KANSAS CORN STEM

Kansas Corn:
DDG Nutrient Testing

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KANSAS CORN COMMISSION
kscorn.com

Kansas Corn: DDG Nutrient Testing

Grade Level: High School

Overview

Corn is a vital part of our society. It has many uses, such as feeding people and producing ethanol. This lab can be used in two different ways. It can be used as a stand-alone lab if you do not have the time or resources to conduct a full ethanol distillation lab. However, you can also use this lab to enhance the Kansas Corn: Ethanol – Corn Mash and Distillation lab and to observe the different levels of nutrient availability before fermentation, after fermentation, and again after distillation. We will focus on what is happening to the nutrients, along with discussing macromolecules and the importance they provide to organisms.

The first part of the lab is creating a corn mash that will ferment and form methanol and ethanol. Discussions about ethanol can begin here. The main focus will be on what the yeast is doing to the corn, as well as the purpose of the enzymes that are present in the corn mash. The next part of the lab will be to compare the nutrient availability with a corn slurry (this can be made at the start of the second lab day), and the corn mash. This lab focuses on the liquid feed. Lugol's Iodine provides a black color change when present in starch. The Buiret Test Solution provides a purple color change when present in protein. The last indicator provides an orangish-red color change when heated and present with glucose. These changes provide an important laboratory practice in observations.

Kansas College and Career Ready Standards

Science

- **HS-LS1-6.** Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules.
- **HS-ETS1-3.** Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.

English

- **W.9-10.1** Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence
- **W.9-10.2** Write informative/ explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.
- **W.9-10.4** Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience

Learning Objectives

- Students will understand reactions and how indicators can be used to identify materials in a solution
- Students will understand the hydrocarbon structure of the nutrients found in the solutions
- Students will gain a better understanding of laboratory procedures
- Students will understand the use of macromolecules in growth and development of organisms

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Materials Needed:

- DDG Nutrient Testing PowerPoint (available online at kansascornstem.com)
- -DDG Nutrient Testing Student Packet (pg. S1-4, or available online at kansascornstem.com)

For Preparation of Corn Mash:

Preparation of Enzymes

- 2, 500ml beakers
- 500 ml distilled water
- Liquid Amylase Enzyme Concentrate
- Liquid Glucoamylase Enzyme Concentrate

Preparing the Mash

- Hot plate
- Beakers (100, 500, 600 ml)
- Graduated cylinders (1, 1000 ml)
- Digital thermometer
- Balance
- Pipettes
- Distilled water
- 50g Ground Corn
- Buffer Solution pH 5
- Prepared yeast solution
- Prepared Amylase Solution
- Prepared Gluco-Amylase solution
- Yeast

For Workstations

- 2 pipettes per station
- 6 test tubes per station
- Test tube rack
- Parafilm (or plastic wrap and a rubber band)
- Benedicts Qualitative Solution
- Lugol's Solution (Iodine)
- Biuret Test Solution
- Hot plate
- Beaker (600 ml)
- Water (does not have to be distilled; it will just be used as hot water bath)
- Safety Data Sheets (pg. 10-15 or available online at kansascornstem.com)
- If using as a stand alone lab – DDG Student Lab Report Sheet (pg. S1-S4, or available online at kansascornstem.com)

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Safety Considerations

- All glassware has a possibility of breaking. Protective eyewear should be worn at all times. The indicators being used can cause skin irritations and have the possibility of staining clothes.
- Biuret Reagent, Lugol's Solution, and Benedict's Solution are all possible skin irritants. Please review all Safety Data Sheets (pg. 10-14 or available online at kansascornstem.com) for reagents used in lab for further safety information.

Procedures for Instruction

Note: The following procedures are what you will use if you are doing this as a stand-alone lab. You will need to make up the mash and slurry prior to starting the lab. You also have the option to perform this lab as part of the sequence in ethanol distillation. Kansas Corn: Ethanol – Corn Mash and Distillation (available online at kansascornstem.com) is the recommended unit to perform first in the sequence. The DDG Nutrient Test can be done before and after fermentation, as well as after distillation is complete, to compare the levels of nutrients in the different stages of production.

