**Highly-sensitive cholesterol biosensor based on well-crystallized flower-shaped ZnO nanostructures**

Ahmad Umar\textsuperscript{a,b,*}, M.M. Rahman\textsuperscript{b}, A. Al-Hajry\textsuperscript{c}, Y.-B. Hahn\textsuperscript{b,*}

\textsuperscript{a} Najran University, Saudi Arabia
\textsuperscript{b} Chonbuk National University, South Korea
\textsuperscript{c} Najran University, Najran Saudi Arabia

**Abstract**

This paper reports the fabrication of highly-sensitive cholesterol biosensor based on cholesterol oxidase (ChOx) immobilization on well-crystallized flower-shaped ZnO structures composed of perfectly hexagonal-shaped ZnO nanorods grown by low-temperature simple solution process. The fabricated cholesterol biosensors reported a very high and reproducible sensitivity of 61.7 A M$^{-1}$ cm$^{-2}$ with a response time less than 5 s and detection limit (based on S/N ratio) of 0.012 M. The biosensor exhibited a linear dynamic range from 1.0–15.0 M and correlation coefficient of R = 0.9979. A lower value of apparent Michaelis–Menten constant (Km app), of 2.57 mM, exhibited a high affinity between the cholesterol and ChOx immobilized on flower-shaped ZnO structures. Moreover, the effect of pH on ChOx activity on the ZnO modified electrode has also been studied in the range of 5.0–9.0 which exhibited a best enzymatic activity at the pH range of 6.8–7.6. To the best of our knowledge, this is the first report in which such a very high-sensitivity and low detection limit has been achieved for the cholesterol biosensor by using ZnO nanostructures modified electrodes.