Bioanalytical Determination of Glucose Concentration in Sports Drinks using UV/Vis Spectroscopy

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Abstract

The purpose of our project is to indirectly monitor the enzymatic activity of glucose oxidase as it reacts with the glucose present in sports drinks through the quantitative analysis of the generated ferricyanide. As glucose oxidase catalyzes the oxidation of beta-D-glucose in the presence of oxygen, D-glucono-1,5-lactone is produced along with hydrogen peroxide. The hydrogen peroxide is used in a subsequent reaction with ferrocyanide catalyzed by horse radish peroxidase to produce water and the chromophore ferricyanide. This compound absorbs in the ultraviolet/visible spectrum at 420 nm, which can be quickly measured using Ultraviolet/Visible Spectroscopy. Since the molar ratio of each component in this reaction mechanism is 1:1, the total concentration of glucose can be found by calculating the total concentration of ferricyanide using Beer's Law, and that value can be compared to the glucose values listed by manufacturers on product labels. By unconventionally applying the biochemical principles of enzyme kinetics to quantitative analysis for the purpose of verifying reported ingredient concentrations in food, this project encourages students to explore alternative approaches to familiar laboratory techniques and consider new uses for common instruments.

Keywords

Redox chemistry; Glucose; Ferricyanide; Glucose Oxidase; Horse Radish Peroxidase; Bioanalytical chemistry; UV/Vis Spectroscopy; Beer's Law; Enzyme Kinetics.