Length of Time for Preparation: 1 day for preparation

- Day 1: Set up workstations for lab

Length of Time for Classroom Teaching: 1-2 days of classroom work

- Day 1: Prepare corn mash for fermentation, students can fill in the Introduction, Question, Hypothesis, and Procedure on DDG Student Lab Report Sheet (pg. S1-4, or available online at kansascornstem.com).
- Day 2: Test nutrient availability of liquid

Preparation Procedure/Instructions

Preparation of yeast solution (1-2 hours before the lab)

1. Vigorously shake your distilled water to oxygenate it fully.
2. Measure and mix together 300 ml of distilled water and 0.6 g of glucose and add it to a 500 ml beaker to make a 2% glucose solution.
3. Measure 7 grams of dried fresh yeast and add it to your 2% glucose solution. Gently stir and cover beaker with a watch glass or plastic wrap.
4. Allow your 2% glucose/yeast solution to culture for 2-4 hours. This will "wake up" your yeast, feed them, and start them metabolizing.

Preparation of Enzymes (Prepare before the start of the lab)

1. Mix 2.0 mL of amylase concentrate with 98 mL of distilled water to produce a 2% solution. Stir thoroughly.
2. 2. Mix 2.0 mL of glucoamylase concentrate with 98 mL of distilled water to produce a 2% solution. Stir thoroughly

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Prescribed preparation of corn mash

1. Add about 500 ml water to a 1 liter beaker and heat to boiling on a hot plate.
2. Weigh out 50 g of ground corn. Add ground corn to the 500 ml Erlenmeyer flask and stir.
3. Add 10.0 ml of amylase solution.
4. Add 200 ml distilled water to the ground corn and stir.
5. Use a ring stand and utility clamp to insert the flask into the boiling water as shown in the image below.
6. Boil for 10 minutes, the temperature in the flask will be 90-95°C
7. After boiling is completed, remove the flask from the hot water bath and allow it to cool to 50°C or below.
8. Stir the resulting mixture and add it to the cooled corn mash. Stir the mixture occasionally with a stirring rod throughout the next 10 minutes.
9. At the end of the 10-minute period, measure 20 ml of the pH 5 buffer. Shake the buffer solution and add it to the corn mash to maintain a slightly acidic pH.
10. Shake the glucoamylase solution, then measure 5 ml of glucoamylase solution. Add it to the corn mash.
11. Add 5.0 g of yeast to the corn mash and stir the entire mixture well.

Day 2: Corn Slurry Preparation and Workstation Set-up.

- You have the option to make the corn slurry ahead of time, or you can let the students make the slurry in class. For one group, grind 5 g of corn and mix it with 20 ml of distilled water.
- Filter the slurry, keeping the liquid food sample.
- For each work station:
  - Provide each group with a small beaker of 5-10 ml of the corn slurry and a separate beaker with 5-10 ml of the fermented corn mash.
  - Provide each group with 2 separate pipets.
- The indicators can be set out to be used when needed, or about 3 ml of each can be provided for each group.
- Each group will need 6 test tubes and a test tube rack.

Background Information

In the United States, commercial production of fuel ethanol involves breaking down the starch present in corn into simple sugars, also called “glucose”. These sugars are than fed to yeast, which begins the process of fermentation. The main product is used as ethanol – it is primarily found as a fuel additive in the gasoline used in our vehicles. The ethanol industry utilizes many different parts of the production process. Some of the other products produced include animal feed, corn oil, and carbon dioxide. The product used in animal feed is known as distillers grains. There are two types of these grains – wet distillers grains and dry distillers grains. Wet distillers grains have a high water content and low shelf life. This results in transportation to local farmers near the ethanol plant for use in feed for livestock. Dry distillers grains have been dried to have a low water content. They have a longer shelf life and can provide feed for farmers at locations further away.

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Classroom Discussion

Classroom Discussion: Introduce the topic and assess students for prior understanding. Let students discuss their ideas, and guide the discussion without telling them if they are right or wrong.

