Comparing Vitamin C Content in Fruit Juices

Introduction

Vitamin C (ascorbic acid) is water soluble and a strong reducing agent. In this lab, ascorbic acid reduces an indicator, 2,6-dichloroindophenol. The indicator solution will change from a blue color to an intermediate pink/purple color, then to a colorless/very faint amber endpoint with the addition of ascorbic acid.

Concepts

- Oxidation–reduction
- Consumerchemistry

Materials

2,6-Dichloroindophenol, sodium salt, 0.25 g
Vitamin C tablets, 500 mg, 2
Beral-type pipets, thin-stem
Graduated cylinder, 10-mL
Stirring rod
Test tube rack
Test tubes, 16 × 125 mm
Various fruit juices, including: orange, grapefruit, lemon, lime, etc.

Safety Precautions

Although Vitamin C and 2,6-dichloroindophenol are not considered hazardous, students should wash their hands thoroughly after handling. Food items, once brought into a lab, are considered chemicals and, as such, should not be ingested. Wear chemi- cal-splash goggles. Please review current Material Safety Data Sheets for additional safety, handling, and disposal information.

Preparation

These solutions should be prepared no more than one day in advance and refrigerated until use. Prepare the 0.025% dichlor- oindophenol solution by dissolving 0.25 g of dichloroindophenol in about 500 mL of distilled or deionized water in a one-liter volumetric flask. Fill up to the one-liter mark with water. Cap and invert to mix.

Prepare a 100 mg/100 mL (0.1%) Vitamin C solution by first crushing the two tablets with a mortar and pestle. Fill a one-liter volumetric flask with about 500 mL of distilled or deionized water and transfer the crushed tablets to the flask. Fill up to the one liter mark with water. Mix thoroughly on a magnetic stirrer. Do not heat. There will be a small amount of undissolved binder material; this is not the ascorbic acid.

Procedure

1. Using a 10-mL graduated cylinder, measure out 10 mL of 0.025% dichloroindophenol solution. Transfer to one of the test tubes.
2. Using a Beral-type pipet, add the Vitamin C solution drop by drop, counting each drop added to the test tube until the color changes from blue to the colorless/very light amber endpoint. Be sure to stir or swirl the solution after each drop is added. Record the number in a data table. Repeat the procedure two more times to obtain more accurate results.
3. Repeat the procedure using fruit juice as the Vitamin C source. Be sure to ignore the intermediate pink color; continue adding drops until the clear-amber color appears. Record the drop counts for the fruit juice sample in the data table.
4. Repeat with other juices. Try other vitamin supplements or make solutions with Vitamin C rich fruits or vegetables (like limes).

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Disposal

Please consult your current *Flinn Scientific Catalog/Reference Manual* for general guidelines and specific procedures governing the disposal of laboratory waste. All solutions may be disposed of down the drain according to Flinn Suggested Disposal Method #26b.

Connecting to the National Standards

This laboratory activity relates to the following National Science Education Standards (1996):

Unifying Concepts and Processes: Grades K–12

Evidence, models, and explanation

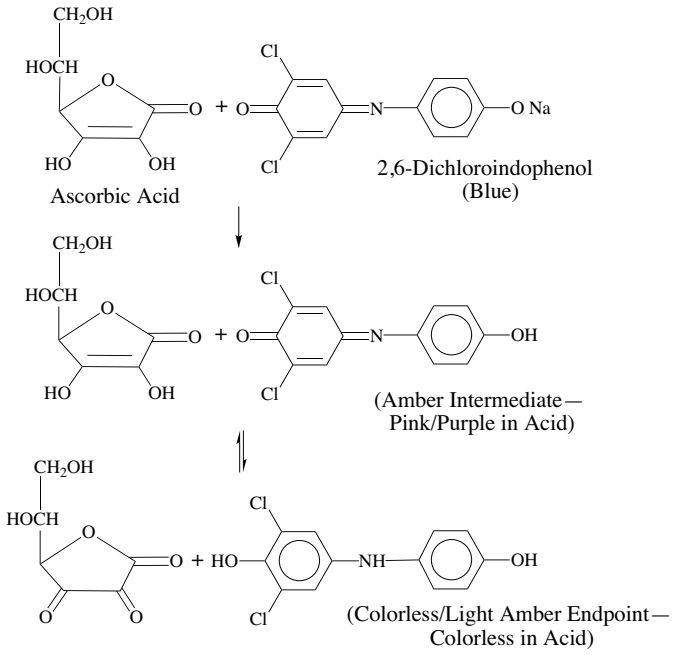
Content Standards: Grades 5–8

Content Standard B: Physical Science, properties and changes of properties in matter
Content Standard F: Science in Personal and Social Perspectives, personal health

Content Standards: Grades 9–12

Content Standard B: Physical Science, structure and properties of matter
Content Standard F: Science in Personal and Social Perspectives, personal and community health

Reaction



Discussion

Using the Vitamin C solution as a standard, the amount of Vitamin C in fruit juices can be calculated. If it takes 29 drops of Vitamin C solution and 77 drops of orange juice to neutralize 10 mL of dichloroindophenol solution, the calculations are as follows:

(Drops standard)(Concentration standard) = (Drops unknown)(Concentration unknown)
(29 drops) (100 mg/100 mL of Vitamin C) = (77 drops) (n mg/100 mL of Vitamin C)
n = 37.6mg

Therefore the concentration of Vitamin C in the orange juice is 37.6 mg/100 mL.effect is shown below.

Listed below are a few juices and their ranges of Vitamin C content.

Juice	Vitamin C Content
Orange	20–80 mg/100 mL
Grapefruit	35–65 mg/100 mL
Lemon	30–70 mg/100 mL
Lime	5–40 mg/100 mL

Vitamin C, ascorbic acid, is important nutritionally. There are numerous natural sources including citrus fruits and some green plants such as spinach and green peppers. All plants and animals except humans, other primates, and guinea pigs, produce Vitamin C naturally; therefore, Vitamin C must be a part of our daily diet. The Recommended Dietary Allowance (RDA) of Vitamin C for teens is 60 mg per day, which is provided by one 8 oz. glass of fresh orange juice. Many medical and dietary professionals believe that higher daily doses of Vitamin C have a positive effect on the immune system, helping us to stave off a variety of infections and diseases, including the common cold.

A deficiency in Vitamin C can result in a disease known as scurvy, the symptoms of which are bleeding, spongy gums and a tendency to bruise easily. You may have heard of British sailors historically referred to as "limeys". The name limey was given to the sailors because, during long voyages, they would eat limes to prevent scurvy.

References

Boyer, R. F. Modern Experimental Biochemistry; Addison-Wesley: Reading, MA, 1986.
Morholt, E. and Brandwein, P. F. A Sourcebook for the Biological Sciences. Harcourt Brace Jovanovich, San Diego, CA, 1986.
Recommended Dietary Allowances, 10th ed.; National Research Council; National Academy: Washington, D.C., 1989; pp 118–124.

Materials for *Comparing Vitamin C Content in Fruit Juices* are available from Flinn Scientfic, Inc.

Catalog No.	Description
D0009	2,6-Dichloroindophenol, 1 g

Consult the Flinn Scientific website for current prices.