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## Rapid Paper Based Colorimetric Detection of Glucose using a Hollow Microneedle Device

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### Abstract

The monitoring of blood glucose is a key aspect of diabetes care in limiting the negative effects of hyperglycaemia to both the microvasculature and macrovasculature. Self-monitoring of blood glucose (SMBG) gives an indication of blood glucose at a specific point in time and is recommended to be carried out four times daily. However, due to the inconvenience and associated pain of blood withdrawal, SMBG is often carried out less frequently than recommended or not at all. Extraction and subsequent determination of glucose in interstitial fluid (ISF) using microneedles (MNs) is an emerging area of research due to their minimally invasive nature and lack of associated pain. In this manuscript, a novel method for the fabrication of a hollow microneedle device is reported. The microneedle produced had a sharp bevelled edge and was 400  $\mu\text{m}$  in length. Additionally, a paper backplate embedded with a colorimetric system for the rapid visual determination of glucose in simulated ISF was developed and paired with the hollow MN. This device rapidly extracted simulated ISF within five seconds and its ability to produce a glucose concentration dependent colour change within 30 seconds was demonstrated. Using this approach, it was possible to discriminate between glucose concentrations in normal glycaemia (4-7 mM) and hyperglycaemia (>7 mM) ranges using the naked eye. While further development is

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