

## For Teachers Renewable Keratin wastes for use in metal mining

### Module 4



#### Objective: WOOL ABSORPTION OF HEAVY METALS

#### Introduction

In recent years various applications of wool have been studied; in particular it has been discovered that wool could be used to clean up soils contaminated of heavy metals. In this respect its use would have a dual purpose: to help with the disposal of extra and waste wool and to use a completely natural material.

#### Necessities



Reagents	Formula		Quantity (g) or Concentration (M)
Copper (II) Sulphate	$\text{CuSO}_4$		$\text{CuSO}_{4(aq)}$ 200mg/l

#### List of materials/tools

- Wool flock
- 2 Test strips for dosing copper
- Beaker
- Glass rod
- 2 Beakers
- Pliers
- Gloves
- Safety Glasses

Strips can be used to dose the quantity of copper ions  $\text{Cu}^{2+}$  in solution (e.g. Quantofix <http://www.mn-net.com/Testpapers/QUANTOFIXteststrips/QUANTOFIXKupfer>), but a spectrometric analysis may also be carried out if the necessary equipment is available. The use of strips has the advantage that the result can be immediately read and they are easy to use.

#### Lab Procedure

Pour a few ml of the solution of copper (II) sulphate into a beaker, then add a piece of wool flock and blend the compound until it is completely soaked in the solution. Wait a few hours.

Observe the potential variations in wool colouring.

It is preferable to use the wool flock, because its white colour makes it possible to notice the absorption of  $\text{Cu}^{2+}$  ions.

Pour some solution of copper (II) sulphate in the other beaker and immerse briefly a strip in both beakers, wait 20 seconds and watch the colouring. Thanks to their change in colour, it is possible to determine the variation of concentration of copper in wool.

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### Additional Safety Notes



Wear gloves and safety glasses

### Results:

Strip colour DEEP PURPLE → HIGH concentration of COPPER

Strip colour PINK → LOW concentration of COPPER

Solutions	Strip Colour	Solution concentration
Copper (II) sulphate solution	<i>Purple</i>	<i>200 mg/l</i>
Copper (II) sulphate solution and wool	<i>Very light pink</i>	<i>10-20 mg/l (the colour and therefore the concentration depends also on the time of reaction)</i>



### Questions/Quiz

- Which colouring has the wool taken after being soaked in copper sulphate? Why?  
*The wool is greyish blue because it has absorbed  $\text{Cu}^{2+}$  ions*
- Work out the quantity of copper absorbed by the wool during the time of incubation.  
*The calculation can be done approximately by comparing the colouring of the strips and the ones stated on the container.*
- Do you think that time should be considered a variable to evaluate wool's ability of absorption?  
How could you verify this?  
*Repeat the experiment by immersing different strips in the solution at different times (e.g. at a distance of one hour).*
- Think of an experiment to measure the quantity of wool needed to absorb a fixed quantity of copper.  
*Repeat the experiment using a beaker with different wool quantities, previously weighed.*