roll the pin over the slices to crush the flesh. While holding the bag over a beaker, cut the corner of the bag off, about ¼" of the corner, allow the liquid to drain into the beaker. Pour this liquid into a labeled test tube.

I. Teams will be provided with unlabeled commercially produced pickles and their labels. Based on analysis of the pickles and information gathered from the laboratory activity, the teams will match the labels of the pickles to the unknown pickles. Teams will be graded on the most correctly matched labels and pickles as judged by the Event Supervisor.
II. Extract fluid from pickles and fresh cucumbers using the rolling pin method. Measure the pH of extracted fluid. The pH of each teams samples will be compared to the Event Supervisor's measured pH.
III. Teams will use a homemade salenometer to determine the density of a brine salt solution with a density between 1 and 5%. Teams will get within .5% for regional, .2% for state and .1% for national.

4. SAMPLE QUESTIONS/ACTIVITIES:

a. What bacteria are typically used to prepare kombucha?
b. Determine the moisture content in percentage of the provided pickles.
c. Are all pickles fermented?
d. Of the following experimental setups of fermentation with balloons indicating carbon dioxide production, which flask has fructose?
e. Which of the following microscopic images contain *Lactobacillus*?
f. What is the purpose of fermentation in the production of chocolate?

5. SCORING:

a. High score wins. Part I is worth 60% of the overall score while Part II accounts for 40% of the score.
b. Ties will be broken using selected questions along with the quality of free response answers.
c. A penalty of up to 10% may be given if the area is not cleaned up as instructed by the event supervisor.
d. A penalty of up to 10% may be given if a team brings prohibited lab equipment to the event.

6. RESOURCES:

pH paper resource: https://www.microessentiallab.com/Category/62_1/Short_Range_pH_Paper.aspx