

# [Measuring concentrations of vitamin c | experiment](https://assignbuster.com/measuring-concentrations-of-vitamin-c-experiment/)

Vitamin C also known as ascorbic acid is synthesized by plant tissues, as well as mammals except guinea pig and primates (including man). Experiment by Lind in 1753 were the first to show the powers of vitamins when he examined that the killer disease scurvy could be prevented or rapidly cured by feeding patients fresh citrus fruits. Many foods in this world contain vitamin C.

Ascorbic acid is a powerful reducing agent giving up 2 hydrogen atoms to become dehydroascorbic acid. The usual method for the determination of ascorbic acid content is based upon its stability to reduce the dye 2-6 dichlorophenol indophenols (D. C. P. I. P) to a colourless compound. The concentration of D. C. P. I. P is set by an international standard.

The mass of ascorbic acid equivalent to 1 cm³ of D. C. P. I. P is given as 0. 05 mg (International Data Standard July 1980)

RESEARCH QUESTION: What is the effect of cooking on the amount of vitamin C in foods?

HYPOTHESIS: If the cooking time for the lemon juice is longer, than the concentration of ascorbic acid contain in the lemon juice will become lower. This is because, when much time is spent to boil the lemon juice, the vitamin C will destroy and as the result it lessens the concentration of the ascorbic acid. Therefore, higher volume of solution\* is needed to bleach the blue colour of the D. C. P. I. P solution.

## VARIABLE:

INDEPENDENT: The time period for the lemon juice to be cooked. Those lemon juices are cooked for three different time period 0 minute (fresh lemon juice), 10 min and 60 minute (1 hour).

DEPENDENT: The concentration of ascorbic acid in the lemon juice. The concentration is measured by calculating the volume of solution\* used to reduce the blue colour of D. C. P. I. P to colourless. By using a burette, the mixture of lemon juice, distilled water and glacial acetic acid is titrated into the D. C. P. I. P solution. The volume is noted when the blue colour change to colourless.

CONTROL:

1. The volume of appropriate lemon juice used for each experiment. 4. 00 cm³ of appropriate lemon juice is poured into the 100 cm³ measuring cylinder for each three experiment.
2. The volume of D. C. P. I. P used for every trial. By using a syringe 1 cm³ of D. C. P. I. P is being mixed with distilled water and lemon juice.
3. The volume of glacial acetic acid used to mix with distilled water and lemon juice. For each experiment, only 10. 0 cm³ of glacial acetic acid is being poured in the solution.

## APPARATUS:

Glacial acetic acid

Some

Distilled water

Some

D. C. P. I. P

Some

Lemon juice

4. 0 cm³ for each kind of juice

Table 2: The list of material

## METHOD:

Refer to the attachment.

## DATA PROCESSING AND PRESENTATION

## QUANTITATIVE DATA:

Number

Juice sample (lemon)

Trials

The volume of solution\* use to reduce the blue of D. C. P. I. P to colourless, V, cm³, (±0. 05 cm³)

Uncertainty for measuring cylinder = (± 0. 1 cm³)

Volume of glacial acetic acid = (10. 0 ± 0. 1) cm³

Volume of appropriate lemon juice = (4. 0 ± 0. 1) cm³

Volume of D. C. P. I. P = (1. 0 ± 0. 1) cm³

Volume of solution\* = (100. 0 ± 0. 5) cm³

## QUALITATIVE DATA:

Observation:

The colour of D. C. P. I. P changes from blue to colourless when the lemon juice is being titrated into it.

The juice is yellowish in colour and become lighter when it is diluted with acid and water.

## DATA PROCESSING:

## The volume of solution\*

The volume of solution\* is calculated by using the step below;

(Final volume – initial volume) cm3

For example, the volume of solution for the first trial which tested upon the fresh lemon juice:

9. 50cm³ – 3. 90 cm³ = (5. 60 ± 0. 10) cm³

The volume of solution for other trials for each appropriate lemon juice is calculated using the same method as above.

