

Study of chlorophyll extract from Yanang leaves for application in copper removal from water sources in industrial processes



Presented By Miss Thapanee Ganoi Miss Panvad Thinnakorn
Na Ayutthaya Miss Anchistha Chumphoo

Advisor

Miss Waewdaw Rupean Miss Kontree Sutthanee



Background and Rationale

objectives

Variable

Scope of Research



1

Industrial plant



2

Discharge wastewater



3

Fish in water sources



4

Affecting health

Background and Rationale

objectives

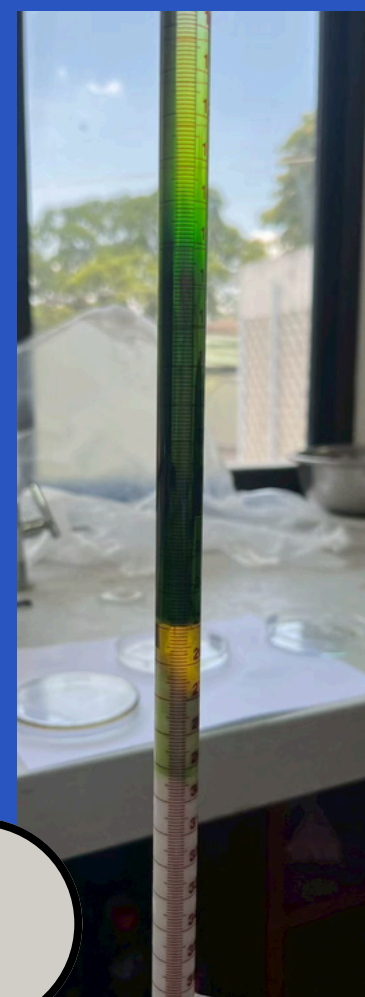
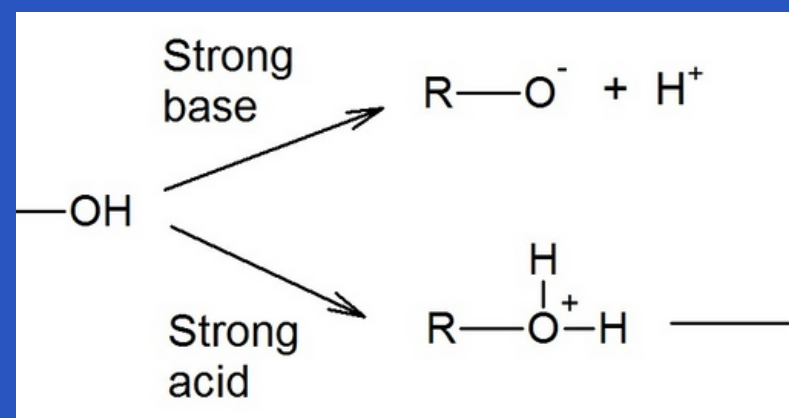
Variable

Scope of Research



1

yanang leaves



2

chlorophyll
extract from yanang leaves





Background and Rationale

Objective

Variable

Scope of Research

1

To study the efficiency of copper ion adsorption by chlorophyll extract from Yanang leaves

2

To study the optimal ratio of chlorophyll for the most effective copper ion binding.



Background and
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Independent variable: Efficiency of copper ion adsorption

Dependent variable: Concentration of chlorophyll

Controlled variable: Volume of chlorophyll extract and copper solution.

Background and
Rationale

Objective

Variable

Scope of
Research

1

To study the properties and benefits of chlorophyll in Yanang leaves.

2

To test the copper-binding capacity of chlorophyll extracted from Yanang leaves.

3

To study and test the copper-binding ability of Yanang leaves at different ratios to find the most suitable formula.

Experiment 1

Experiment 2

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Variable

Independent Variable Pure Chlorophyll Solution

Dependent Variable Absorbance Value (Copper Absorption by Chlorophyll)

Controlled Variable Copper Solution Concentration

Hypothesis

The results showed that when the absorbance value decreased, it indicated that chlorophyll was able to absorb copper. As a result, the copper concentration decreased, leading to a lower absorbance value.

