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Towards point of care sensing of glycated albumin for better glycemic control

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Diabetes is rapidly emerging as a major threat to public health. Diabetes is not a single disorder, but is a collection of several disorders with different underlying causes and with multiple hormonal abnormalities. It is characterized by disordered carbohydrate metabolism with hyperglycemia resulting from dysfunction of insulin secretion, insulin action or both. The long term complications of diabetes mellitus include the progressive development of retinopathy, nephropathy, foot ulcers, neuropathy, cardiovascular diseases and amputation. Albumin is one of the most abundant proteins in plasma. The normal concentration of the albumin in plasma is 35 to 50 g/l. Albumin protein has three domains I, II, III that are further subdivided into two subdomains, A and B which enable its functional conformational structure. Presence of 17 disulphide bridges makes it resistant to the change in the pH and other altering environment. Hyperglycemia in diabetes mellitus induces the formation of the advanced glycation end products (AGE), thought to be toxins that bind to proteins present in plasma. HbA1c, which gives 90 days average blood glucose level, is clinically recommended as gold standard for assessment of the glycemic control in diabetic patients. Glycated albumin (GA) has been recently used as another clinical gold standard indicator of glycemic control. Since the half life of human serum albumin is 2 weeks, it could serve as an efficient marker for short term glycemic control compared to HbA1c. Further HbA1c test results could be affected in a number of situations, such as structural hemoglobinopathies, thalassemia syndromes and chemical alterations of haemoglobin. Moreover, any condition that decreases mean erythrocyte age, such as chronic kidney disease, will falsely lower HbA1c test results regardless of the assay methods for assessments. We present a novel technology for electrochemical detection of serum albumin that is being extended for glycated albumin measurement for point of care application by exploring the binding property of albumin with electrochemically active molecules such as copper and hemin.

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