



Breath Acetone Based Detection of Diabetic Ketoacidosis

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Abstract

Diabetes mellitus has become a major global health challenge, affecting hundreds of millions of people worldwide and placing a significant burden on healthcare systems. Among its acute complications, diabetic ketoacidosis (DKA) is a severe and potentially life-threatening condition that requires rapid intervention. Conventional diagnostic approaches rely on invasive blood sampling, causing discomfort and limiting frequent monitoring. This study developed a non-invasive, portable colorimetric breath-testing prototype for early DKA risk screening through acetone detection in exhaled breath. The sensing platform was fabricated by immobilizing an optimized reagent system consisting of 0.10 M sodium nitroprusside (SNP), 1 M sodium hydroxide (NaOH), and 1 M glycine onto a glass fiber sheet substrate to enhance colorimetric response. The sensing strip was integrated into a 3D-printed device containing a silica gel moisture filter and an internal flow-stop channel to increase gas-sensor interaction time. When tested with simulated breath samples containing 3.3–132 ppm acetone, the alkaline-activated glass fiber strips exhibited distinct and stable yellow-to-purple color transitions. The prototype achieved an average visual reading accuracy of 88% in classifying acetone levels into safe, caution, and danger zones. Furthermore, the sensor showed good selectivity, with no observable color response to common respiratory interferents, including ammonia, methanol, and ethanol. This low-cost and painless screening approach demonstrates potential as an accessible tool for early DKA risk assessment and future development toward non-invasive monitoring systems.

Keywords: Diabetic ketoacidosis (DKA), Breath acetone, Sodium nitroprusside (SNP), Colorimetric sensor, Non-invasive detection