# Cellulose-based hydrogel on quantum dots with molecularly imprinted polymers for the detection of CA19-9 protein cancer biomarker

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## ABSTRACT

Molecularly imprinted polymers (MIPs), were successfully assembled around quantum dots (QDs), for the detection of the carbohydrate antigen CA19-9, a biomarker associated with pancreatic cancer (PC). The imprinted materials MIP@QDs were incorporated within cellulose hydrogels and designated as imprinted hydrogels (iHGs). The concept is to use MIPs which function as the biorecognition elements, conjugated to QDs as the sensing system. The fluorescence quenching of the iHGs occurred with increasing concentrations of CA19-9, showing linearity in the range $2.76 \times 10^{-2} – 5.23 \times 10^{2}$ U/ml, in a 1000-fold diluted human serum. The iHGs show a linear response below the cutoff values for pancreatic cancer diagnosis (< 23 U/ml), a limit of detection of $1.58 \times 10^{-3}$ U/ml and an imprinting factor (IF) of 1.76. Moreover, they exhibit stability and selectivity towards CA19-9, when compared with the non-imprinted controls, here designated as non-imprinted hydrogels (non-iHGs). In conclusion, this work demonstrates that the conjugation of MIPs to QDs increases the sensitivity and specificity of the developed sensing system for optical detection methods within clinical significance ranges. This fact shows potential for the iHGs to be applied as a sensitive, low-cost format for point-of-care tests (PoCTs).

## KEYWORDS

Carbohydrate antigen A 19–9; pancreatic cancer diagnosis; quantum dots; molecularly imprinted polymers; optical sensor; imprinted cellulose hydrogels.

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