Measurement of vitamin c

Lab Report: MEASUREMENT OF VITAMIN C Introduction Nutritional diseases were once the number one cause of death only a century ago, but rarely affect our lives today. The complete lack of vitamin C (ascorbic acid) characterized by dark purple spots on the skin and rotting gums, a disease called scurvy, took the lives of many sailors up until the mid 1800s when the prevention was discovered. Consequently, British sailors became referred to as ‘ limeys’ because of their daily habit of eating limes to maintain their vitamin C levels. Citrus fruits and green plants synthesize a very high concentration of ascorbic acid, and other plants and most all animals can produce some amount as well, except humans.

We must rely on our dietary intake to maintain healthy levels of this nutrient. The recommended amount of vitamin C ranges from about 60mg up to 3g per day, depending on the physician and the individual’s needs, but many products on the market are supplemented with ascorbic acid to ensure our daily requirements can be met. While scurvy is no longer a predominant threat to our health, deficiency of vitamin C can still cause a few complications affecting our joints and a weakness getting over the flu. Therefore, it is imperative that vitamin C concentrations can be quantified in what we consume and its presence in our bodies. Ascorbic acid can be analyzed using titration techniques with iodine, 2, 4-dinitrophyenylhydarzine, a redox indicator, or N-Bromosuccinimide (NBS), but caution must be used with temperature because ascorbic acid in the oxidized form, dehydroascorbic acid, is unstable. Both forms are biologically active, but dehydroascorbic acid has no affect with scurvy.

N-Bromosuccinimide (NBS) readily oxidizes ascorbic acid before other interferences can react, enabling reliable measures of ascorbic acid content by titration. The addition of potassium iodide and starch to create a titration endpoint marker can therefore be done without complication or risk of contaminating the ascorbic acid analyte, and the resulting free iodine is immediately detected by the blue color change occurring with reaction to starch. The reaction is as follows: Experimental Solution Preparation Following procedure 1 described in the lab manual, we began sample titrations of NBS, known concentration 1. 288×10^-3M, against a known ascorbic acid solution of concentration 2.

189×10^-3M. 10. 00mL of ascorbic acid was added to an Erlenmeyer flask, along with 2mL of 4% KI solution, 4 drops of starch indicator solution, and 5mL distilled water. Four titrations with the NBS standard solution were carried out following this procedure, and the first discarded due to instrumental error with the buret. The measurements of NBS volume are recorded in Table 1.

For the second titration, one Nature Made Vitamin C tablet was weighed, ground thoroughly in a mortar, transferred to weighing paper and weighed again with masses of 0. 611g solid and 0. 5700g ground. The ground tablet was transferred to a 500mL volumetric flask, 5mL of 5% sulfuric acid was added then distilled water filling the flask and it was mixed well. Each following titration used a 5.

0mL aliquot of this solution transferred to an Erlenmeyer flask with 2mL of 4% KI solution, 5mL of 5% sulfuric acid, 4 drops of starch, and 5mL distilled

water. Titrations were carried out identically to procedure 1 and the volumes of NBS for each trial is listed in Table 2. In the last procedure, 10. 0mL of Ocean Spray White Cranberry was used and transferred into an Erlenmeyer flask with the same solution components of procedure 2.

Volume of NBS for each trial is recorded in Table 3. 1. 288 x10^-3M NBS, 2. 89 x10^-3M ascorbic acid, 4% (w/v) KI solution, 5% (V/V) H2SO4, and 1% (m/v) soluble starch solution were provided. Results The experimental ascorbic acid concentration determined from procedure 1 is 9. 823 x10^-4M, and the percent error with the known ascorbic acid concentration of 2.

189 x10^-3M is -55. 13%. Calculation: 1: 1 mol ratio 1. 288 x10^-3M NBS/7. 63mL NBS x (1L/1000mL) = 9.

827×10^-6mol of NBS: n mol ascorbic acid 9. 827×10^-6mol ascorbic acid/10. 0mL ascorbic acid x (1L/1000mL)= 9. 823×10^-4M ascorbic acid E=(experimental value-true value)/true value x 100E=(9. 823×10^-4M-2.

189 x10^-3M)/2. 189×10^-3M x 100 = -55. 13% The Nature Made Vitamin C tablet had an average mass of 646. 1g, a 29. 22% relative error compared to the product label.

Our fruit juice, Oceanspray White Cranberry, had an average mass of 0. 407mg/mL, a 40. 34% relative error compare to its label(using 70mg vitamin C per day as the RDA). Data analysis was performed on each table for mean volume (mL), standard deviation, and the 95% confidence interval for each measurement using the functions in Microsoft Excel. Discussion While the percent error for each procedure shows significant discrepancies in actual

and true values of vitamin C, the titration techniques themselves show very close precision. Our results might be better explained by one of the initial concentrations of NBS or ascorbic acid being labeled incorrectly or measured incorrectly, due to the fact that all our calculations were based on these standard measurements and our figures are very precise.

Also, the Food and Drug Administration responsible for the Nutrition Facts ound on products might regard a value of vitamin C above 100% unnecessary. Indeterminate errors such as the measurement of the buret by different lab partners could also have had an affect on our results. The importance of vitamin C in our human biological processes has already been expressed by its prevention of scurvy, although exact metabolic processes are not completely understood. The interactions seen through chemical analyses and laboratory experiments like this always have the potential to discover novel reactions and lead to a further understanding of ascorbic acid’s processes.