

**INDONESIA UNIVERSITY OF EDUCATION/UPI/
FACULTY OF SCIENCE AND MATHEMATICS EDUCATION
DEPARTMENT OF BIOLOGY**



**Primary School Teacher guide for the experiment
on how sensitive is the iodine test on starch
concentration?**

FOR

Biology Practical/BI706/

Submitted to:

Dr. Sri Anggreani

BY:

Sisay Hailu and Fayo Wado

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Teacher Guide for the Experiment on How Sensitive is the Iodine Test on Starch Concentration?

Experiment Title: How sensitive is the iodine test?

Lesson Summary:

Students are given a serial dilution of starch solution is made, starting from 1% and going down to .00010%. The resulting solutions are tested with iodine to estimate its sensitivity. Food samples are crushed in water and the extract tested with iodine.

Prior knowledge: knowledge of starch-iodide reaction, use of graduated pipette or syringe for measuring small volumes of liquid.

Minimum learning Competency /MLC/ Standards:

MLC/Standard:- Understand the effect of starch concentration on sensitivity of iodine test by using scientific method and the mechanisms of identifying nutrient content in the food.

Specific objectives: after performing this experiment learners will be able to:-

- Identify the effect of strength of starch solution the sensitivity of iodine test.
- Identify the constant, independent and dependent variables in the experiment.
- Measure the required amount of starch and iodine for the experiment.
- Use technology to test for the presence of starch in the diet/food/ in their daily life.
- Develop willingness to carry practical work following scientific methods.
- Draw a conclusion on the sensitivity of iodine test on strength of starch solution.
- Compare and contrast the relationships among concentration of starch and iodine test.

Background Information:

Plants store glucose as the polysaccharide starch. The cereal grains (wheat, rice, corn, oats, barley) as well as tubers such as potatoes are rich in starch. Starch can be separated into two fractions--amylose and amylopectin. Natural starches are mixtures of amylose (10-20%) and amylopectin (80-90%). Amylose forms a colloidal dispersion in hot water whereas amylopectin is completely insoluble. The structure of amylose consists of long polymer chains of glucose units connected by an alpha acetal linkage. Amylose in starch is responsible for the formation of a deep blue color in the presence of iodine. The iodine molecule slips inside of the amylose coil.

Iodine - KI Reagent: Iodine is not very soluble in water, therefore the iodine reagent is made by dissolving iodine in water in the presence of potassium iodide. This makes a linear triiodide ion complex which is soluble. The triiodide ion slips into the coil of the starch causing an intense blue-black color.

Starch Test: Add Iodine-KI reagent to a solution or directly on a potato or other materials such as bread, crackers, or flour. A blue-black color results if starch is present. If starch amylose is not present, then the color will stay orange or yellow. Starch amylopectin does not give the color, nor does cellulose, nor do disaccharides such as sucrose in sugar.

Iodine Test: When following the changes in some inorganic oxidation reduction reactions, iodine may be used as an indicator to follow the changes of iodide ion and iodine element. Soluble starch solution is added. Only iodine element in the presence of iodide ion will give the characteristic blue black color. Neither iodine element alone nor iodide ions alone will give the color result.

Hypothesis:-

- As the strength/concentration of starch solution increases, the colour change after adding iodine solution for test is increased/ more positive /proportional/that is deep Blue Black color will be observed.

Prediction

- Failure to obtain a blue colour may mean that starch is not present or is no sufficient concentration to give a blue colour with iodine.

Advance preparation and materials availability:

1 % starch solution 15 ml per group; iodine solution 5 ml per group; Food samples cut into pieces of about 1 ml. If the teacher uses the samples suggested, there will be a range of results from no starch (apple and onion), a little starch (banana), to much starch (potato). If seeds are to be used, they should be soaked the day before. The food samples should be collected or bought from super market or cafeteria or home two days before the practical session.

Apparatus-per group

15ml 1% starch solution, 5 ml iodine solution, 10 ml graduated pipette or syringes, test-tube rack and 7 test-tubes, dropping pipette, beaker, 5 labels or spirit marker, 5 Petri dishes, food samples /bread, rice, egg, potato, small mortar and pestle /.

