

Starch test

Reagents:

1. Potato starch – p
2. Potato – p
3. Bread - p
4. Flour – p
5. Apple - neutral
6. Cheese – n
7. Sugar – n
8. Iodine solution
9. Water

Preparation for experiment:

- **Iodine dilution** – 1:10 dilution is okay (1ml of 5% iodine + 9ml water). We are using this to compare samples under identical conditions.
- **Prepare the food** – put small slices of each food separately on a white plate (maybe a plastic plate will be better not to stain the white porcelain or ceramics).

Experiment

1. Place small pieces of food on separate plates. For fruits and vegetables use freshly cut surfaces, use a small piece of bread and cheese and make small heaps out of flour and sugar.
2. Add diluted iodine to each sample and observe.

Explanation - Iodine forms a strongly colored complex with starch. Starch has a helical structure; it coils into a spiral shape (because of amylose). Iodine does not solve well in water, so in iodine solutions there is an equilibrium of iodine and iodine salts, such as Potassium Iodine. Together these compounds create polyiodide species, such as I_3^- and these structures are very linear. Once polyiodide is in the same mixture as the starch, it slides into the helical structure of the starch. After the iodide molecule gets trapped into the starch, the starch acts as an electron donor and the polyiodide chain acts as an electron acceptor. This transfer of electrical charge changes how the electrons move and alter the energy levels of the system. So, the new combination absorbs almost all visible light, which our eyes perceive as a deep, dark blue-black color.

Vitamin C detection

Reagents:

1. Iodine solution
2. Starch solution (to use as an indicator)
3. Vitamin C
4. Fresh Orange juice
5. Packaged orange juice
6. Lemon juice
7. Apple juice
8. Water

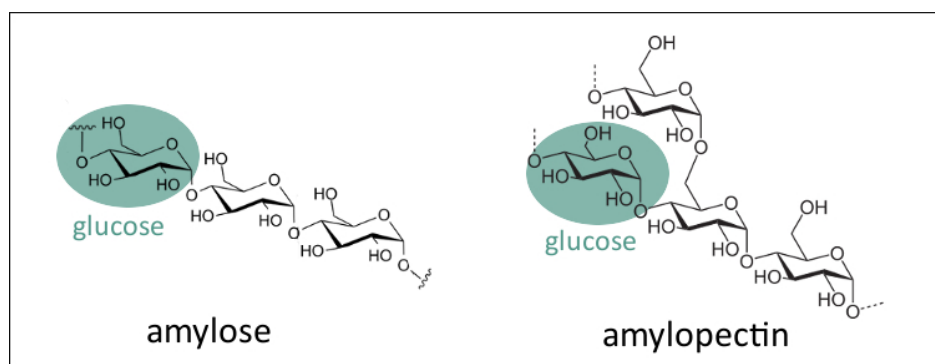
Preparation for experiment:

- **Iodine dilution** – 1:10 dilution is okay (1ml of 5% iodine + 9ml water). We are using this to compare samples under identical conditions.
- **Starch Indicator** – 0.5 g starch + 50 ml water. Mix the starch with a teaspoon of cold water to make smooth mass. Then add boiling water to this, stirring continuously. Heat until it becomes translucent/cloudy rather than having obvious starch particles and after, let it cool completely. 8-10 drops per sample should be fine.
- **Vitamin C control** – 1ml ampoule + 49 ml water. This is for positive control.
- **Preparing the samples** – if the juices are pulpy, straining them first would be better. Dilute the strongly colored juices 1:1 with water, so that the reaction can be easier to see.

Experiment:

1. **Indicator chemistry** – 5 ml water + 8-10 drops of starch indicator -> dark blue/purple/blue-black color.

Explanation - Iodine forms a strongly colored complex with starch. Starch has a helical structure; it coils into a spiral shape (because of amylose). Once iodine is in the same mixture as the starch, the polyiodide chain slides into the helical structure of the starch. After the iodide molecule gets trapped into the starch, the starch acts as an electron donor and the polyiodide chain acts as an electron acceptor. This transfer of electrical charge changes how the electrons move and alter the energy levels of the system. So, the new combination absorbs almost all visible light, which our eyes perceive as a deep, dark blue-black color.



2. Vitamin C chemistry – 5 ml diluted vitamin C + 8-10 drops of starch + 1 drop iodine. After adding iodine swirl. The iodine color disappears because vitamin C reacts with iodine.

Explanation – ascorbic acid (vitamin C) + iodine $\rightarrow$ dehydroascorbic acid + iodide ions + hydrogen ions (protons). During this reaction, colorful iodine molecules are changed into colorless iodide ions. Vitamin C acts as a reducing agent, which means it easily gives away electrons. When we mix vitamin C with iodine, vitamin C donates electrons to the iodine molecules, reducing them into iodide ions. Iodide ions do not have color in water, so the liquid is clear. Meanwhile, since vitamin C loses electrons, it turns into dehydroascorbic acid.

3. Sample investigation – 5 ml of each prepared sample + 8-10 drops of starch. Mix them well. Then add diluted iodine one drop at a time. After each drop wait a few seconds and observe. We're looking for a point at which the dark color remains.

Explanation – the color remains after all the vitamin C in the juice is used up, so there is no more ascorbic acid that will reduce iodine into iodide, so free iodine remains. Add to this the presence of starch, with which iodine creates a blue-black color because the iodine gets embedded into the starch structure. So, the more iodine required to reach the endpoint – greater vitamin C in that amount of sample.