# Non-Enzymatic Electrochemical Glucose Sensing Using Graphite Pencil Electrodes

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Glucose is an important water-soluble substance present in many biological fluids, pharmaceuticals, foods, and soft drinks. Hence, the development of a rapid and simple method of glucose detection could be beneficial to many fields such as medical, pharmaceutical, and food industry. Although electrodes based on glucose oxidase enzyme are currently extensively used for glucose detection in biological samples, they are plagued by drawbacks such as bad stability, high cost of enzymes and unfavorable operative conditions giving erroneous results. In order to overcome some of these limitations of enzymatic sensors, a graphite pencil electrode (GPE) is introduced as a non-enzymatic glucose sensor. All types of pencils from B-8B from one selected brand were tested. Among them, 3B exhibited the best results as a glucose sensor. It gave linear calibration for 1-10 ppm ($R^2$ = 0.7825, sensitivity = $7\times10^{-5}$), 10-100 ppm ($R^2$ = 0.9885, sensitivity = $8\times10^{-6}$) and 100-1000 ppm ($R^2$ = 0.9285, sensitivity = $6\times10^{-7}$) working ranges. It showed the highest linearity and sensitivity in the 10-100 ppm glucose concentration. The GPE responds considerably well in the presence of other substances such as sodium chloride ($R^2$ = 0.9868, sensitivity = $8\times10^{-6}$) and citric acid. Citric acid interfered only when present in high concentrations such as 1:1 and 1:2 citric acid: glucose concentrations. Interference was negligible at 1:3 citric and higher acid: glucose ratios ($R^2$ = 0.9807, sensitivity = $1\times10^{-5}$). The 3B pencil response stability is good as it responds to glucose even after a two-month period with only slight loss of sensitivity and linearity. GPE was utilized successfully to determine glucose concentrations in glucose injection samples.

**Keywords:** Glucose, 3B pencil, graphite