Day 1: Making Fermented Corn Mash and Forming Predictions:

- Our job is to try and figure out what product will provide us with the highest nutrient availability. We will be comparing a corn slurry and a corn mash after fermentation.
  - What is fermentation?
  - What role does the yeast play in the fermentation process?
  - What is the purpose of the enzymes?
  - Which product do you believe will have more nutrients? Why do you think this?
  - What purposes does the fermented corn mash provide? What can be made? What are some of the products produced?
- As students are finishing the questions above allow them time to review the procedure. They can begin filling in the DDG Lab Report Sheet.
  - They should start with the introduction. This should give examples of the lab to be conducted, provide objectives of the lab, and should discuss the importance of the lab.
  - The next step will be developing a question for them to answer.
    - In our lab the questions to be answered is:
      - Does fermenting corn provide a higher nutrient availability?
    - Some possible questions for them to find as a secondary lab to this one:
      - Does the type of yeast affect the nutrient availability?
      - Does the amount of yeast affect the nutrient availability?
      - Does the type of enzyme affect the nutrient availability?
  - Students should develop a hypothesis as to what they think the outcome will be.
  - Have students write in the procedure for the lab that they will be conducting the next day.

Day 2: Perform lab

Procedure for Lab:

Carbohydrate Indicator Test (Glucose)

1. Label 1 test tube Corn Slurry and a 2nd test tube Corn Mash
2. Add 2 ml of corn slurry to a test tube and mix 2 ml of Benedict's Solution.
3. Cover with Parafilm and mix.
4. Place test tube in a boiling water bath for 2 minutes.
5. Record color change in the table on the DDG Student Lab Report Sheet
6. Repeat process in a new test tube with the fermented corn mash.

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Complex Carbohydrate Indicator Test (Starch)

1. Label 1 test tube Corn Slurry and a 2nd test tube Corn Mash
2. Add 1 ml of corn slurry in a test tube and add 1 drop of the Lugol's Solution.
3. Cover with Parafilm and mix.
4. Do not heat solution.
5. Record color change in table on the DDG Student Lab Report Sheet
6. Repeat process with the corn mash.

Protein Indicator Test (Do not heat; heating will cause the proteins to breakdown, resulting in a negative test).

1. Label 1 test tube Corn Slurry and a 2nd test tube Corn Mash
2. Add 1 ml of corn slurry and add 2 ml of Biuret Reagent to a test tube.
3. Cover with Parafilm and gently mix.
4. Wait 30 seconds for a color change.
5. Record color change in the table on the DDG Student Lab Report Sheet
6. Repeat process with the fermented corn mash.

Teacher Resources

DDG Nutrient Testing Results:

- Benedict's Solution will detect the presence of glucose, and it will provide an orange to red precipitate (form a solid) after heating. The Lugol's Solution (Iodine) will turn black when starch is present. The Buiret Reagent will turn purple when protein is present.

Visit kansascornstem.com for videos and resources to assist with this lab.

Lab Analysis

Have the students answer the following questions on the DDG Student Lab Report Sheet:

- Were your predictions correct?
  - Students will look back at their pre-lab predictions and use the data collected from the lab to show if they were correct or not.
- What do the results tell you about what happened during the fermentation process?
  - They should be making comparisons of the results from the different stages of production. If used as a stand-alone lab, they will have two comparisons – corn slurry and then after fermentation..
- Where are the nutrients located in the slurry?
  - At this stage, you may want to have students test this by taking samples from varying locations in the slurry and performing the lab again.

- This can be done in groups. Each group can compare the results they obtain with the results of other groups to help them determine the answer.

- Where are the nutrients located after fermentation?
  - At this stage, you may want to have students test this by taking samples from varying locations in the slurry and performing the lab again.
  - This can be done in groups and each group can compare the results they obtain with the results of other groups to help them determine the answer.
- Why would this not be the last step in identifying nutrient availability?
  - What are some other options we have? (Note: You can suggest possible research topics for students.)
  - This can be a good place to research and discuss what happens in ethanol plants and why they provide distillers grains.
- This point can also be used to describe the varying sizes and shapes of the molecules present. They can draw and label glucose, as well as make a short chain of starch and a short protein. After they complete this task, they can review why these nutrients are important and describe the role these nutrients have in growth and development of livestock.

Reflection and Conclusion

Students should have made observations about the results they found in the test. Students should be able to identify where these distillers grains are produced and the importance it has for the ethanol industry. The following include some sample questions to pose for the students after the tests are completed:

1. What does the results tell us about the availability of nutrients before fermentation? After fermentation?
2. Which product would be better to use as a food source? Why?
3. Is there a nutrient missing that is needed for life functions?
4. Why would an ethanol plant want to produce distillers grains?

