**Learning & Teaching Resources**

**for Science (S1-3) Curriculum (2017)**

**Unit 9 Common Acids and Alkalis**

**Acids, Alkalis & “Cheese” Making**

**Student Version**

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*(Developed by Hong Kong Association for Science and Mathematics Education)*

**Learning Objectives**

After the activities, you are able to:

* perform tests on the acidic or alkaline properties of substances by using plant extracts;
* design and make acid-alkali test paper by using plant extracts;
* design the packing methods to keep acid-alkali test paper; and
* make “cheese” by using milk and acidic substances.

**Activity 1：Colours of natural plant extracts under acidic or alkaline medium**

**Materials and Apparatus:**

* Dilute hydrochloric acid 1 bottle
* Dilute sodium hydroxide solution 1 bottle
* Distilled water in wash bottle 1 bottle
* Solution X 1 bottle
* Part of Plant A Some pieces
* Part of Plant B Some pieces
* Part of Plant C Some pieces
* Beaker (100 cm3) 3
* Measuring cylinder (10 cm3) 1
* Mortar and pestle 1 set
* Filter funnel 1
* Filter paper 3
* Gauze (10 cm x 10 cm) 3
* Dropper 8
* Spot tile 1

**Safety precautions:**

* Wear safety goggles when carrying out the experiment
* Handle acidic solution and alkaline solution with care because

they are corrosive

* Wash hands thoroughly with liquid soap after the experiment

**Procedures:**

1. Write down the names of the plants (with specific part) in the table below.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Plant A** | **Plant B** | **Plant C** |
| **Name of the plant**  **(with specific part)** |  |  |  |

1. Put Plant A into a mortar and use the pestle to grind it.
2. Add 10 cm3 of distilled water into the mortar and stir the mixture.
3. Put a piece of gauze into the filter funnel. Filter the mixture and put the extract of Plant A into a beaker.
4. Repeat steps 2 to 4 using Plant B and Plant C respectively.
5. Cut the filter paper into strips, and soak them into extract of Plant A, Plant B and Plant C respectively.
6. Dry the filter paper strips with plant extracts in oven and record the colour of the papers in Table 1.
7. Put the filter paper strips into different wells of the spot tile respectively.
8. Put 1 to 2 drops of distilled water, dilute hydrochloric acid solution and dilute sodium hydroxide solution onto separate piece of filter paper strips with the extract of Plant A and record the final colour of the paper strip in Table 1.
9. Repeat step 9 using filter paper strips with the extract of Plant B and Plant C respectively.
10. Test solution X with filter paper strips with extracts of Plant A, Plant B and Plant C respectively and observe any colour changes.
11. Record the results of step 10 to step 11 in Table 1.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Table 1** | | | | | |
| Plant | Original colour of the filter paper strip with plant extract | The colour of the filter paper strip after testing | | | |
| Distilled water | Dilute hydrochloric acid solution | Dilute sodium hydroxide solution | Solution X |
| A |  |  |  |  |  |
| B |  |  |  |  |  |
| C |  |  |  |  |  |

**Discussion questions:**

1. Which plant extract (A, B or C) gives the most significant change in colour?

1. According to the experimental result, solution X is acidic / alkaline / neutral .
2. What characteristic(s) should the extracts of the plants have so that it can be used to serve as an acid-alkaline indicator?

**Activity 2：DIY acid-alkali test paper**

**Part 1：Preparing acid-alkali test paper**

In this activity, students will prepare 10 acid-alkali test paper suitable for household uses with reference to the results from Activity 1.

**Procedures:**

1. Choose a suitable part of Plant A, Plant B or Plant C for preparing the acid-alkali test paper according to the result in Activity 1.
2. Prepare suitable amount of plant extracts with reference to Activity 1.

3. Prepare 10 pieces of filter paper strips according to your designed shape and size.

4. Soak the prepared filter paper strips into the plant extract.

5. Dry the filter paper strips with oven.

**Part 2：Design the packing for storing the acid-alkali test paper and the instruction of use**

1. The design should consider:
2. The Packing – the ease of carrying, durability and convenience to use

(b) The instruction of use – proper procedures and safety precautions

1. (a) Attach a photo of your product in the space below. Present the ideas of the design of your product to the classmates.

|  |
| --- |
|  |

1. Testing result:

|  |  |  |  |
| --- | --- | --- | --- |
| Plant extract used | Colour of the test paper in **acidic** solution | Colour of the test paper in **neutral** solution | Colour of the test paper in **alkaline** solution |
|  |  |  |  |

(c) The instruction of use of the acid-alkali test paper:

|  |
| --- |
|  |
|  |
|  |
|  |

(d) The packing and storage method for the test paper:

|  |
| --- |
|  |
|  |
|  |
|  |

**Activity 3：Peer assessment on the product presentation**

Rank the products made by the groups using the following assessment form.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Group | Sharpness of the results shown by the acid-alkali test paper  (30%) | Conciseness of the instructions of use  (30%) | Applicability of the packing design  (30%) | Convenience  in using the  test paper  (10%) |
| A |  |  |  |  |
| B |  |  |  |  |
| C |  |  |  |  |
| D |  |  |  |  |
| E |  |  |  |  |
| F |  |  |  |  |
| G |  |  |  |  |
| H |  |  |  |  |

**Activity 4：Making “cheese” by mixing milk and different substances**

**Materials and Apparatus:**

* Hot plate 1
* Beaker (100 cm3) 8
* 10 cm3 measuring cylinder 1
* Glass rod 4
* Thermometer 1
* Dropper 4
* Spot tile 1
* Filter funnel 1
* Filter papers 4
* Solution A 25 cm3
* Solution B 25 cm3
* Solution C 25 cm3
* Solution D 25 cm3
* Milk 800 cm3

**Safety precautions:**

* Wear safety goggles when carrying out the experiment
* Handle acidic solution and alkaline solution with care because

they are corrosive

* Washing hands thoroughly with liquid soap after the experiment

**Procedures:**

**(A) Testing the acidic and alkaline properties of the unknown solutions**

1. Identify whether solutions A, B, C and D are acidic or alkaline using the acid-alkali test papers prepared in Activity 2.

2. Record the results in Table 2.

**(B) “Cheese”-making**

1. Add 200 cm3 milk into a beaker and heat it to around 70 oC.

2. Put 5 cm3 of solution A into the beaker and stir it using glass rod for one minute.

3. If insoluble substance is formed, filter the insoluble substance and wash it with small amount of water. Record the result in Table 2.

4. Repeat steps 1 to 3 using solutions B, C and D respectively.

|  |  |  |
| --- | --- | --- |
| **Table 2** | | |
| Solution | Is the solution acidic, alkaline or neutral? | Is “cheese” formed after mixing the solution with milk? |
| A |  |  |
| B |  |  |
| C |  |  |
| D |  |  |

**Conclusion:**

“Cheese” can be formed when milk is mixed with acidic / neutral / alkaline solution.

**Discussion questions:**

1. Why do we need to heat the milk to 70 °C?

2. Why do we need to wash the insoluble substance with small quantity of water?

1. According to the experimental results, which solutions (A, B, C or D) can form “cheese” when mixing with milk?

4. With reference to the information search on the internet, briefly describe the science in the formation of “cheese”.