

Student's Card 1

Assessing the Quality of Resources Used for Extraction of Calcium Carbonate






Module 1

Objective: Determining the Amount of Calcium Carbonate in Eggshells of Various Origins

Introduction

Since the consumption of calcium carbonate does not exceed the amount of this mineral stored in natural deposits, it is not considered a non-renewable resource, however, water is consumed and carbon dioxide is released during its production and processing. Meanwhile, several million tonnes of waste are produced each year, including eggshells, which along with other types of waste could be used to extract calcium carbonate. Concurrently studies have shown that the chemical composition of eggshells varies depending on the origin of the eggs.

Necessary Lab Supplies

Reactants	Formula		Quantity (g) or Concentration (M)
Eggshells	-	-	1.0 g
Hydrochloric acid	HCl		2 M
Ammonium buffer solution	NH ₄ Cl + NH ₃		-
Eriochrome Black T	C ₂₀ H ₁₂ N ₃ NaO ₇ S		0.5%
Water	H ₂ O	-	-
EDTA disodium salt (complexon III)	C ₁₀ H ₁₄ N ₂ Na ₂ O ₈		0.05M

List of lab equipment:



- balances (readability of at least 2 decimal places);
- stand with burette clamp;
- conical flask (250 mL);
- beaker (100 mL);
- Mohr pipette (20 mL, 10 mL);

Student's Card 1

Assessing the Quality of Resources Used for Extraction of Calcium Carbonate

- volumetric flask (100 mL);
- spoon;
- rubber pipette filler;
- burette (readability of at least 1 decimal place);
- funnel;
- graduated cylinder (at least 20 mL volume).

Lab Procedure

- Weigh 1.0 grams of eggshells and place them into a volumetric flask. Using a Mohr pipette add 10 mL 2M HCl to the eggshells. Allow the eggshells to dissolve in the hydrochloric acid solution for approx. 2 min.
- To the resulting solution add deionized water until it reaches the mark and mix.
- Using the Mohr pipette transfer 10 mL of the eggshell solution into a conical flask. Using a graduated cylinder measure 20 mL of ammonium buffer solution and add that along with 3-5 drops of an indicator – the Eriochrome Black T to the solution in the conical flask.
- Fill up a burette with the complexon III solution until it reaches the mark. Titrate the eggshell solution with the complexon III solution until the colour of the solution changes from red to blue. Wash the used conical flask and rinse it with deionised water. Repeat the titration at least two more times.

Additional Safety Notes



The ammonium buffer solution contains a large amount of concentrated ammonia, which is an irritating, highly volatile gas with a pungent smell. For this reason, it is better to conduct the experiment in a fume hood. In addition, the hydrochloric acid solution is quite concentrated and irritating to the skin and eyes, so it needs to be handled with caution.

Calculations

The volume of complexon III used during the analysis of the eggshell solution

No.	$V_{compl.III}, mL$
1.	
2.	
3.	

1. Calculate the average volume of complexon III used!

Student's Card 1

Assessing the Quality of Resources Used for Extraction of Calcium Carbonate

2. Calculate the amount of complexon III!

3. Calculate the mass of calcium carbonate in 1.00 g of eggshells; note that its amount in 1 mL of the analysed solution is equal to the amount of complexon III!



Quiz

1. Compare the obtained data with other classmates who had analysed eggshells of other origins! Summarize the obtained data in a table, adding a column specifying the origin of the eggshells! Is there a correlation between the origin of the eggshells and the calcium carbonate content in them?
2. How important of a resource is calcium carbonate? Where is it used? Work in groups and use the available literature to create posters on the use of calcium carbonate and present them to the class!