Students should understand that the production of ethanol not only makes ethanol that we use in gasoline, but it also provides farmers with resources to help cattle and other livestock grow by using distillers grains as a food source.

Any educator electing to perform demonstrations is expected to follow *NSTA Minimum Safety Practices and Regulations for Demonstrations, Experiments, and Workshops*, which are available at http://static.nsta.org/pdfs/MinimumSafetyPracticesAndRegulations.pdf, as well as all school policies and rules and all state and federal laws, regulations, codes and professional standards. Educators are aunder a duty of care to make laboratories and demonstrations in and out of the classroom as safe as possible. If in doubt, do not perform the demonstrations.

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Science and Agriculture Careers:

To wrap-up this topic, students can research some of the following careers. Students can find out what role each of the careers plays in studying nutrients and their functions in agriculture. Students can complete this part of the write up on the DDG Student Lab Report Sheet.

- Agricultural Inspector
- Agricultural Specialist
- Chemist
- Food Specialist
- Soil and Plant Scientist

To learn more about agriculture careers visit agexplorer.com. You can also find career profiles at kansascornstem.com.

Sources:

- Ohio Corn and Wheat Curriculum- http://ohiocorneducation.org/
- This website gives some basic information on distillers grains and the nutrient content available in them - http://ekaellc.com/distillers/

DDG Nutrient Testing Student Worksheet

Grade Level: High School

Background information

In the United States, commercial production of fuel ethanol involves breaking down the starch present in corn into simple sugars, also called "glucose". These sugars are than fed to yeast, which begins the process of fermentation. The main product is used as ethanol – it is primarily found as a fuel additive in the gasoline used in our vehicles. Some of the other products include animal feed, corn oil, and carbon dioxide. The remaining nutrients include proteins, fats, minerals, and vitamins that are essential in use in feed for livestock. Our focus is on the nutrient availability of the products before fermentation occurs and after.

We will be using three indicators to test for nutrient availability – Benedict's Solution, Lugol's Solution, and Biuret Reagent. Benedict's Solution will detect the presence of glucose, and it will provide an orange to red precipitate (form a solid) after heating. The Lugol's Solution (Iodine) will turn black when starch is present. The Buiret Reagent will turn purple when protein is present. This process will allow us to see where the nutrients are available at different times of production of corn products, like ethanol.

Pre-lab Check Questions: Answer the following questions with your partners before beginning the lab.

1. What is fermentation?

2. What role does the yeast play in the fermentation process?

Investigation Question

Which of these, corn slurry (before fermentation) or corn mash (after fermentation), will provide the highest nutritional value to livestock after fermentation has occurred?

Materials

Corn Mash (4 ml per group)
5 pipettes per station
Test tube rack
Parafilm
Lugol's Solution (Iodine)
Hot plate or water bath
Water (for hot water bath)
Sharpie (for labeling test tubes)
Corn Slurry (4 ml per group)
6 test tubes per station
Test tube holder (for use with hot bath)
Benedict's Solution
Biuret Reagent Solution
Beaker (600 ml) (for water bath)
Tape (for labeling test tubes)

Procedure for Lab

Carbohydrate Indicator Test (Glucose)

1. Label a test tube for corn slurry glucose test, and another test tube for corn mash glucose test.
2. Add 2 ml of corn slurry to a test tube, then add 2 ml of Benedict's Solution.
3. Cover with Parafilm and mix.
4. Place test tube in a boiling water bath for 2 minutes. (Caution: Use a test tube holder as the test tube will be hot to touch).
5. Record color change in the table.
6. Repeat steps 2 - 5 in a new test tube with the fermented corn mash.

Complex carbohydrate Indicator Test (Starch)

1. Label a test tube for corn slurry starch test, and another test tube for corn mash starch test.
2. Add 1 ml of corn slurry in a test tube and add 1 drop of the Lugol's solution.
3. Cover with Parafilm and mix.
4. Do not heat solution.
5. Record color change in the table.
6. Repeat steps 2 - 5 in a new test tube with the fermented corn mash.

Protein Indicator Test (Do not heat; heating will cause the proteins to breakdown which will give a negative test.)