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EXTRACTION OF PURE CHLOROPHYLL USING COLUMN CHROMATOGRAPHY

1. Extract green pigment from Yanang leaves using acetone until 100 mL of green solution is obtained.
2. Mix the green solution with 30.00 g of magnesium sulfate and filter the mixture into a beaker.
3. Add 13.77 g of silica to the green extract and mix well.
4. Perform column chromatography by first adding a layer of silica into the column, followed by the green extract mixed with silica. Then, add hexane to allow the solution to flow through the column.



Experiment 1

Experiment 2

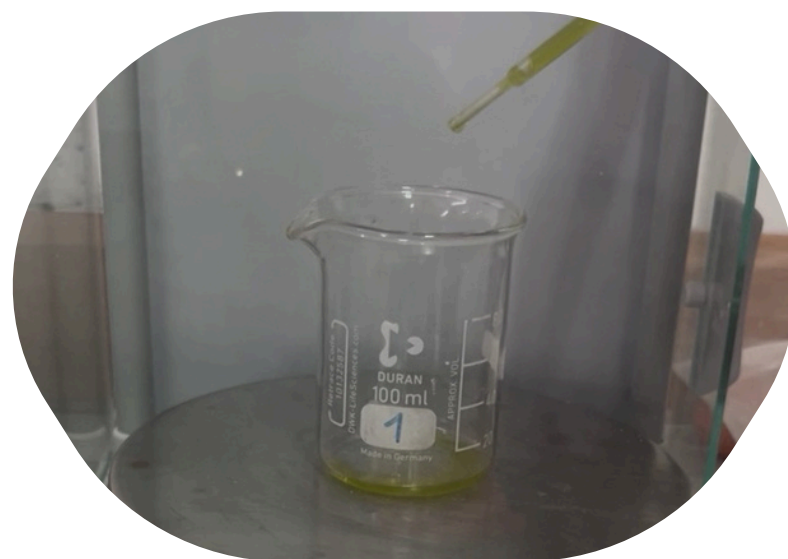
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TESTING THE COPPER ABSORPTION OF CHLOROPHYLL



1. Evaporate the pure chlorophyll extract and dilute it with ethanol to obtain a 0.10 g solution.



2. Add copper(II) sulfate powder to prepare a 1 M copper solution and store it in a beaker.



3. Take 100.00 g of the copper solution from the beaker and mix it with the prepared chlorophyll extract.



Experiment 1

Experiment 2

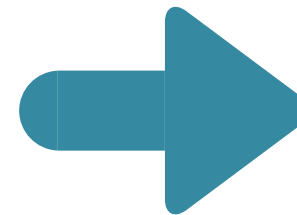
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TESTING THE COPPER ABSORPTION OF CHLOROPHYLL



4. Cover the mouth of the beaker with parafilm and allow the substances to react for 24 hours.

5. Measure the absorbance of the copper solution and the pure chlorophyll extract using a UV-Vis spectrophotometer.

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Variable

Independent Variable

Chlorophyll Concentration

Dependent Variable

Absorbance Value (Efficiency of Copper Absorption by Chlorophyll)

Controlled Variable

Copper Solution Concentration: 1 Molar

Hypothesis

The higher the concentration of chlorophyll, the greater its ability to absorb copper, resulting in a lower absorbance value.

