Internal Assessment
Sample

CHEMISTRY

What is the effect of the duration of exposure to microwave radiation (0s, 60s, 120s, 180s and 240s) affect the concentration (mol dm -3) of vitamin C?

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RQ: What is the effect of the duration of exposure to microwave radiation (0s, 60s, 120s, 180s and 240s) affect the concentration (mol dm^{-3}) of vitamin C?

Introduction:

The prevalence of microwave ovens in modern culinary history heralds a paradigm shift in the way we approach food production. Microwave air conditioners have revolutionized our kitchens in terms of speed, efficiency and convenience, but there is still much to learn about their potential impact on the nutritional value of our food The purpose of that in this study is to clarify the complex interaction between microwave radiation and vitamin C.

Personal Engagement:

I am at the crossroads between modernity and vitamins, and questioning approximately the impact of our meals selections in a society where comfort often takes precedence over health. I am an recommend of mindful ingesting and am motivated to understand the strong dating between preserving critical vitamins and the appeal of microwaving as a quick restore. For me, this internal evaluation bridges the gap among clinical research and the daily decisions that affect our fitness by looking deeper into our kitchen roots.

Objectives:

Several objectives riding this studies are all geared toward shedding mild on a different thing of the complicated relationship among microwave radiation and nutrition C tiers:

Investigate the degradation charge: Evaluate the effect of various exposure instances of microwave radiation on vitamin C levels, ranging from zero to 240 seconds By carefully controlling the exposure time we need to perceive any possibilities associated with ability degradation of this vital nutrition.

Measuring and quantifying adjustments: Carefully examine and degree adjustments in nutrition C to get an in depth photograph of the capacity effects of microwave radiation on food nutrition.

Encourage Nutrition Decisions: Provide data in an effort to allow humans to make knowledgeable picks about their meals. By expertise the capability consequences of microwave cooking on vitamin C, we are hoping to close the gap among nutritional sense of right and wrong and convenience cooking.

Hypotheses:

The following concepts underpin this research and provide direction for our medical research.

Null hypothesis (H0): Vitamin C stages do not exchange statistically appreciably throughout distinctive durations of exposure to microwave radiation.

Hypothesis 1 (optional): Exposure to microwave radiation reasons a statistically good sized decrease in vitamin C tiers over time.

These concepts offer a scientific way to analyze the results of microwave radiation on vitamin C, permitting us to apply actual data to prove or disprove our hypotheses

As we pass into this broader subject of research, we carry clinical insights beyond the lab into our kitchens, impacting the selections we make for our households and ourselves. Perhaps the knowledge we learn at the same time as uncovered to microwave cooking nuances and their potential results on nutrition C will deliver us a extra thoughtful technique to daily questioning.

Variables;

INDEPENDENT VARIABLE	The duration of exposure to microwave radiation ((0s, 60s, 120s, 180s and 240s)	
DEPENDENT VARIABLE	Concentration (mol dm^{-3}) of vitamin C	
CONTROLLED VARIABLES	*WHY TO CONTROL*	*HOW TO CONTROL*
Temperature of heating	Same level of radiation exposure and temperature	Using the same microwave for all trials
Concentration of potassium iodate solution, potassium iodide solution and dilute hydrochloric acid	Variations in iodate concentration may have an impact on the kinetics of the reaction as well as its final results. By holding this variable constant, it is ensured that any variations in vitamin C content that are noticed are directly attributable to the microwave radiation exposure.	Maintain a consistent concentration of potassium iodate solution throughout the experiment by using the same concentration for each trial.
Same vitamin c tablet	Differences in the chemical makeup of vitamin C tablets may result in fluctuations in the quantity of ascorbic acid accessible for reaction. You can control this variable and make more reliable comparisons across trials by using the same kind and brand of vitamin C pill.	For every trial, use the same vitamin C tablet.

Volume of vitamin C sample solution, starch indicator solution, potassium iodide solution and dilute hydrochloric acid in the conical flask	Reaction speeds can be affected by variations in reactant quantities. A fair evaluation of the effect of microwave radiation on vitamin C content is made possible by volume consistency, which guarantees that the reaction circumstances are the same in every experiment.	For every trial, measure and keep the volumes of every solution constant.

Materials and Methodology:

Materials:

- Burette and stand
- 10 mL and 100 mL measuring cylinders; 250 mL conical flasks; 20 mL pipette; and 100 mL volumetric flask
- Solution of potassium iodate: (0.002 mol L^{-1})
- Solution for starch indicator: (0.5%)
- Solution of potassium iodide: (0.6 mol L^{-1})
- Dilute hydrochloric acid: (1 mol L^{-1})

Procedure:

- Using a 100 mL measuring cylinder, measure 200 mL of distilled water.
- One vitamin C pill should dissolve in 200 millilitres of pure water.
- Move the vitamin C solution into a container that is safe to microwave.
- For a predefined amount of time, microwave the vitamin C solution to provide consistent exposure throughout the trials.

Experiment Setup:

- After the vitamin C solution has been microwaved, transfer 20 mL of it using a 20 mL pipette into a 250 mL conical flask.