1. Label a test tube for corn slurry protein test, and another test tube for corn mash protein test.
2. Add 1 ml of corn slurry and add 2 ml of Biuret Reagent to a test tube.
3. Cover with Parafilm and gently mix.
4. Wait 30 seconds for a color change.
5. Record color change in the table.
6. Repeat steps 2 - 5 in a new test tube with the fermented corn mash.

Sample	Carbohydrate Indicator Test (Glucose)	Complex Carbohydrate Indicator Test (Starch)	Protein Indicator Test
Corn Slurry			
Fermented Corn Mash			

Lab Analysis

1. Were your predictions correct?

2. What do the results tell you about what happened during the fermentation process?

Reflection and Conclusion

1. Our livestock are in need of protein. Based on our observations, which solution would best be used for our livestock?

2. Based on our test results, which types of macromolecules are primarily seen after the fermentation process?

Take it further!

Protein is vital for the health and upkeep of livestock. Do some research to compare the different benefits between using distillers grains (wet (WDG) or dried (DDG)) to other corn based feeds in the daily diet of livestock. Look for the topics below during your research. Write a two-paragraph summary or your findings.

- Cost of feed
- Availability of feed
- Nutrient supply

Science and Agriculture Careers

These are a few of the careers that would apply to this type of laboratory specialty. Do a little research and write a short summary on one that would interest you. You may even find one not on the list.

- Agricultural Inspector
- Agricultural Specialist
- Chemist
- Food Specialist
- Soil and Plant Scientist

FLINN SCIENTIFIC, INC.
Safety Data Sheet (SDS)

SDS #: 102.00
Revision Date: March 21, 2014

SECTION 1 — CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Benedict's Qualitative Solution

Flinn Scientific, Inc. P.O. Box 219, Batavia, IL 60510 (800) 452-1261
CHEMTREC Emergency Phone Number: (800) 424-9300

Signal Word **WARNING**

Pictograms

SECTION 2 — HAZARDS IDENTIFICATION

Hazard class: Skin corrosion or irritation (Category 3). Causes mild skin irritation (H316).

Hazard class: Serious eye damage or irritation (Category 2B). Causes eye irritation (H320).

SECTION 3 — COMPOSITION, INFORMATION ON INGREDIENTS

Component Name	CAS Number	Formula	Formula Weight	Concentration
Sodium citrate dihydrate	6132-04-3	$Na_3C_6H_5O_7 2H_2O$	294.10	16-20%
Sodium carbonate, anhydrous	497-19-8	Na_2CO_3	105.99	8-12%
Copper(II) sulfate, anhydrous	7758-98-7	$CuSO_4$	159.61	1-2%
Water	7732-18-5	H_2O	18.02	66-75%

SECTION 4 — FIRST AID MEASURES

Call a POISON CENTER or physician if you feel unwell.
If inhaled: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do so. Continue rinsing (P305+P351+P338). If eye irritation persists: Get medical advice or attention (P337+P313).
If skin irritation occurs: Get medical advice or attention (P332+P313).
If swallowed: Rinse mouth. Call a POISON CENTER or physician if you feel unwell.

SECTION 5 — FIRE FIGHTING MEASURES

Nonflammable, noncombustible solution.
In case of fire: Use a tri-class dry chemical fire extinguisher.

NFPA CODE
None established

SECTION 6 — ACCIDENTAL RELEASE MEASURES

Ventilate area. Contain the spill with sand or absorbent material and deposit in a sealed bag or container. See Sections 8 and 13 for further information.

SECTION 7 — HANDLING AND STORAGE

Flinn Suggested Chemical Storage Pattern: Inorganic #2. Store with acetates, halides, sulfates, sulfites, thiosulfates and phosphates.

SECTION 8 — EXPOSURE CONTROLS, PERSONAL PROTECTION

Wear protective gloves, protective clothing, and eye protection (P280). Wash hands thoroughly after handling (P264).

SECTION 9 — PHYSICAL AND CHEMICAL PROPERTIES

Light blue liquid. Odorless.

pH: ~11

Used to test for reducing sugars.

SECTION 10 — STABILITY AND REACTIVITY

Shelf life: Indefinite, if stored properly.

SECTION 11 — TOXICOLOGICAL INFORMATION

Acute effects: Eye and mild skin irritant.
Chronic effects: N.A.
Target organs: N.A.

