

Vitamin C Content of Foods

Experiment #11

Pre-lab Exercise

1. Vitamin C is considered to be unstable during cooking. What kind of chemical reaction do you expect vitamin C to undergo in solution (hydrolysis, oxidation, reduction)? [Hint: look at the reaction with iodine in the introduction].
2. Show the chemical reaction you would expect for loss of ascorbic acid when heated in air (O_2). Again, look at the reaction with iodine, oxygen should react similarly with regard to this reaction?
3. The formula shown in the introduction (equation 1) can be used to calculate the amount of ascorbic acid (mg) in test solutions. If 10.5 mL of iodine solution is needed to titrate 10.0 mL of 1.0 mg/mL ascorbic acid standard solution and 7.0 mL of iodine solution is needed to titrate 10.0 mL of an ascorbic acid test solution. What is the concentration (mg/mL) of ascorbic acid in the test solution?

4. In Experiment #5, The Chemistry of Carbohydrates, you tested for starch with iodine solution. What color change is observed when iodine solution is added to starch solution?
5. What is the recommended dietary allowance (RDA) for vitamin C for adults? See text book or find this information on the internet.
6. What disease results if a person becomes deficient in vitamin C? What are the symptoms of this disease?
7. Given the symptoms of vitamin C deficiency, what is one biochemical function for vitamin C in the body? You should describe the biochemical or metabolic function in which vitamin C is involved (see textbook).

Name _____

Section _____

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Data & Report Sheet

Part B. Titration of Ascorbic Acid Standard Solution (1 mg/mL):

Flask 1

Flask 2

Final level of iodine soln. in buret:
(Read from top of buret down)

Initial level of iodine soln. in buret:
(Zero is at top of the buret)

-

-

Total vol. of iodine soln. used:

Average volume used:

_____ mL

Use this number in the denominator of Equation 1
for all calculations using Equation 1.

B-1. When you mix 10.0 mL of ascorbic acid standard solution in the flask with 10 mL water, 2 mL of 6M acetic acid solution and 1 mL of starch solution, is it necessary to know the exact final volume of this solution to get an accurate determination of ascorbic acid in the titrations of test solutions? Explain. Hint: Do the volumes of water, acetic acid and starch solutions enter into the calculations to determine the amount of ascorbic acid? Does the volume of ascorbic acid solution added before titration influence how much iodine solution will be needed?

Part C. Determination of Ascorbic Acid in Test Solutions:

Titration Results	deionized H ₂ O		sodium carbonate solution	
	1	2	1	2
Final vol, mL				
Initial vol, mL				
Total used, mL (numerator in Eq. 1)				
Vit C, mg/mL				
% Original Vit C Remaining in Sample (100 x vit C, mg/mL above)				

C-1. Give a brief explanation for any differences in the amount of ascorbic acid remaining in the heated test solutions, *i.e.*, what may cause differences between deionized water and alkaline sodium carbonate conditions?

C-2. Does heating cause any disappearance of vitamin C in the water solutions? Why would heating affect vitamin C?

Name _____

Section _____

Part D. Vitamin C in Beverages.Beverage Samples: A) _____ mL of _____
Type of BeverageB) _____ mL of _____
Type of Beverage

C) 10 mL of vitamin C tablet dissolved in 200 mL water.

Titration Results

	A	B	C
Final vol, mL			
Initial vol, mL			
Total vol used, mL (numerator in Eq. 1)			
Concentration of Vit C (mg/mL)			
Vit C per serving (mg/mL x mL/serving)*			
% RDA for Vit C (RDA = 60 mg)			

* If you use 8 ounces as a typical serving size, that is equivalent to about 235 mL/serving.

D-1. Check the labels for the juice or beverage containers and record whether vitamin C is listed for that beverage and indicate how much is supposed to be in the beverage if that information is given. If it's not given, do you think it should be? If the label indicates 100% (of RDA), how does your result compare with the manufacturer's claim?

D-2. Would you consider either of the beverage samples a "good" source of vitamin C in the diet? Give your own clarification of what a "good" source would be.

[Answer questions on next page].

D-3. If you measured vitamin C in the solution prepared from a vitamin C tablet, calculate how much vitamin C was in the tablet (show your work) and compare that with the amount claimed to be in the tablet given on the label. [Note: You dissolved the tablet in 200 mL of water, so the serving size for the calculation would be 200 mL]. What may account for any significant difference between what you measured and what is claimed? (Check the expiration date on the vitamin C bottle).

Give a brief summary of your own conclusions about the chemical stability of vitamin C and how this might affect the amount of vitamin C that may be found in foods, such as cooked vegetables.