Lesson Plan that show what the students and teacher to do

Suggested learning and teaching activities:	Time allocation	Remarks
I. Pre-lab Teacher asks the students 'What is the indicator used to test the presence of starch in unknown food sample? Teacher also asks the students to read the <i>Background Information, Setting the Stage, and Laboratory Methods</i> to themselves. Give students a conceptual framework for the lab: Why are they doing these experiments? <ul style="list-style-type: none"> • Help students connect the concepts addressed in the lecture with their applications in the lab exercise. • Begin the pre-lab introduction by reviewing some of the related concepts from lecture. After focusing on the related lecture concepts, discuss with the students how these concepts relate to the current lab exercise. • Outline what the students should do during lab: <ul style="list-style-type: none"> ○ The chronological steps of the lab ○ What they need to observe, draw, record, or take note of ○ What they must present after the lab period 	10 min.	Students should learn the use of Iodine in testing the presence of starch in the diet during lecture class. Teacher asks a few questions to check if the students are familiar with the concept. <u>Leading/Inquiry questions</u> <ol style="list-style-type: none"> 1. How to search the presence of starch in unknown food? 2. What will happen to the color change while the starch solution become more diluted? 3. Does the size/kind of food affect your result? 4. Which food has higher content of starch? 5. Which of the food sample does not contain starch? 6. Draw your own hypothesis on the relation between the sensitivity of iodine test on starch concentration. 7. Test your hypothesis through experiment following the given procedure
Teacher briefs the students the objectives and procedure of this investigation - to compare the staining power of three solutions on onion cells. Teacher demonstrates the procedure of sample preparation to the students. Allow time for students to answer the <i>Focus Questions</i> . Review answers to <i>Focus Questions</i> as a class. Review Laboratory Method, indicating reagents and materials needed.	10 min.	Teacher asks some questions about food test to enhance the analytical thinking of students. For instance: <ul style="list-style-type: none"> • Why do we need to test the food that we eat? • [Remarks: students seldom think so much about the rationale of the questions.
II. Laboratory Allow the students to work through <i>Experiment part I and II: testing the sensitivity of Iodine test on starch</i>		Students perform the experiments in groups - record, compare and discuss the result. The discussion should include the

<p><i>concentration following the given procedures,</i></p> <ul style="list-style-type: none"> • Visit every group, pair, or student at least once, if not more, during the lab period. • Ask good, probing questions that lead students to think further about the material. Refrain from merely asking, “Do you understand everything?” and then walking away. Be aware of different levels of questioning and how they influence student learning and interaction. Know when to use broad or focused questions. • Check on students how they are doing. • Pause lab in the middle once or twice (if applicable) to go over questions with the whole class, to look at a demonstration, or to discuss concepts or procedures. 	<p>30 min.</p>	<p>possible source of error and suggestion to improve the experimental procedure.</p> <ul style="list-style-type: none"> • What did you observe when you add iodine solution in different starch concentration and on different food samples? • Would you observe the same colour change uo on iodine test in each test tube? • Why the color observed at each test tube become different? • While performing the experiment following the given procedure identify the dependent and independent variables.
<p>III. Post-lab As groups finish and clean up, ask each group to report their findings on the board or overhead transparency, making a chart with the class results. Have each group discuss their conclusions. Summarize the class data and clarify any misconceptions.</p> <p><u>Assessment:</u></p> <ul style="list-style-type: none"> ✓ Observation on students practical performance during experiment (i.e. care for themselves, equipments and chemicals, performing the activity following the given procedure, proper utilization of lab apparatus, etc.) ✓ Students write a report for summarizing the objectives, steps taken to test the sensitivity of iodine test on starch concentration, their observation and conclusion. ✓ Students refelect thier experimental observation. ✓ Answer and question on their report during refelaction. ✓ 	<p>20 min.</p>	<p>Students' Presentation should include the materials they used and the steps they followed, observation, result, drawings, and/or pictures (if possible), data interpretation, conclusion, source of error.</p> <ul style="list-style-type: none"> • Why do we need to add equal amount of water in each of the test tube by transferring the starch solution from one test tube to the other? • Why equal amount of food samples were taken? • What is your conclusion based on data? • Is the conclusion accept/reject the hypothesis?