## The average volume of solution\*

The average volume of solution is counted by dividing the volume (calculated in (a)) with 5 trials. The formula is illustrated below:

Volume for (trial 1 + trial 2 + trial 3 + trial 4 + trial 5) cm³

5

The fresh lemon juice is taken as the example for this formula.

= (5. 60 + 8. 00 + 5. 20 + 6. 00 + 5. 50) cm³

5

= 30. 30 cm³

5

= (6. 06±0. 10) cm³

The calculation for the other two appropriate lemon juices will be using the same method as shown in (2).

## The concentration of ascorbic acid in each lemon juice

The calculation to determine the concentration of ascorbic acid in each juice is shown below;

The mass of ascorbic acid equivalent to 1 cm3 D. C. P. I. P = 0. 05 mg

Now n cm3 of the juice solution\* = 1 cm3 D. C. P. I. P

So, n cm3 of the solution\* = 0. 05 mg ascorbic acid

Therefore, 1 cm3 of the solution\* = mg ascorbic acid

Therefore, 1 cm3 of the original juice = mg ascorbic acid

Therefore, concentration of ascorbic acid in original juice

= mg/100cm3

For example, the calculation for determining the concentration of fresh lemon juice.

Average volume for solution\* = 6. 06 cm³

The mass of ascorbic acid equivalent to 1 cm3 D. C. P. I. P = 0. 05 mg

Now 6. 06 cm3 of the juice solution\* = 1 cm3 D. C. P. I. P

So, 6. 06 cm3 of the solution\* = 0. 05 mg ascorbic acid

Therefore, 1 cm3 of the solution\* = mg ascorbic acid

Therefore, 1 cm3 of the original juice = mg ascorbic acid

Therefore, concentration of ascorbic acid in original juice

= mg/100cm3

= 20. 63 mg/100 cm³

The calculation of concentration ascorbic acid for other appropriate lemon juice is counted using the steps in no (2) above.

## The calculation of standard deviation

The calculation of standard deviation for the concentration of ascorbic acid in each lemon juice is measured by using the formula below.

Δ M = ΔV1 + ΔV2 + ΔV3 + ΔV4 + ΔV5 x M

V1 V2 V3 V4 V5

ΔM = the uncertainty for the concentration of ascorbic acid in the lemon juice

M = the concentration of ascorbic acid in the lemon juice

ΔV1 = the uncertainty for the volume of D. C. P. I. P (syringe)

V1 = the volume of D. C. P. I. P (syringe)

ΔV2 = the uncertainty of the volume of glacial acetic acid (10cm³ measuring cylinder)

V2 = the volume of glacial acetic acid (10cm³ measuring cylinder)

ΔV3 = the uncertainty for the volume of appropriate lemon juice (10cm³ measuring cylinder)

V3 = the volume of appropriate lemon juice (10cm³ measuring cylinder)

ΔV4 = the uncertainty for the volume of solution\* (100 cm³ measuring cylinder)

V4 = the volume of solution\* (100 cm³ measuring cylinder)

ΔV5 = the uncertainty for the average volume of solution in burette

V5 = the average volume of solution in burette

An example for determining the standard deviation of the concentration of ascorbic acid in the lemon juice is shown below.

Fresh lemon juice,

Δ M = 0. 1 + 0. 1 + 0. 1 + 0. 5 + 0. 10 x 20. 63

1. 0 10. 0 4. 0 100. 0 6. 06

= ± 3. 23 mg/100 cm³

The calculation for other standard deviation will be using the same formula as above.

## The tables for data processing and graph

Number

The cooking time for the sample of juice (lemon)

The average volume of solution\* use to reduce the blue of D. C. P. I. P to colourless, V, cm³, (±0. 10 cm³)

The concentration of ascorbic acid in each lemon juice, M, mg/100 cm³

The standard deviation for the concentration of ascorbic acid in each lemon juice, M, mg/100 cm³ (±)

## DISCUSSION

D. C. P. I. P is used as an indicator for vitamin C. If more vitamin C or ascorbic acid is found in the food, then the rate for the D. C. P. I. P to change its blue colour will become faster.

