

Aim: The objective of this experiment is to determine the vitamin C content of a lemon.

Apparatus: Lemon juice, vitamin C solution (fresh, 0.1%), 2 test tubes, test tube rack, pipette to measure 2.00 cm^3 volume, DCPIP (dichlorophenolindophenol, 0.1% aqueous solution).

Procedure: The lemon juice and vitamin C solution were provided by the teacher. The vitamin C solution was made up to contain 0.001 g vitamin C in 1.0 cm^3 water.

- (i) Using a pipette, place exactly 2.00 cm^3 of DCPIP solution into a test tube.
- (ii) Using a different graduated pipette, add the vitamin C solution, drop by drop, to the DCPIP solution in the test tube. Shake the tube very gently after the addition of each drop of the vitamin C solution and continue adding drops until the DCPIP solution is decolorized.
- (iii) Record the exact volume of the vitamin C solution which has been added.
- (iv) Repeat this procedure. Average the results to obtain the mean volume of 0.1% vitamin C.
- (v) Calculate the mass of vitamin C (in grams) in this volume of vitamin C solution. From that we obtain the amount of vitamin C required to decolorize 2 cm^3 of DCPIP.
- (vi) The next step is to find the volume of lemon juice which contains the equivalent mass of vitamin C. To find this, repeat steps (i)-(iii) using lemon juice (add the lemon juice drop by drop to 2 cm^3 of DCPIP solution in a test tube until it becomes decolorized. Record the exact volume of lemon juice added).
- (vii) Repeat Step (vi). Average the two results. This is the volume of lemon juice which contains the mass of vitamin C calculated in Step (v).
- (viii) Work out the mass of vitamin C in 1.00 cm^3 of lemon juice.

Data Collection:

Vitamin C needed to decolorize 2.00 cm^3 of DCPIP		
Trial 1	Trial 2	Average
1.12 mL	1.12 mL	1.12 mL
Lemon Juice needed to decolorize 2.00 cm^3 of DCPIP		
Trial 1	Trial 2	Average
1.40 mL	1.42 mL	1.41 mL

Data Analysis:

To calculate the amount of vitamin C in 1.12 mL of vitamin C solution:

Since the solution contains 1 mg of vitamin C in 1.00 mL, 1.12 mL of the vitamin C solution contain 1.12 mg of vitamin C.

To calculate the content of vitamin C in 1.40 mL of lemon juice:

The volume of lemon juice in a typical lemon is approximately 120 mL.

$$1.12\text{ mg} \times 120\text{ mL} / 1.41\text{ mL} = \mathbf{95.3\text{ mg vitamin C / lemon}}$$

Conclusion: The major source of error in this investigation is that we did not take an exact measurement of the volume of the lemon, but rather approximated the volume to 120 mL. This leads to an inaccurate result.

Experimentally we found that a lemon contains about 95 mg of vitamin C. The recommended daily intake is 60 mg but researchers are thinking of increasing the value to 100-200 mg. The reason for this is that ascorbic acid is found to be an antioxidant (abundant in fruits and vegetables), that is, it protects the cardiovascular system and prevents scurvy as well as the oxidation of cholesterol, which in turn decreases the possibility of heart attacks and strokes.