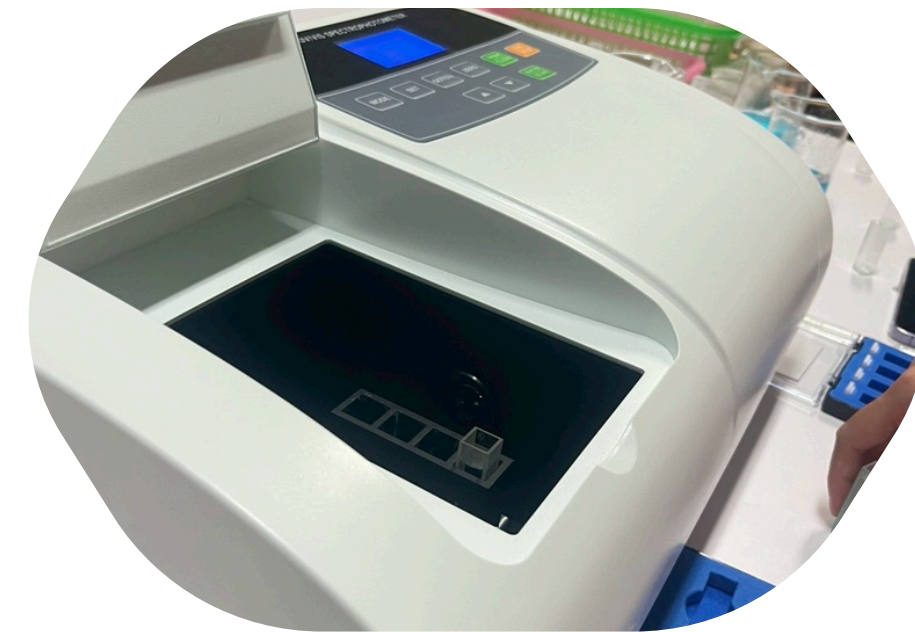
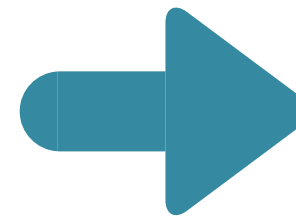


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TESTING THE EFFICIENCY OF COPPER ABSORPTION BY CHLOROPHYLL



1. Divide the copper solution into different concentrations: 0.1 M, 0.2 M, 0.3 M, and 0.4 M, and place each in a separate beaker.



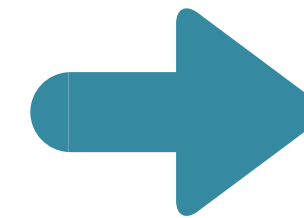
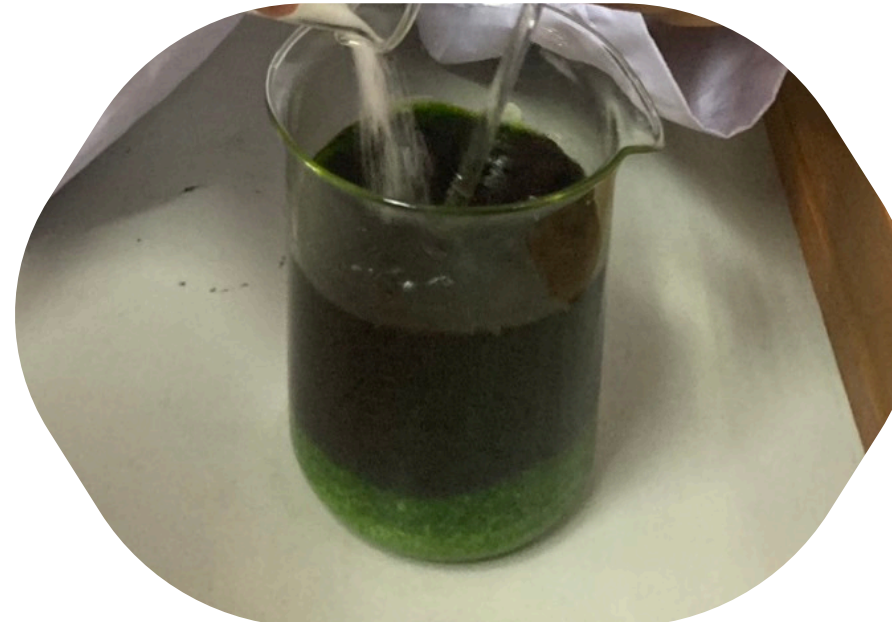
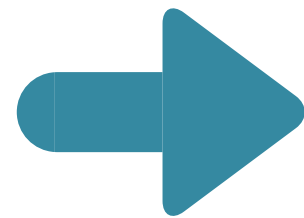
2. Measure the absorbance of each copper solution using a UV-Vis spectrophotometer.

