Wax-printed paper sensor using gold nanoparticle and gold enhancer for diagnosis of diseases

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Microfluidic paper-based analytical devices (μPAD), recognized as a powerful analytical platform for improving healthcare, have been used as clinical point-of-care (POC) sensor. However, it is still difficult to detect the low concentration of biomarkers in a sample fluid due to the limited sample volume and relatively low limit of detection (LOD). To overcome these hurdles, we developed wax-printed paper sensor by adapting gold nanoparticles (GNP) accumulation system with signal enhancer and hydrophobic boundary of wax ink to improve sensitivity and to prevent loss of samples. Microfluidic patterned hydrophobic barriers, by heating the wax-printed paper, guided the sample fluid flows only into sensing pathway preventing the loss of sample fluid by capillary penetration in unwanted direction. Also, injection of the gold enhancer, made up of silica nanoparticle and GNPs, showed more obvious optical signal than when it was not used. Performances including calculations of LOD and LOQ of the fabricated wax printed μPAD was examined with HCG samples. In conclusion, our wax-printed paper sensor with GNP and gold enhancer showed considerable potential for the POC sensor.