Components of Wood Ash

Introduction

Ash is a common substance we see around us. It is obtained by burning wood, cattle dung cakes, incense sticks, coconut shells, natural fibers etc. It is grayish in color. It is generally defined as the solid residue that remains after burning a material, while some products of combustion escape as gases. Ash, as we know, is used in a large number of applications such as for pest control in agricultural soils, and to control bacterial growth in rotting materials, cleaning utensils, etc. Can we also use ash for washing clothes?

We may want to ask if wood ash is a single substance or it has many substances in it? Different colours (white, black and grey) and different shades in ash indicates it most probably has multiple substances in it. Separations of substances from a mixture has been one of the very important processes for chemists to purify or to obtain “Pure” substances. The extracted pure substances are useful in production of medicines, household substances, or raw materials for industries.

In this unit, we will try to explore components of wood ash and separate them on the basis of their solubility in water and lemon juice.

Materials Required

1. Wood Ash. Make sure the ash collected is not contaminated with soil or any other unburnt matter (like food matter), otherwise the original properties of ash will not be observed in the tasks. It should also not be wet.
2. Juice of 3-5 Lemons, squeezed and filtered through a strainer
3. Funnel and filter paper (or a cloth and a tea-strainer)
4. 4-5 beakers (100 or 250 mL) or any other similar containers
5. Glass rod, or spoon, or spatula
6. Test tubes, test tube stand
7. Litmus paper (red and blue), and turmeric powder
8. A piece of cloth having oil stains

Task 1: Let us think a bit

Q1. Can you list some ways in which wood ash is used in your homes or surroundings?

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Q2. What do you think ash is made of?

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Q3. Do you think ash is soluble in water? Give reason for your answer.

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Q4. If water is mixed with ash, would the water filtrate be acidic, basic, or remain neutral?

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Ash is gray in color. To understand this colour we should understand that wood or plant parts, contain different types of components, such as starch, silica, some metal salts, some volatile compounds. If we take the following white coloured substances and observe changes in their colour on burning:

(i) Salt and lime (calcium oxide), when burned, remain white.

(ii) Camphor when burned completely disappears leaving no residue behind.

(iii) Sugar on burning produces a black coloured charred substance. If the burning is continued longer, then eventually the black char may also disappear completely.

(iv) white sand (which most consists of silica) doesn't show any change on heating or burning.

Q5. If a mixture of salt, sugar, camphor and white sand is taken and burnt, what would be the color of the ash obtained?

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Q6. What kind of particles do you observe in the ash? Why do you think ash is grey in color?

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Task 2: Ash & water

In this task, we will see if ash dissolves in water. But before that note the place from where the ash was collected. Source of ash: _____

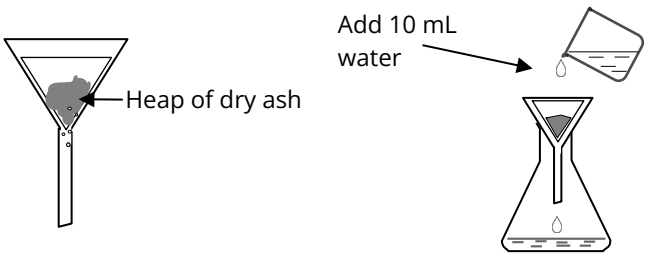
Do the following task in groups of 3-4 students. Take about 5 g (or a table spoonful) of powdery part of ash (and avoid the big pieces from the ash).

Step 1: Fold a filter paper and set it in a funnel (instead of filter paper, a clean white thick cloth kept on a tea strainer can also be used).

Step 2: Set this funnel/strainer on an empty beaker (or conical flask). Add 5 g of ash in the funnel.

Step 3: Mark the level of ash in the funnel for later comparison.

Step 4: Slowly add about 10 mL of water.



Q1. Was water completely absorbed by the ash or did some of it come down the funnel? If sand was kept instead of ash, would sand also absorb the same amount of water?

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Q2. Do you think some part of the ash has dissolved in water? On what basis did you answer this question?