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TESTING THE EFFICIENCY OF COPPER ABSORPTION BY CHLOROPHYLL



3. Weigh out Yanang leaves in amounts of 5.00 g, 10.00 g, 15.00 g, 20.00 g, and 25.00 g, and extract each with 200 mL of acetone. Filter the extracts and separate them into 5 beakers.

4. Mix each filtered extract with 200.00 g of magnesium sulfate, stir for approximately 2 minutes, and then filter again.

5. Mix the chlorophyll extract from each beaker with the copper solution at a ratio of 1:1000.

Experiment 1

Experiment 2

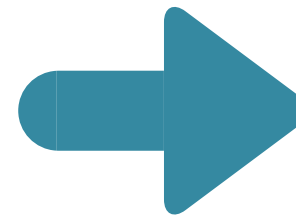
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TESTING THE EFFICIENCY OF COPPER ABSORPTION BY CHLOROPHYLL



7. Seal each beaker with parafilm and allow the reaction to proceed for 24 hours.

8. Measure the absorbance of the solutions using a UV-Vis spectrophotometer.



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Average \ Round	copper solution	Copper solution with chlorophyll extract from yanan leaves
1	0.29	0.022
2	0.243	0.031
3	0.229	0.027
Average	0.254	0.027

The table shows the absorbance values of 1 Molar copper solution and copper solution with chlorophyll extract from yanan leaves by using Uv-Visible Spectrophotometer

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From the experimental results, we have found the difference between the mean of 1 Molar copper solution and copper solution with chlorophyll extract from yanan leaves by using Uv-Visible Spectrophotometer, which was found to be decreased from the initial value.

The reduced absorbance value was due to Chlorophyll has a ring structure that can bind to metals such as copper (Cu^{2+}), where the copper replaces the magnesium (Mg^{2+}) in the middle of the chlorophyll molecule, resulting in the adsorption of copper.

Experiment 1

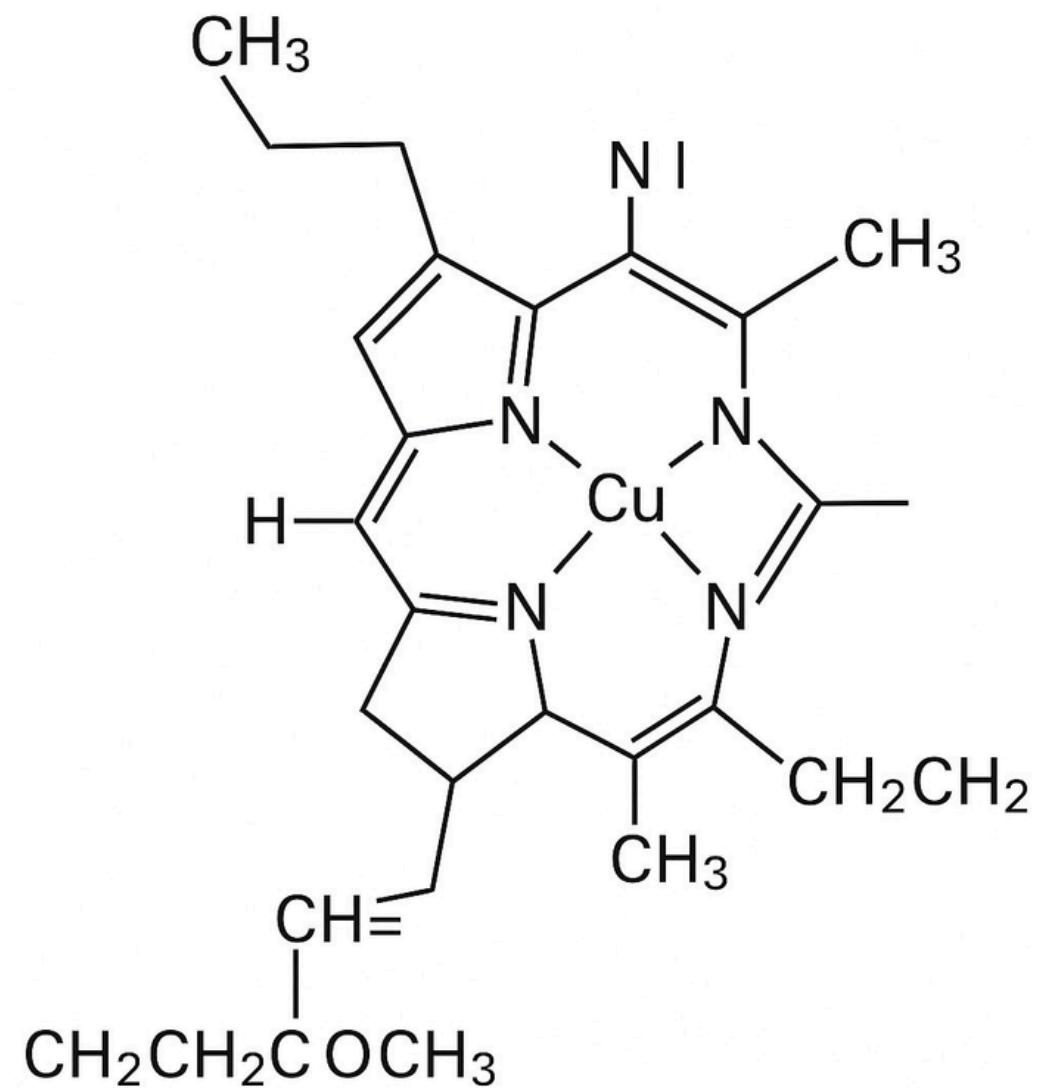
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The image shows Cu-chlorophyll, where copper replaces magnesium in the porphyrin ring. Four nitrogen atoms coordinate with Cu²⁺, forming a stable complex with various side chains.

