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

Karen C. Timberlake

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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 FDA Consumer ,1979 **Chemistry** Eugene LeMay, Jr., Herbert Beall, Karen M. Robblee, Douglas C. Brower, Prentice-Hall Staff, 2002-02 Laboratory Experiments for General Chemistry Harold R. Hunt, Toby F. Block, George M. McKelvy, 1998 Illustrated Guide to Home Forensic Science Experiments Robert Thompson, Barbara Fritchman Thompson, 2012-08-14 Learn how to analyze soil hair and fibers match glass and plastic specimens develop latent fingerprints and reveal blood traces conduct drug and toxicology tests analyze gunshot and explosives residues detect forgeries and fakes analyze toolmark impressions and camera images match pollen and diatom samples extract isolate and visualize DNA samples P 4 of cover FDA Papers ,1971 Kinn's The Medical Assistant - E-Book Brigitte Niedzwiecki, Julie Pepper, 2022-11-20 Selected for Doody's Core Titles 2024 in Medical Assisting More than any other product on the market the most successful Medical Assistants begin their careers with Kinn Known for more than 65 years for its alignment with national curriculum standards Kinn's The Medical Assistant An Applied Learning Approach 15th Edition teaches the real world administrative and clinical skills essential for a career in the modern medical office always with a focus on helping you apply what you ve learned This edition features a new unit on advanced clinical skills and expanded content on telemedicine infection control related to COVID 19 IV therapy radiology rehabilitation insurance coding privacy data security and much more With its approachable writing style appropriate for all levels of learners and a full continuum of separately sold adaptive solutions real world simulations EHR documentation experience and HESI remediation and assessment quickly master the leading skills to prepare for certification and a successful career in the dynamic and growing Medical Assisting profession Comprehensive coverage of all administrative and clinical procedures complies with accreditation requirements Step by step illustrated procedures include rationales and a focus on professionalism Electronic health record EHR coverage provides access to hands on activities using SimChart for the Medical

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<u>Current List of Medical Literature</u>, 1959 Includes section Recent book acquisitions varies Recent United States publications formerly published separately by the U S Army Medical Library

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