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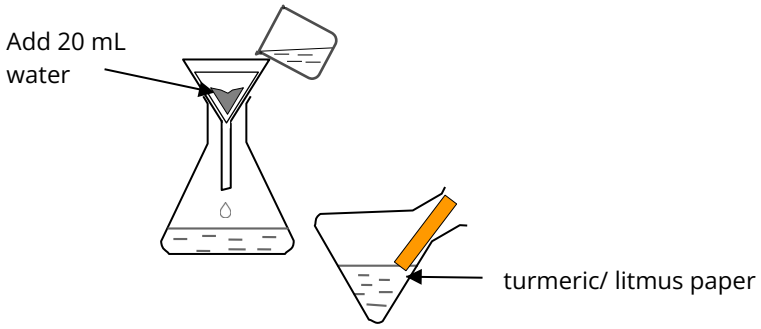
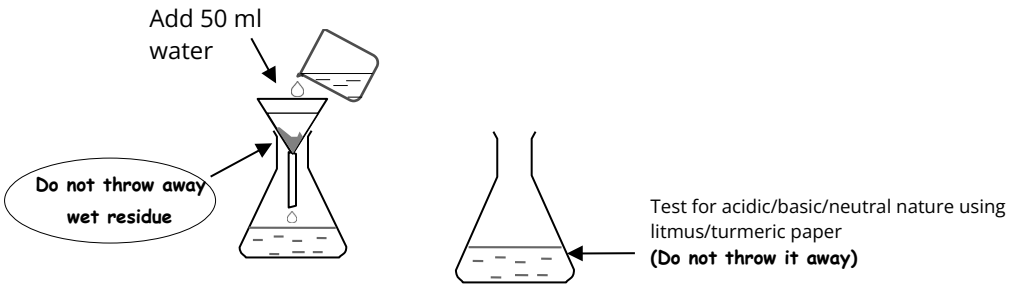
Step 5: Slowly pour another 20 mL water over the ash in the funnel. This time, some water will start collecting in the beaker under the funnel.



Step 6: Use litmus/turmeric paper to check if the water filtrate collected under the funnel is acidic/basic/neutral.

Q3. Can you tell if anything from the ash has dissolved in water? If yes, what is the chemical nature of this water soluble substance in ash?

Step 7: Remove the beaker/container containing the filtrate, and put another beaker/container under the funnel/strainer. Add 50 mL water to the funnel, stir the ash gently with a glass rod/spoon (should not tear the wet filter paper) and collect the filtrate. Repeat this step by adding another 50 mL of water. Check this filtrate with litmus/turmeric.



Q4. Is something still dissolving from the ash? Would all the ash dissolve in water?

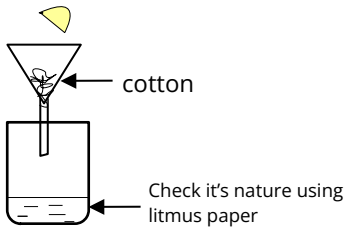
Step 8: If you feel more water needs to be added, add the water, let it filter and let the residue in funnel settle down.

Note: Do not throw the ash filtrate obtained in the above task. You will need it for further tasks.

Preparing for Task 4: Before you move to task 3, it will be better to do the preparation on (instructions given under Task 4) one day before you are planning to do Task 4.

Task 3: Ash residue & Lemon juice

Step 1: Squeeze some lemons and strain the juice through a tea strainer or filter it through cotton. Check if this juice is acidic, basic or neutral.



Q1. What observation is expected when lemon juice is added to the filtrate? What is expected when the juice is added to the solid remaining in the funnel?

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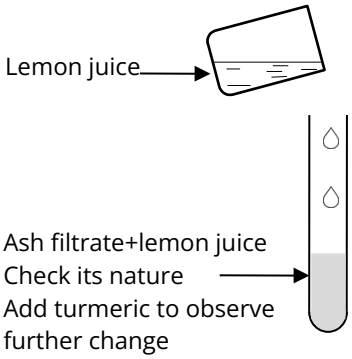
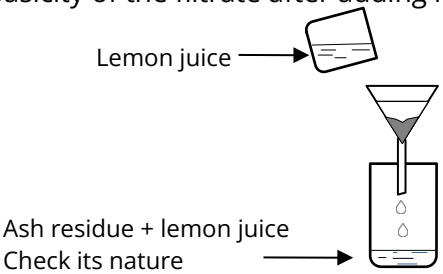
Step 2: Take some ash filtrate in a test tube, add some lemon juice and note down the observations. Add some turmeric and see if there is change in acidity/basicity of the filtrate after adding lemon juice.