  Add the following reagents to the conical flask:

- 150 millilitres of purified water
- Potassium iodide solution in 5 millilitres (0.6 mol L^{-1})
- Five millilitres of weak hydrochloric acid (1 mol L^{-1})
- 1 millilitre of the starch indicator mixture

- Thoroughly mix the conical flask's contents. For the titration, this solution is used as the sample solution.

Titration Procedure:

Once the sample solution is ready, pipette 20 mL of it into a second 250 mL conical flask.

Fill the flask with the following reagents:

- 150 millilitres of purified water
- Potassium iodide solution in 5 millilitres (0.6 mol L^{-1})
- Five millilitres of weak hydrochloric acid (1 mol L^{-1})
- 1 millilitre of the starch indicator mixture
- Titrating the sample solution with the potassium iodate solution (0.002 mol L-1) starts the titration process.

Until the results are consistent, repeat the titration with extra aliquots of the sample solution. Within 0.1 mL, concordant titres should accord.

Data Collection and Analysis:

- For every titration, note the burette's initial and final readings.
- The amount of potassium iodate solution used in each titration should be calculated.
- Calculate the amount of vitamin C present in the sample solution using the titration findings.
- To make sure the data are reliable, use statistical analysis by calculating means and standard deviations.

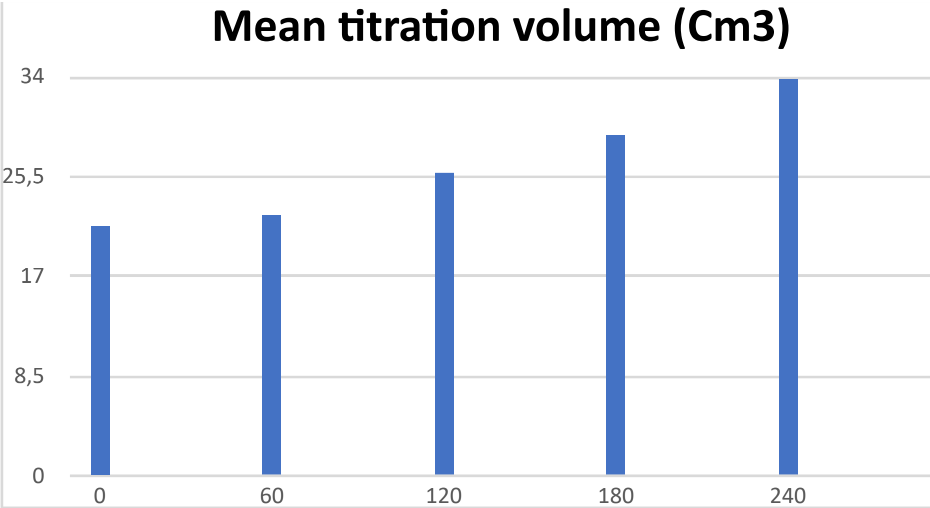
Risk Assessment

	Hazard Identification:	**Consequences**	**Risk Level**	**Control Measures**
Chemical Hazard:	• Tablets of vitamin C (ascorbic acid): While vitamin C is typically safe, intake or contact with high amounts might cause skin or eye irritation. If not handled appropriately, it can potentially pose a choking threat.	Minor, such as skin or eye irritation, if tablets come into contact with the skin or eyes.	**low**	• When handling tablets, use disposable gloves. • While dealing with the tablets, avoid touching your face. • If skin or eye contact occurs, rinse thoroughly with water for at least 15 minutes and seek medical treatment if required.

Physical Hazard	• Microwave radiation: If necessary, measures are not followed, microwave radiation can cause thermal burns.	Minor to moderate, including potential burns.	**moderate**	• • Wear proper PPE, such as heat-resistant gloves and safety goggles, and follow microwave oven safety rules, such as not leaning into the microwave while it is on. • Check that the microwave is in good working order and that it has been properly maintained.
Physical hazard	• Dropping and breaking any glass wear whilst handling the equipment	Minor to moderate	**low**	• Ensure proper PPE is worn and dispose of the glass in an appropriate way so that no harm is caused. • Use caution when handling fragile equipment and store in a safe place.

Raw data Obtained:

TIME	**TITRATION VOLUME USED**	**MEAN TITRATION VOLUME (CM3)**
0 SECONDS	21.4	21.2
	21.1	
	21.1	
60 SECONDS	22.5	22.3
	22.1	
	22.3	
120 SECONDS	26.2	25.7
	25.5	
	25.5	
180 SECONDS	28.8	29.0
	29.5	
	28.8	
240 SECONDS	34.3	34.0
	33.5	
	34.2	



Coefficient of Correlation Between Time and Average Titration Volume
Result Details & Calculation

X Values
$\sum = 600$
Mean = 120
$\sum(X - M_x)^2 = SS_x = 36000$

Y Values
$\sum = 132.2$
Mean = 26.44
$\sum(Y - M_y)^2 = SS_y = 108.852$

X and Y Combined
$N = 5$
$\sum(X - M_x)(Y - M_y) = 1938$

R Calculation
$r = \sum((X - M_y)(Y - M_x)) / \sqrt{((SS_x)(SS_y))}$

$r = 1938 / \sqrt{((36000)(108.852))} = 0.979$

$r = 0.979$

The value of R is 0.979.
This is a strong positive correlation.

