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A Review Paper on Green Chemistry: Natural Indicator Study

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Abstract- This paper looks at how we can make science labs safer and cleaner by using natural indicators instead of harsh chemicals. Usually, scientists use synthetic dyes to tell if a liquid is an acid or a base, but these can be bad for the environment. Our study shows that we can use colorful parts of plants—like red cabbage, flower petals, and fruit skins—to do the same job. These natural options are cheap, easy to find, and do not create toxic waste. We explain how these plant dyes change color just like the lab chemicals do, making them perfect for schools and green laboratories. By switching to these "earth-friendly" tools, we can follow the rules of green chemistry and protect our planet while still doing great science.

Keywords: Green Chemistry, Natural Indicators, Anthocyanins, pH Sensitivity, Sustainable Laboratory, Bio-indicators, Acid-Base Titration, Eco-friendly Extraction.

I.INTRODUCTION

Synthetic indicators often involve toxic chemicals and complex disposal protocols. Green Chemistry promotes the use of renewable resources. Natural indicators derived from plants offer a biodegradable, non-toxic, and cost-effective solution for acid-base titrations and environmental monitoring.

II. METHODOLOGY: PREPARING NATURAL INDICATORS

A. Source Selection

Flowers

Red hibiscus, Rose petals, Butterfly pea (Blue pea).

Hibiscus

Butterfly pea

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Plants/Vegetables:Red cabbage, Turmeric, Beetroot.

Red cabbage

Beetroot

Extraction Process

1. Preparation

Start by chopping or shredding about a quarter of a red cabbage. You don't need to be precise; smaller pieces just provide more surface area for the pigment to escape.

2.The extraction

Place the cabbage pieces into a glass bowl or beaker. There are two common ways to pull the color out:
The Boiling Method: Pour boiling water over the cabbage until it is just covered. Let it sit for about 10 minutes.
The Simmer Method: Place the cabbage and water in a pot on the stove and simmer for a few minutes until the liquid turns a deep, dark purple.

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3. Separation

Once the liquid is dark purple and has cooled down, pour the mixture through a strainer or coffee filter. This removes the solid cabbage chunks, leaving you with a concentrated purple liquid. This liquid is your "neutral" indicator.

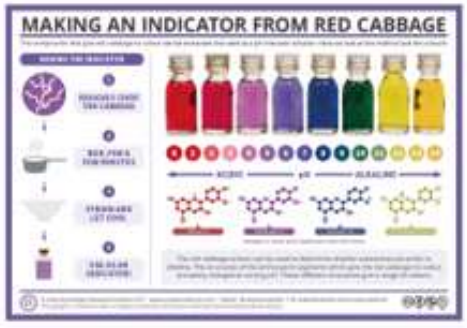
How to use it

To test different substances, pour a small amount of your purple cabbage juice into clear cups.

Acids: Add something like lemon juice or vinegar. The purple liquid will turn pink or red.

Bases: Add something like baking soda or soapy water. The liquid will turn green or yellow.

Neutral: If the substance is neutral (like plain water), the liquid will stay purple.



III. RESULTS & DISCUSSION

Natural indicators are substances obtained from plants or natural materials that show different colors in acidic and basic media. They are widely used in chemistry laboratories,environmental testing,and educational experiments because they are inexpensive,eco friendly,and easily available.

The extracted indicators exhibit distinct color shifts based on the concentration of hydrogen ions (H^+). For example, red cabbage juice transitions from red (acidic) to purple (neutral) to green/yellow (basic).

Indicator Source	Acidic Color	Basic Color
Red Cabbage	Red / Pink	Green / Yellow
Turmeric	Yellow	Red / Brown
Hibiscus	Bright Pink	Dark Green

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IV. CONCLUSION

Natural indicators align with the principles of sustainability. While they may have a shorter shelf life than synthetic versions, their accuracy in basic laboratory settings proves them to be viable "green" alternatives.

the preparation of natural indicators from plant extracts like anthocyanins and flavonoids represents a transformative step in green chemistry, delivering eco-friendly, biodegradable alternatives to synthetic dyes with comparable pH sensitivity and titration precision while minimizing environmental hazards and promoting sustainable practices—paving the way for broader adoption in analytical labs and future innovations in renewable reagents.

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