Vitamin C Analysis (Redox Titration)

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PURPOSE: The goal of this experiment is to determine the ascorbic acid content in juice and a vitamin C tablet using redox titration with 2,6-dichloroindophenol.

Required Reading & Videos

- Ref. (I), section 4.4 (Oxidation-Reduction (Redox) Reactions), solve sample problem 4.18
- Very important: Read sections G and H of Easter Laboratory Skills and Economics review section F
- Video: Making a Solution Using a Volumetric Flask.
- Video: Using an Automatic Pipet

Introduction:

Ascorbic acid (AA), commonly known as vitamin C, is an organic compound of carbon, hydrogen and oxygen that occurs naturally in fruits and vegetables. It is an essential nutrient in the diet but is readily assidized or destroyed when emosed to heat and oxygen during food spocessing. packaging and storage. Vitamin C deficiency causes scurvy a wedespread sailor's disease until the early 19th century. with serious symptoms including bleeding of the mucous membranes, anemia and eventually death. In 1747, James Lind, a naval surgeon, conducted an experiment with sick sailors. He discovered that citrus fruits cured scurvy. In 1928, vitamin C was isolated for the first time, and five years later its chemical structure was determined. Vitamin C was named accorbic acid to indicate its anti-corbutic (antiscurvy) properties. Soon after its discovery, an industrial process was developed to produce ascerbic acid from glucose. Today it is the most produced vitamin in the world exceeding 100,000 tons per year (2).

Thrimetric Analysis of Vitamin C

AA is not only used as a dietary supplement but also as a food preservative. It acts as an anticoodant — a substance that inhibits condation and free radical damage to cells. When AA is involved in redoor reactions, it plays the role of a reducing agent by donating two electrons.

$$C_6H_6O_6 \rightarrow C_6H_6O_6 + 2H^* + 2e^-$$

 AA debydco- AA

In this reaction, AA is condined to dehydroascorbic and. The content of AA in samples can be determined by titrating the samples with 2,6-dichloroindophenol (DCP). DCP is also an organic compound and acts as an oxidizing reagent.

$$C_{13}H_3O_3NCl_3 + 2H^* + 2\pi \rightarrow C_{13}H_3O_3NCl_3$$

DCP letaco dyre

In this reaction, DCP is reduced to leuco dye. Combining these two chemical equations, we obtain the equation for the reaction of AA with DCP:

$$C_6H_6O_6 + C_DH_7O_3NCI_3 \rightarrow C_6H_6O_6 + C_DH_9O_3NCI_3$$
AA DCP debroko-AA leuco dre

DCP is a blue dye, but it is pink under acidic conditions. In a titration with blue DCP solution, the dye initially turns pink when it enters the acidic solution, but then the color is immediately removed because it is reduced to the colorless leuco dye. Once the titration is complete, a fraction of a drop of excess DCP solution imparts a pink color to the solution. The error introduced by the excess DCP is negligible. DCP is very reactive and decomposes over time. Therefore, DCP solutions must be freshly prepared and standardized just prior to use. Standardization is the titration of a titrant with a weighed quantity of a primary standard. With the known amount of the primary standard used, the concentration of the titrant can be calculated. In this experiment, you will standardize the DCP solution with reagent-grade AA.

The titration is performed in the presence of metaphosphoric acid and acetic acid (MPA-HOAc solution) to stabilize AA. Keep in mind that this experiment is quantitative. Work accurately and transfer solids and liquids quantitatively. All students must demonstrate their ability to use an automatic pipet prior to the experiment.

Apparatus:

125-ml. Erlenmeyer flasks, buret, automatic pipet & tip, 50-ml. volumetric flask, 100-ml. volumetric flask, funnel, mortar and pestle, and graduated cylinders.

Chemicals

- MPA-HOAc solution (contains 3% metaphosphoric acid and 8.4% acetic acid): Toxic and corrosive. Causes severe skin burns and eye damage.
- A recerbic acid: not hazardous.
- 2,6-Dechloroundophenol solution (the molarity of DCP will be determined in Part I). May cause eye, skin, and respiratory tract irritation. Spill on skin Immediately flush skin with excess water for 15 minutes while removing contaminated clothing. This solution also contains 0.004 M NaHCOs.

Experimental Procedure

Fart I. Standardizing the DCP Solution

- Using a 50-mL volumetric flask, prepare an aqueous solution that is approximately 0.005 M in AA (see video and required reading for instructions). Include the procedure and calculations in your notebook <u>prior to lab</u>. Record the mass of AA accurately and recalculate the molarity. Pour the solution into a beaker.
- 2. The automatic pipet (AP) at your station should only be used to transfer AA solution and Vitamin C tablet solution (Part III). Rings the tip between different solutions. The AP is a delicate and expensive instrument. Handle it carefully and follow the instructions! Transfer 2.50 mL of your AA stock solution to a 125-mL. Erlenmeyer flask using the AP at your station.

Analysis For Vitamin C Pre Lab Answers

Shiyang Pan, Jinhai Tang

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Clinical Molecular Diagnostics Shiyang Pan, Jinhai Tang, 2021-07-08 This book covers the discovery of molecular biomarkers the development of laboratory testing techniques and their clinical applications focusing on basic research to clinical practice It introduces new and crucial knowledge and ethics of clinical molecular diagnosis This book emphasizes the applications of clinical molecular diagnostic test on health management especially from different diseased organs It lets readers to understand and realize precision healthcare General, Organic, and Biological Chemistry Study Guide and Selected Solutions Karen C. Timberlake, 2001-11 Keyed to the learning goals in the text this guide is designed to promote active learning through a variety of exercises with answers and mastery exams The guide also contains complete solutions to odd numbered problems **Experimental Organic Chemistry** Daniel R. Palleros, 2000-02-04 This cutting edge lab manual takes a multiscale approach presenting both micro semi micro and macroscale techniques. The manual is easy to navigate with all relevant techniques found as they are needed Cutting edge subjects such as HPLC bioorganic chemistry multistep synthesis and more are presented in a clear and engaging fashion Chemistry Eugene LeMay, Jr., Herbert Beall, Karen M. Robblee, Douglas C. Brower, Prentice-Hall Staff, 2002-02 FDA Consumer ,1979 Laboratory Experiments for General Chemistry Harold R. Hunt, Toby F. Block, George M. McKelvy, 1998 FDA Papers, 1979 Safety-Scale Lab Exp Biochem 2e Spencer L. Seager, Michael R. Slabaugh, 1994-05 Journal of AOAC International ,1992 **Nutrition Abstracts and** Laboratory Handbook University of Minnesota. Hospital and Clinic, 1991 A guide to test characteristics **Reviews** .2006 Biological Science Biological Sciences Curriculum Study, 1996 and selection for use at UMHC Haver-Glover Messenger ,1939 Progress Thru Research ,1973 Advances in Automated Analysis, 1971 **Biological Abstracts** Jacob Richard Schramm, 1963 Government Reports Announcements & Index ,1980 Food Science and Technology Abstracts ,1980 American Men of Science ,1949 Toxicology Research Projects Directory, 1980 An indexed directory of current research project abstracts in toxicology and related fields

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