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Exploring the Akshya-Juned qualitative technique for carbohydrate detection in protein solutions

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Abstract
The Akshya-Juned Qualitative Technique is a novel method for detecting carbohydrates in protein solutions, utilizing a rapid colorimetric approach. This technique involves treating protein samples, including milk, albumin, and albumin mixed with dextrose, with 40% sodium hydroxide (NaOH) and sodium acetate. The alkaline environment facilitates the hydrolysis of proteins and the breakdown of lactose into simpler sugars, promoting the Maillard reaction between amino acids and reducing sugars. This reaction produces melanoidins, resulting in a chocolate brown color that signifies the presence of carbohydrates. The method's effectiveness was demonstrated through positive results with milk and albumin containing dextrose, and a negative result with plain albumin. Additionally, we propose a quantitative extension of the test, where the intensity of the color change correlates with the carbohydrate content, offering a semi-quantitative measure of carbohydrates in protein-rich samples. This technique provides a straightforward, efficient means of carbohydrate detection, with potential applications in biochemical analysis and quality control.

Keywords: Akshya-Juned qualitative technique, carbohydrate detection, protein solutions, maillard reaction, colorimetric assay, quantitative analysis

Introduction
Detecting carbohydrates in protein solutions is crucial for understanding their role in biological systems and various industrial applications. Carbohydrates often coexist with proteins in complex mixtures, such as glycoproteins, making detection challenging due to interference. Traditional methods like the Molisch and Anthrone tests are often hindered by the presence of proteins, resulting in unreliable data (Plummer, 1971) [1]. Advanced techniques, such as the phenol-sulfuric acid assay, provide better sensitivity and specificity for carbohydrates, even in the presence of proteins (DuBois *et al*., 1956) [2]. Further refinements using High-Performance Liquid Chromatography (HPLC) have enabled more precise carbohydrate detection in protein-rich environments, which is essential for both research and quality control (Chaplin, 1986) [3]. Additionally, modern methods such as enzyme-linked assays and gas chromatography-mass spectrometry (GC-MS) offer enhanced detection capabilities, improving quantification in complex mixtures (Gorinstein *et al*., 2001; Saba & Aguilar, 2007) [4, 5].
In the context of carbohydrate detection in protein solutions, we propose the Akshya-Juned Qualitative Technique as a rapid and efficient chemical method that identifies carbohydrates by producing a distinct color change. This approach addresses the common challenge of protein interference in traditional carbohydrate detection methods, providing a reliable and quick means of distinguishing carbohydrates in complex mixtures. By focusing on colorimetric changes, this technique offers a straightforward, time-saving alternative for accurately detecting carbohydrates in protein-rich environments.

Methodology
The Akshya-Juned Qualitative Technique for carbohydrate detection in protein solutions is a rapid and efficient chemical method based on colorimetric changes. In this experiment, three protein samples were used: 3 mL of milk, 3 mL of albumin solution, and 3 mL of albumin mixed with 0.5 g dextrose. To each sample, 1 mL of 40% sodium hydroxide (NaOH) and a pinch of sodium acetate were added. The mixtures were then heated for 1 minute to initiate the reaction. The presence of carbohydrates was indicated by a chocolate brown color, while a yellow color signified a negative result. This technique provides a straightforward and quick way to detect carbohydrates in protein-rich environments.

Results

The results of the Akshya-Juned Qualitative Technique showed distinct color changes across the different samples. Both the milk and the albumin with dextrose samples gave a positive result, displaying a chocolate brown color, indicating the presence of carbohydrates. Milk contains galactose, a type of carbohydrate, which accounts for its positive result. The albumin mixed with dextrose produced an even deeper c color due to the higher carbohydrate content from the added dextrose. In contrast, the plain albumin sample showed a yellow color, indicating a negative result, as albumin does not naturally contain carbohydrates. These observations confirm the method's sensitivity to varying carbohydrate concentrations in protein solutions.

Table 1: Showing presence of carbohydrate in protein solution

S. No.	Sample	Colour	Results
1	Milk	chocolate brown	+ve
2	Albumin + Dextrose	chocolate brown	+ve
3	Albumin	yellow	-ve

Fig 1: Showing presence of carbohydrate in protein solution

Conclusion

In conclusion, the Akshya-Juned Qualitative Technique effectively utilizes the Maillard reaction to detect carbohydrates in protein solutions. When milk is treated with 40% sodium hydroxide (NaOH) and sodium acetate, the alkaline environment hydrolyzes proteins such as casein and breaks down lactose into simpler sugars. This reaction facilitates the Maillard reaction, where amino acids from proteins interact with reducing sugars to form melanoidins, resulting in a characteristic chocolate brown color due to non-enzymatic browning (Belitz *et al*., 2009) [6]. Sodium acetate, while serving as a buffering agent, does not directly influence the browning but helps maintain the reaction environment (Nursten, 2005; Labuza & Baisier, 1992) [7, 8]. The significance of this test lies in its ability to rapidly and visibly indicate the presence of carbohydrates. Furthermore, we propose a quantitative approach to this technique, as the intensity of the color change can vary according to the carbohydrate content, providing a measure of carbohydrate concentration in the sample. This enhancement makes the test not only a qualitative but also a semi-quantitative tool for carbohydrate analysis in complex protein mixtures.

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