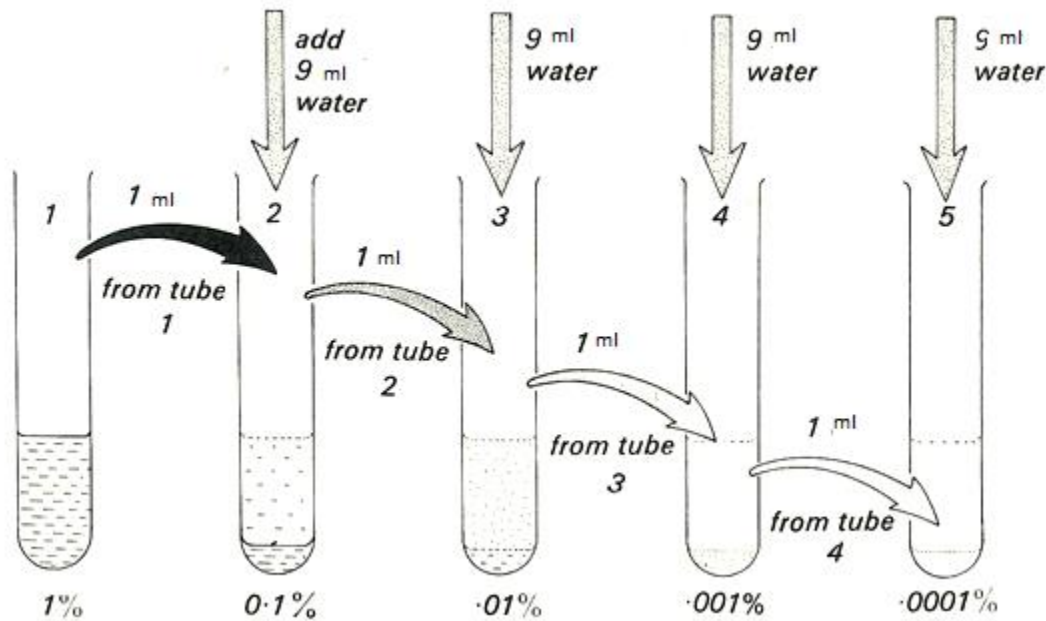
Finally, teacher gives comments on students' findings and concludes on the activities.	10 min.	Through this activity, students should focus more on the process skills - the interpretation of the result based on the observation.
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Procedures that show how the experiment can be conducted

Make a dilution of starch solution as follows:

- a. Place five clean test-tubes in a rack and label them 1-5.
- b. Using a 10 ml pipette or syringe, place 10 ml 1% starch solution in tube 1.
- c. Take 1ml of the solution from tube 1 with the pipette or syringe and place it in tube 2.
- d. Add 9 ml water with the pipette or syringe to tube 2 and shake sideways to mix the contents. The 1 ml of 1% starch solution has now been diluted ten times to make a 0.1 % solution.
- e. Transfer 1 ml of this 0.1% starch solution from tube 2 into tube 3.
- f. Add 9 ml water to tube 3 and shake. This will give a .01 % solution.
- g. Transfer 1 ml solution from tube 3 to tube 4 and dilute with 9 ml water so making a .001% solution.
- h. Repeat the operation for tube 5.
- i. Tubes 1-4 will now have 9 ml solution in them but tube 5 will have 10 ml so remove 1 ml of this solution from tube 5 so that the subsequent test is a fair one.
- j. Add one drop of iodine solution to each tube and shake to mix.

The procedure summerised as follows



Variables:

Constant variable: Amount of water and Iodine solution

Independent variable:- strength/concentration/ of starch solution

Dependent variable:- colour change after adding iodine on starch.

Data collection and analysis

Strength of solution	Colour after adding iodine	Interpretation
0.0001%		
0.001%		
0.01%		
0.1%		
1%		

Discussion

1. What is the least concentration of starch that iodine solution will detect?
2. If your answer to question 1 is a single percentage, it will need a qualifying statement.
3. Do you think a 0.0001 % solution contains any starch at all? Why?

