

## Utilization of Rambutan (*Nephelium lappaceum*), Eggplant (*Solanum melangona*), and Camote Tops (*Ipomoea batatas*) as Natural Indicators: Development of a Laboratory Guide for Acid-Base Chemistry Instruction

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### Abstract

This study investigates the use of locally accessible plant materials in acid-base chemistry education as sustainable substitutes for synthetic pH indicators. Despite their effectiveness, traditional indicators are often expensive, potentially dangerous, and environmentally unsustainable, emphasizing the need for more sustainable alternatives in educational settings. This study explores the potential of rambutan (*Nephelium lappaceum*), eggplant (*Solanum melongena*), and camote tops (*Ipomoea batatas*) peels as natural pH indicators and creates a laboratory guide for classroom use. It is based on green chemistry principles and contextualized science education. Moreover, the study aimed to (1) evaluate the color response and pH levels of the selected plant extracts; (2) evaluate their efficacy in comparison to commercial indicators; (3) analyze pH changes over time; and (4) create a laboratory manual for the instruction of acid-base chemistry. A quasi-experimental research approach was utilized, employing aqueous extraction techniques. The extracts were examined in buffer solutions at pH 4, 7, and 9, with observations recorded at various time points. The Friedman test, the Wilcoxon signed-rank test, and the chi-square test were all used to analyze the data. The results showed that all plant extracts changed color across different pH levels, indicating they could distinguish acidic, neutral, and basic solutions. There were strong links between changes in the color of the extract and the results of routine litmus paper tests, which shows that they are good markers. Although the pH values did not consistently change in a statistically significant manner over time, the extracts demonstrated stability and sensitivity, particularly in alkaline solutions. Hence, the research suggests that rambutan peel, eggplant peel, and camote tops serve as effective, cost-efficient, and environmentally sustainable substitutes for synthetic pH indicators. The established laboratory guide enhances their practical incorporation into science education, fostering sustainability and contextualized learning in resource-constrained environments.

*Keywords: Chemistry education, natural pH indicators, anthocyanins, quasi-experimental design, aqueous extraction, development of laboratory guides, Philippines*