D. C. P. I. P (blue) + ascorbic acid D. C. P. I. P. H2 (colourless)

The bar graph shows the relationship between the cooking time for the juice sample and the concentration of ascorbic acid in these lemon juice, M, mg/100 cm³.

According to the bar graph, the highest concentration of ascorbic acid is in the fresh lemon juice which is 20. 63 mg/100 cm³. This shows that, a fresh uncooked fruits contain a lot of vitamin C which is also known as the ascorbic acid. By observing the bar graph above, we can say that there is almost 100% of vitamin C contain in the fresh lemon juice or other fruits.

If the concentration of ascorbic acid contain in the lemon juice is higher, then less solution\* is needed to undergo this titration. By referring to the Table 4, only 6. 06 cm³ of solution\* is required for changing the blue colour of D. C. P. I. P to colourless.

15. 63 mg/100 cm³ of the concentration of ascorbic acid has been measured in the lemon juice boiled for about 10 minutes. This shows that even though the liquid is boiled for a short time period, but it has affected the vitamin C in the juice quite much.

The boiled lemon juice (1 hour) has lowest concentration of ascorbic acid which is 12. 78 mg/100 cm³ and it is clearly shown by the bar graph. From this observation, we can say that, when the lemon juice is being cooked, the amount of ascorbic acid is reduced because a lot of vitamin C has been destroying while boiling the juice.

Ascorbic acid present in almost all fruits and vegetable that man eats. For example, guava, citrus fruits, spinach, broccoli and potatoes. They are best consuming when they are still fresh. However, if people still want to cook them, make sure they set the fruits and vegetable on fire less than 10 minutes. This is important in order to keep the vitamin C concentration in the fruits or vegetable which is essential for our body system.

## LIMITATION AND SUGGESTION

LIMITATIONS

SUGGESTIONS

The way of shaking the D. C. P. I. P in the conical flask. The D. C. P. I. P in some mixture turns to colourless faster than it should be. This has affected the mass of ascorbic acid used in the experiment.

Shake the conical flask which contains the D. C. P. I. P slowly. For each experiment, only one person is assigned to shake the D. C. P. I. P as to synchronize the force incurred onto the solution. Thus the accurate volume of ascorbic acid can be obtained during the experiment.

The solution is not well mix. When the liquid is poured into the burette, some of the lemon juice assembles at the top of the apparatus. Therefore, when it is being titrated, the concentration of ascorbic acid is not fully obtained.

Before putting the solution\* into the burette, stir the distilled water, glacial acetic acid and lemon juice well by using a glass rod. The process can be done in the 100 cm³ measuring cylinder.

The colour change of D. C. P. I. P is quite difficult to be seen. Student could sometimes misinterpret the exact time when the changes of colour occur. This may lead to a fluctuation in the volume of solution\* used during titration.

Placed a white tile under the conical flasks as to make it easy to see the colour change of the solution. This may help in getting the accurate volume of solution used to titrate the D. C. P. I. P.

Parallax error may occur while reading the volume of solution\* in the burette. This is more complicated especially when the bubble accumulate at the surface of the solution\*.

Make sure the eye is parallel to the meniscus of the solution (water). For both initial and final volume, consider the reading below the bubble. By doing so, an accurate volume may be attain

## CONCLUSION

Therefore as the conclusion, when longer time is spent to boil the lemon juice, then the concentration of vitamin C in that lemon juice will reduce. As the result, higher volume of solution\* is needed to titrate with the D. C. P. I. P. Higher quantity of solution\* is also used to discolour the blue solution of D. C. P. I. P during the experiment. Therefore, the hypothesis is supported.

\*solution = appropriate lemon juice + distilled water + glacial acetic acid