ORL-RAT LD_{50}: 300 mg/kg (for $CuSO_4$)
IHL-RAT LC_{50}: N.A.
SKN-RBT LD_{50}: N.A.

N.A. = Not available, not all health aspects of this substance have been fully investigated.

SECTION 12 — ECOLOGICAL INFORMATION

Data not yet available.

SECTION 13 — DISPOSAL CONSIDERATIONS

Please review all federal, state and local regulations that may apply before proceeding.
Flinn Suggested Disposal Method #26b is one option.

SECTION 14 — TRANSPORT INFORMATION

Shipping name: Not regulated. Hazard class: N/A. UN number: N/A.

N/A = Not applicable

SECTION 15 — REGULATORY INFORMATION

Not listed.

SECTION 16 — OTHER INFORMATION

Consult your copy of the *Flinn Science Catalog/Reference Manual* for additional information about laboratory chemicals.

Revision Date: March 21, 2014

FLINN SCIENTIFIC, INC.
Safety Data Sheet (SDS)

SDS #: 121.00
Revision Date: March 21, 2014

SECTION 1 — CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Biuret Test Solution

Flinn Scientific, Inc. P.O. Box 219, Batavia, IL 60510 (800) 452-1261
CHEMTREC Emergency Phone Number: (800) 424-9300 **Signal Word** **DANGER**

Pictograms

SECTION 2 — HAZARDS IDENTIFICATION

Hazard class: Skin corrosion or irritation (Category 1). Causes severe skin burns and eye damage (H314). Do not breathe mist, vapors or spray (P260).

Hazard class: Corrosive to metals (Category 1). May be corrosive to metals (H290).

SECTION 3 — COMPOSITION, INFORMATION ON INGREDIENTS

Component Name	CAS Number	Formula	Formula Weight	Concentration
Copper(II) sulfate pentahydrate	7758-99-8	$CuSO_4 \cdot 5H_2O$	249.69	0.2%
Sodium hydroxide	1310-73-2	NaOH	39.997	30%
Water	7732-18-5	H_2O	18.00	70%

SECTION 4 — FIRST AID MEASURES

Immediately call a POISON CENTER or physician (P310).
If inhaled: Remove victim to fresh air and keep at rest in a position comfortable for breathing (P304+P340).
If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do so. Continue rinsing (P305+P351+P338).
If on skin (or hair): Immediately remove all contaminated clothing. Rinse skin with water (P303+P361+P353).
If swallowed: Rinse mouth. Do NOT induce vomiting (P301+P330+P331).

SECTION 5 — FIRE FIGHTING MEASURES

Nonflammable, noncombustible solution.
In case of fire: Use a tri-class dry chemical fire extinguisher.

NFPA CODE
None established

SECTION 6 — ACCIDENTAL RELEASE MEASURES

Ventilate area. Contain the spill with sand or absorbent material and deposit in a sealed bag or container. See Sections 8 and 13 for further information.

SECTION 7 — HANDLING AND STORAGE

Flinn Suggested Chemical Storage Pattern: Inorganic #4. Store with hydroxides, oxides, silicates and carbonates.
Store in a Flinn Chem-Saf™ bag.

SECTION 8 — EXPOSURE CONTROLS, PERSONAL PROTECTION

Wear protective gloves, protective clothing, and eye protection (P280). Wash hands thoroughly after handling (P264).

SECTION 9 — PHYSICAL AND CHEMICAL PROPERTIES

Blue liquid. Slight acrid odor.

pH: basic

Used to test for proteins.

SECTION 10 — STABILITY AND REACTIVITY

Shelf life: Good, if stored properly.

SECTION 11 — TOXICOLOGICAL INFORMATION

Acute effects: Corrosive.
Chronic effects: N.A.
Target organs: N.A.

ORL-RAT LD_{50}: 500 mg/kg (as sodium hydroxide)
IHL-RAT LC_{50}: N.A.
SKN-RBT LD_{50}: 50 mg/24H (as sodium hydroxide)

N.A. = Not available, not all health aspects of this substance have been fully investigated.

SECTION 12 — ECOLOGICAL INFORMATION

Data not yet available.