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From the science project on Study of chlorophyll extract from Yanang leaves for application in copper removal from water sources in industrial processes , Experiment 1, the experimental results showed that 0.10 g of chlorophyll extract from Yanang leaves per 100 g of copper solution could absorb copper up to 89.37%, as seen from the average absorbance value of the copper solution which was equal to 0.027 and the average value of the copper solution with chlorophyll extract from Yanang leaves which was equal to 0.254



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Concentrations	Absorbance
0.1	0.51
0.2	1.221
0.3	1.531
0.4	2.139

The table shows the absorbance values of different concentrations of the copper solution to be used to create a standard curve.

Experiment 1

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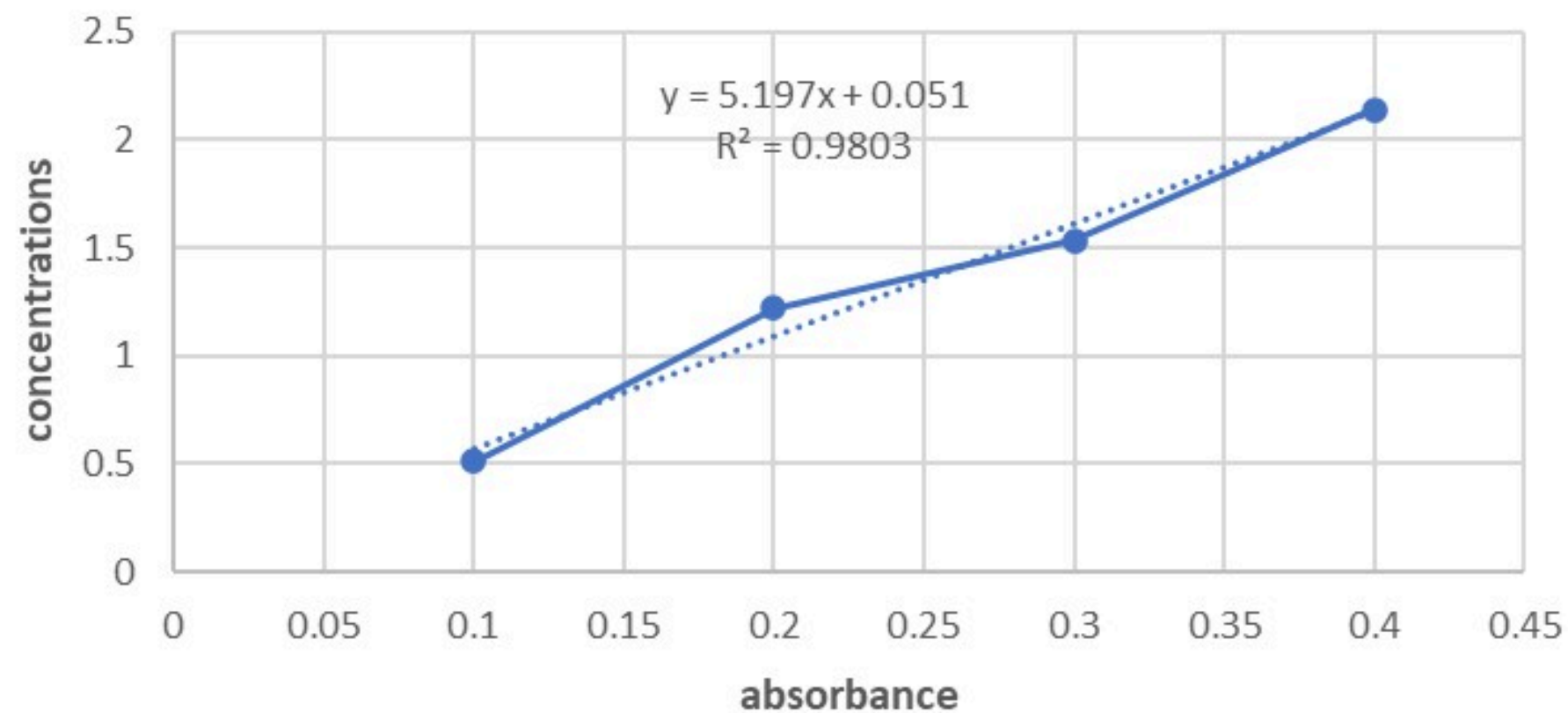
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Standard curve showing absorbance values of gold red solution at different concentrations



Standard curve showing absorbance values of gold red solution at different concentrations. The R Square value is 0.9803 and the equation Y is equal to

$$y = 5.197x + 0.051$$

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Concentrations ratio	Absorbance
5 / 200	2.085
10 / 200	1.933
15/ 200	1.634
20 / 200	1.355
25 / 200	1.529

The table shows the different absorbance values of each formula concentration of

The chlorophyll extract from Yanang leaves with copper 0.4 mol / L

(The concentration ratio is the weight of the Yanang leaves to the acetone.)

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Concentration ratio	Copper Remains	Copper adsorption efficiency of chlorophyll
5/200	0.3914	2.15 %
10/200	0.3621	9.475 %
15/200	0.3046	23.85 %
20/200	0.2509	37.275 %
25/200	0.2844	28.9 %

