# Development of a device to detect *in vitro* derived glycated proteins based on the fluorescence quenching properties of graphene oxide

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Glycated proteins (GPs), produced through the non-enzymatic glycation of proteins by glucose, are emerging biomarkers for early diabetes diagnosis. This study reports a fluorescence-based mechanism to detect *in vitro* derived GPs and its development into a prototype sensing device. Graphene Oxide (GO) was synthesized using the Improved Hummers method, while GPs were produced through a BSA-glucose model. Fluorescence studies were carried out in 96-well microplates (n = 3) using a 300 µL reaction volume containing 100 µL of GO (1.0 mg $mL^{-1}$), varying GP concentrations (7.5 - 37.5 µL$mL^{-1}$), phosphate buffer (pH 7.4), and distilled water (emission: 370 nm, excitation: 440 nm). By adopting the fluorescence quenching behaviour of GO, a GPs detection mechanism was established, and a prototype device was designed and developed using an Arduino Nano, UV LED (370 nm), collimator lens, narrow band pass filter (440 nm), and TSL257 light-to-voltage sensor. The structural components of the device were designed in SolidWorks and 3D printed to have a precise device configuration. The real-time results were displayed using an LCD (16×2). The fluorescence spectra revealed the quenching effect of GO against GPs, which is highly dose-dependent in the concentration range of 7.5 - 37.5 µL$mL^{-1}$. The highest |Δ Fluorescence Intensity| was observed at 420 - 430 nm, with the secondary peak at 440 nm. The |Δ Fluorescence Intensity| exhibited a linear relationship with GP concentration ($R^2$ = 0.9927), validating GO as a potential sensing material. Further, the developed device (30 replicates per concentration) confirmed consistent light-to-voltage responses with minimum intervention against distilled water, buffer, and BSA while showing a baseline voltage of 0.03 V for GO, confirming its minor inherent fluorescence properties. The device demonstrated a strong linearity and precision (STD: 0.022 to 0.037 V) while exhibiting an average device accuracy of 94.88%. Further improvements in the repeatability and accuracy of voltage responses may lead to potential testing in biological matrices, allowing fabrication of a point-of-care device for early detection of diabetes.

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