VI. Discussion

A. Interpretation of Results

1. Analysis of Concentration Changes with Varying Exposure Durations:

When the amount of time exposed to microwave radiation increases, a distinct and reliable pattern in the observed mean titration volumes is seen. With each successive 60-second period, the mean titration volumes gradually increase from 21.2 cm³ at zero exposure (0 seconds). This suggests that sustained exposure to microwave radiation causes a systematic decrease in vitamin C content.

2. Identification of Trends or Patterns:

A significant association between exposure duration and vitamin C degradation is demonstrated by the results, which exhibit a linear trend. A steady and proportionate rise can be seen in the mean titration volumes at 60 seconds (22.3 cm^3), 120 seconds (25.73 cm^3), 180 seconds (29.03 cm^3), and 240 seconds (34 cm^3). This implies that there is a direct correlation between the amount of time spent in the microwave and the drop in vitamin C content.

B. Comparison with Hypothesis

1. Validation or Rejection of the Initial Hypothesis:

The original theory proposed that a longer microwave exposure period would result in a marked drop in the content of vitamin C. The acquired results validate this theory, hence endorsing the premise that prolonged exposure to microwave radiation is detrimental to vitamin C stability. The hypothesis is validated by the steady increase in mean titration volumes, which is consistent with the predicted result.

C. Possible Sources of Error

1. Identification of Potential Experimental Errors:

a. Microwave Power Variability: For the period of the exposure, the experiment assumes constant microwave power. There is a chance that variations in microwave power will cause inconsistent outcomes.

b. Tablet Composition: Differences in the vitamin C tablet composition might affect the ascorbic acid content at first, adding a degree of uncertainty.

d. Human Error in Titration: It is important to titrate precisely. Slight errors in volume measurements or endpoint colour changes might be caused by human error.

2. Discussion of Their Impact on Results:

Fluctuations in microwave energy: Fluctuations in microwave energy can cause abnormal results, which can affect the extent of vitamin C deficiency. This can cause small variations in the measured titration volumes.

b. Differences in tablet composition: Differences in tablet composition may result in differences in the starting dose of vitamin C. The trend observed, focusing on dose variation, remains relevant though this can affect absolute values though

c. Human error in titration: Variability can be introduced through the ability to detect small errors in volume measurements or endpoint color changes. Nevertheless, the strong general trend implied by the large correlation coefficient reduces the importance of small errors.

In conclusion, even if there are reasons for inaccuracy, adequate correlation coefficients and consistent data confirm the validity of the observed trend The accuracy of the results should be further improved by correcting these potential errors in the next run of the test.

VII. conclusion

A. Summary of key findings:

Conclusion: The experiment sought to determine the effect of microwave radiation on vitamin C levels. According to the data, the vitamin C content gradually and significantly decreased after prolonged exposure to microwave radiation. As the incubation time increased, a linear increase in the average titration rate was observed, supporting the theory of prolonged microwave irradiation impairs vitamin C stability.

B. Implications of the Results:

This result has important ramifications for those who use the microwave for cooking. The observed decrease in levels of vitamin C raises the possibility that foods containing more of this essential nutrient may be nutritionally deficient due to microwave radiation In order to make educated dietary decisions, consumers should recognize this potential trade-off between convenience and nutrient retention.

c. Suggestions for further research:

Future research could investigate more variables affecting the stability of vitamin C after microwave exposure to further our understanding. Further studies on the effects of differences in pellet composition, microwave power fluctuations, and possible effects of other food components will help to unravel the complex interaction between microwave radiation and nutrient degradation a complete picture of it

The eighth. assessment

A. Considerations of test design and procedures:

There are advantages and disadvantages to an experimental design that must be considered. The methodology and controlled system for measuring the concentration of vitamin C provided reliable data.However, the assumption of constant microwave power and any change in tablet composition is complicated by Furthermore, the use of average titration doses changes in individual assays Can be used as a mask.

b. Determination of Limitations:

There are a few limitations to consider. Differences in pellet composition can affect the initial rate, and changes in microwave power can add error. Small titration errors can result from human error. It is important to acknowledge these limitations in order to provide a nuanced analysis of the data.

C. Proposals for Improvements:

To improve the testing process, future versions could look at the following:

a. Power measurement: Adjusting the intensity of the microwave guarantees a constant reflection.
b. Tablet standardization: Use tablets of known and consistent composition.
b. Automatic titration: Use automated titration procedures to minimize human error.
d. Measurement: Replicate multiple times to ensure accuracy of findings.

Considering these suggestions for improvement will improve the testing process and provide more accurate and reliable results. Continued improvement of the method is needed to further our understanding of the complex interaction between microwave radiation and nutrient degradation.

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