The copper residue is calculated from the equation $y = 5.197x + 0.051$

The copper adsorption efficiency of chlorophyll is calculated from the formula The initial amount of copper is subtracted from the remaining amount of copper and divided by the initial amount of copper. Multiply by 100.



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From the experiment 2, we created a standard curve to find the equation and used that equation to find the residual copper value which led to the calculation of the percentage of copper adsorption efficiency of the cable in the Yanang leaves .

It was found that the concentration with the best absorption value is 20:200, which is because chlorophyll reaches the saturation point in absorbing copper, so the efficiency of copper absorption is maximum at the concentration of 20:200

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Experiment 2

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From the science project on Study of chlorophyll extract from Yanang leaves for application in copper removal from water sources in industrial processes , Experiment 2, the experimental results showed that A ratio of 20 per 200 is the most effective ratio for copper absorption, as seen from the residual copper content is 0.2509 which is the least and the absorption amount is 37.275 % which is the highest.



Recommendations



For future studies, real water samples, such as canal water or wastewater from factories, should be used for testing to evaluate the efficiency of chlorophyll in more complex environmental conditions.



References



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Expected benefits



1

It can be further developed into an efficient filter sheet for absorbing copper metal in water.

2

Has the potential to reduce the concentration of copper in water sources.

3

A novel alternative material for making water filter sheets



Thank You

For Your Attention