SECTION 13 — DISPOSAL CONSIDERATIONS

Please review all federal, state and local regulations that may apply before proceeding.
Flinn Suggested Disposal Method #10 is one option.

SECTION 14 — TRANSPORT INFORMATION

Shipping name: Not regulated. Hazard class: N/A. UN number: N/A.

N/A = Not applicable

SECTION 15 — REGULATORY INFORMATION

Not listed.

SECTION 16 — OTHER INFORMATION

Consult your copy of the *Flinn Science Catalog/Reference Manual* for additional information about laboratory chemicals.

Revision Date: March 21, 2014

FLINN SCIENTIFIC, INC.
Safety Data Sheet (SDS)

SDS #: 413.00
Revision Date: October 7, 2015

SECTION 1 — CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Iodine Solution, Lugol

Flinn Scientific, Inc. P.O. Box 219, Batavia, IL 60510 (800) 452-1261
CHEMTREC Emergency Phone Number: (800) 424-9300

Signal Word **WARNING**

Pictograms

SECTION 2 — HAZARDS IDENTIFICATION

Hazard class: Skin and serious eye damage, corrosion or irritation (Category 2, 2B). Causes skin and eye irritation (H315+H320).

SECTION 3 — COMPOSITION, INFORMATION ON INGREDIENTS

Component Name	CAS Number	Formula	Formula Weight	Concentration
Iodine	7553-56-2	I_2	253.81	1%
Potassium iodide	7681-11-0	KI	166.01	2%
Water	7732-18-5	H_2O	18.00	97%

SECTION 4 — FIRST AID MEASURES

Call a POISON CENTER or physician if you feel unwell.
If inhaled: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do so. Continue rinsing (P305+P351+P338). **If eye irritation persists:** Get medical advice or attention (P337+P313).
If on skin: Wash with plenty of water (P302+P352). **If skin irritation occurs:** Get medical advice or attention (P332+P313).
If swallowed: Rinse mouth. Call a POISON CENTER or physician if you feel unwell.

SECTION 5 — FIRE FIGHTING MEASURES

Nonflammable, noncombustible solution.
In case of fire: Use a tri-class dry chemical fire extinguisher.

NFPA CODE
None established

SECTION 6 — ACCIDENTAL RELEASE MEASURES

Ventilate area. Contain the spill with sand or absorbent material and deposit in a sealed bag or container. See Sections 8 and 13 for further information.

SECTION 7 — HANDLING AND STORAGE

Flinn Suggested Chemical Storage Pattern: Inorganic #2. Store with acetates, halides, sulfates, sulfites, thiosulfates and phosphates. Store away from heat and direct light.

SECTION 8 — EXPOSURE CONTROLS, PERSONAL PROTECTION

Wear protective gloves, protective clothing, and eye protection (P280). Wash hands thoroughly after handling (P264). Will stain skin, clothing, and surfaces.
Exposure guidelines: (as iodine) Ceiling 0.1 ppm (OSHA); TLV 0.01 ppm (inhalable fraction and vapor) (ACGIH)

SECTION 9 — PHYSICAL AND CHEMICAL PROPERTIES

Deep brown liquid. Iodine odor.

Biological stain, Lugol's stain.

SECTION 10 — STABILITY AND REACTIVITY

Shelf life: Fair to poor. See Section 7 for further information.

SECTION 11 — TOXICOLOGICAL INFORMATION

Acute effects: Irritant.
Chronic effects: N.A.
Target organs: N.A.

ORL-HUM LD_{50}: 2-4 g as iodine
IHL-RAT LC_{50}: N.A.
SKN-RBT LD_{50}: N.A.

N.A. = Not available, not all health aspects of this substance have been fully investigated.

SECTION 12 — ECOLOGICAL INFORMATION

Data not yet available.

SECTION 13 — DISPOSAL CONSIDERATIONS

Please review all federal, state and local regulations that may apply before proceeding.
Flinn Suggested Disposal Method #12a is one option.

SECTION 14 — TRANSPORT INFORMATION

Shipping name: Not regulated. Hazard class: N/A. UN number: N/A.

N/A = Not applicable

SECTION 15 — REGULATORY INFORMATION

Not listed.

SECTION 16 — OTHER INFORMATION

Consult your copy of the *Flinn Science Catalog/Reference Manual* for additional information about laboratory chemicals.

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