

For Teachers Renewable Keratin wastes for use in metal mining

Module 2

Objective: WOOL KERATIN FLOCCULATION AND PRECIPITATION

Introduction







After the extraction of keratin by using a NaOH solution, you need to flocculate the protein that is in the solution using different substances even those that are used in everyday life. Finally through the processes of decantation and drying it will be possible to see the keratin powder

Necessities



List of materials/tools

- Test tubes
- Test tube rack
- Small colander
- Pipettes
- Petri dishes
- Gloves
- Safety Glasses

Reagents	Formula		Quantity (g) or Concentration (M)
Keratin's solution in NaOH solution			1.0/0.5 M solution
Ethanol	$\text{CH}_3\text{CH}_2\text{OH}$		
Acetone (Dimethyl ketone)	$\text{CH}_3\text{-CO-CH}_3$	 	
Citric acid (2-Hydroxypropane-1,2,3-tricarboxylic acid)	$\text{C}_6\text{H}_8\text{O}_7$		6%
White wine vinegar			
Lemon juice			

Lab Procedure

- Filter the lemon juice.
It is necessary to filter the lemon juice in order to reduce turbidity.
The pH level of citric acid in a 6% solution is similar to the pH level of the lemon. Therefore the juice may be eliminated.
We have chosen to use both of them to show that substances from everyday life (lemon, vinegar) can be used as chemical reagents; moreover it can be interesting to observe the layers formed between the protein and the lemon juice.
- Label five test tubes and then add 10ml of different solutions to each of the tubes (Ethanol, Acetone, Citric acid, Vinegar, Lemon juice).

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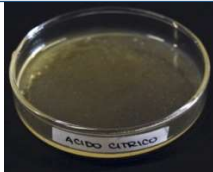

- Add, drop by drop, in each test tube 1/2 ml of the extraction solution and complete the table below.
- Then pour the content of each test tube in a Petri dish and let it evaporate until it is completely dried.
- Observe on a black background and complete the table with these results.

Additional Safety Notes



By using NaOH, wear gloves and safety glasses

Results:

	ETHANOL	ACETONE	WINEGAR	CITRIC ACID	LEMON JUICE
Appearance of the protein in the solution	At first filaments are in suspension, then they settle on the bottom. The solution has become turbid. 	The solution becomes turbid then the protein settles on the bottom. 	We can clearly distinguish the protein's flocculation that then will precipitate 	The protein flocculates and remains in suspension. 	The flocculation is masked by the lemon juice's turbidity. Superficial stratification can be clearly observed, though. 
Appearance after drying					

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Questions/Quiz



1. What is meant by flocculation?

The solution becomes turbid then the protein settles on the bottom.

We can clearly distinguish the protein's flocculation that then will precipitate.

The protein flocculates and remains in suspension.

The chemical-physical process where the solid phase of a colloidal system tends to separate, forming flakes in suspension.

2. What may be the cause of keratin's different behaviour in the various solutions?

Precipitation (or protein flocculation) can be obtained in various ways.

a) *Variations in PH by adding (for example) citric acid which has values of pH close to the protein's isoelectric point (4.2/4.5). This affects its solubility and the protein precipitates towards the bottom;*

b) *Treatment using inorganic solvents miscible with the aqueous phase (like ethanol or acetone) in which proteins are in solution.*

The behavior is different if the flocculation is induced by variations of pH and of solvent.