Step 3: Take the funnel containing the residual ash from task 2 and put another empty beaker under the funnel. Add lemon juice to the solid in funnel. Note any changes you observe (in colour, texture, any gases evolved, smell, heat) and what does this indicate.

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Step 4: Check if the filtrate collecting in beaker below is acidic, basic or neutral.

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Q2. Is any part of ash dissolving in this lemon juice?

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Q3. With which of the following substances, would you observe the similar effect as observed on ash with lemon juice: table salt, washing soda, sand, carbon, chalk powder?

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Step 5: Add about 20 mL more of lemon juice to the funnel. Keep adding the juice slowly and keep stirring till you observe no further dissolution/change taking place in remaining solid.

Step 6: Note the colour and texture of the solid remaining in funnel.

Q4. Is the solid looking different now than the original ash taken. What does this change tell about the components that dissolved in water/lime juice?

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Q5. Has the amount of solid in funnel decreased after adding the lemon juice?

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Q6. Can we obtain the dissolved components (in water and in lemon juice) from the filtrate back in their solid state? How?

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Task 4: Ash Filtrate & Its Uses

First day: Take about 5 mL milk each in two separate test tubes. In one of them, add 3 - 4 mL of the ash filtrate collected in **Task 2.** Keep the other test tube as a reference. Cover the two test tubes with aluminium foil/paper and keep them aside for about 10 hours.

Q1. Predict what will happen to the milk in the two test tubes when you leave them for few hours?

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Second Day: Check the two test tubes next day.

Q2. What differences do you see in the two test tubes? What effect did ash-water filtrate have on the milk?

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Cleaning Oil spots: Take a small piece of cloth and put 2-3 drops of cooking oil on it. Then dip this cloth in the ash filtrate and see if you can remove the oil stain from the cloth.

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Task 5: What have we learnt?

Q3. Based on tasks 2-4, which of the following statement is correct. Give reasons for the incorrect statements being wrong.

- Ash consists of a single substance, which slowly dissolves in water or lemon juice.

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- Ash consists of two components, one soluble in water and other soluble in lemon juice.

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- Ash consists of three components, one soluble in water, one soluble in lemon juice, and one that is not soluble in any of the two.

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- Ash consists of acidic substances.

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- Ash consists of alkaline substances.

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- Ash contains two kind of basic substances, one soluble in water, and one soluble in acids.

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- Ash contains very hard particles, which do not dissolve in water, acids or bases.

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Q4. Based on above observation, was any foul smelling gas or an odour less gas evolved?

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Q5. Now that you know a few properties of ash, can you write any two uses of ash which you had not known before?

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In North-Eastern parts of India, ash from banana leaves is a culinary item. People mix the ash with water, allow the solid to settle. They take the supernatant and add it to food dishes during cooking.

Suggested Readings

1. A good discussion on various chemical substances in wood ash and their dissolution in water is available at: Steenari B.M. et al. (1999) Evaluation of the leaching characteristics of wood ash and influence of ash agglomeration. Biomass and Bioenergy, Volume 16 (2), Pages 119-136. Weblink: www.sciencedirect.com/science/article/pii/S0961953498000701
2. A review on composition and chemistry of ash and correlation with original plants material is available in this article:
   J.O. Babayemi, K.T. Dauda, D.O. Nwude and A.A.A. Kayode (2010) Evaluation of the Composition and Chemistry of Ash and Potash from Various Plant Materials-A Review
   Journal of Applied Sciences, Volume: 10 (16) Page 1820-1824. Weblink: http://docsdrive.com/pdfs/ansinet/jas/2010/1820-1824.pdf