Drawing conclusion and drawing graph

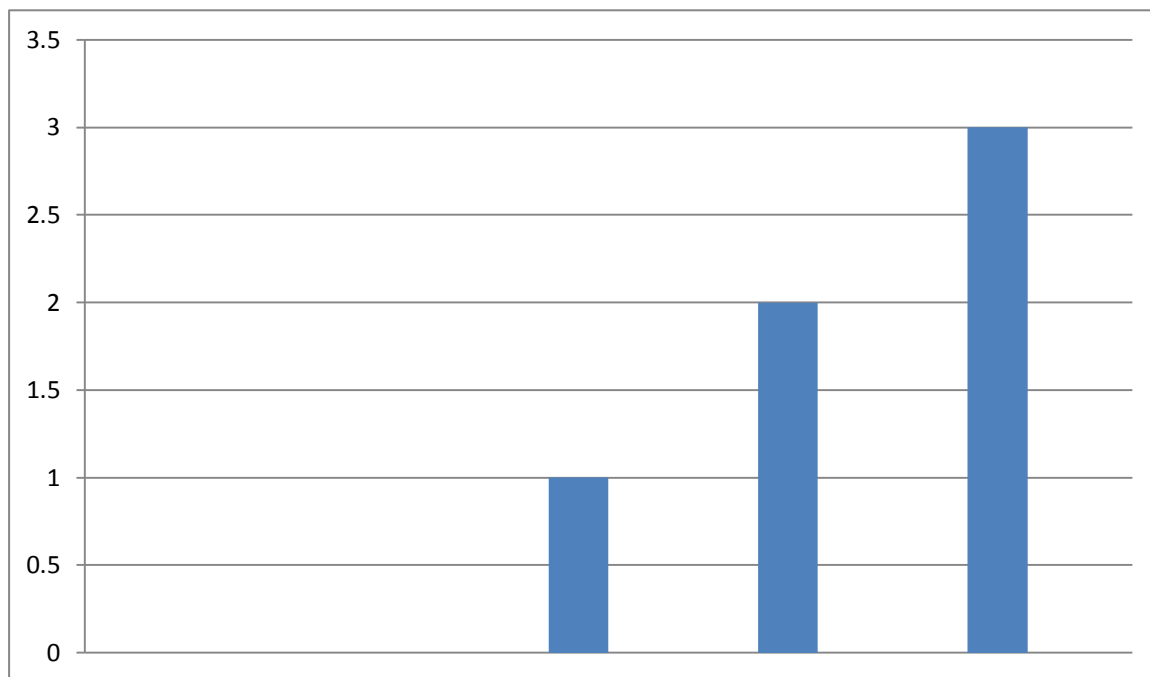


Figure 1.1 A graph showing the sensitivity of iodine test on the strength of starch solution

Experiment Part II. For comparison and checking the presence of starch in food sample

(a) Label 4-6 petridishes or taste tubes.

(b) Crush an equivalent quantity /e.g 1gm), of each food sample separately in a mortar with about 10 ml water.

(c) Pour the mixture into a clean test-tube or petridish.

(e) Add three to five drops of iodine solution to each food samples.

(f) Record your results in the table in your notebook and repeat the experiment with the next food sample.

Food sample	Colour change with iodine	Interpretation of result
1. Rice		
2. Bread		
3. Egg /yellow part/		
4. Egg /white part/		

Experiment Part II . Questions for Discussion

1. If a food sample, extracted and tested as above, gives a blue colour with iodine solution, can you assume that starch is present in the sample?
2. Does the result indicate that the only food present is starch? Why?

3. Does the result mean that starch will be present in all samples of the same food?
4. If the food sample, when tested, gives no blue colour, does it mean invariably that no starch is present?
5. If, with your sample of bread, you obtained a blue colour that corresponded closely to

your 1% result in experiment part I, why would you not be justified in saying that 1% of the potato sample was starch?

Part II. Possible Discussion – *answers*

1. Provided that all precautions /safty labs are taken to exclude starch from other sources, it is reasonable to say that the food sample contains starch.
2. The result shows that starch is present but there may be other substances also.
3. Some samples may not contain starch, e.g. White part of the egg contains starch but yellow part of the egg may not, old peas will contain starch, but young peas may not. Also, different parts of the same vegetable or fruit may have different amounts of starch,
4. Failure to obtain a blue colour may mean that starch is not present or is not in sufficient concentration to give a blue colour with iodine or that it has not been successfully extracted (though the latter seems unlikely).
5. Here several reasons might be indicated. For example:
 - a. The 1 % solution was the strongest tested; the colour may be so intense that the stronger solutions would show no visible difference. Thus bread may contain considerably more than 1 % starch.
 - b. The statement would assume that all starch had been extracted from the bread.
 - c. Unless the volume of the sample is known, the diluting effect of 10 ml water cannot be calculated but the content of 'undiluted' potato would be more than 1 %.

PRECAUTION /Safty lab.

While performing the iodine test for starch we need to follow following precautions;

- Be careful in handling iodine i.e iodine solution must be handled with care. It can stain clothing, equipment and skin.
- DO NOT put iodine in your mouth.
- Do not consume any food in the laboratory in general because it may contaminate the food sample.
- DO NOT eat any tested foods in particular, as iodine can be poisonous.
- Wash your hands and throw everything away when done.
- The starch test is a sensitive one, so if you use a test-tube for more than one experiment, make sure it is thoroughly cleaned out each time or else traces of starch from one food sample may remain on the sides and give a positive result for a sample which, in fact, contains no starch. For the same reason, the mortar and pestle must be washed between each test.
- Wear eye protection glass.

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