A multifunctional molecularly imprinted polymer-based biosensor for direct detection of doxycycline in food samples

In this study, we developed a new type of multifunctional molecularly imprinted polymer (MIP) composite as an all-in-one biosensor for the low-cost, rapid and sensitive detection of doxycycline in pig plasma. The MIP composite consisted of a magnetic core for ease of manipulation, and a shell of fluorescent MIPs for selective recognition of doxycycline. By simply incorporating a small amount of fluorescent monomer (fluorescein-O-acrylate), the fluorescent MIP layer was successfully grafted onto the magnetic core via a surface imprinting technique. The resultant MIP composites showed significant doxycycline-dependent fluorescence quenching in an aqueous environment. Good linearity ranging from 0.2 to 6 μM was achieved, and the limit of detection was determined to be 117 nM. The biosensor also showed good selectivity towards doxycycline when compared to other common antibiotic residues. The multifunctional MIP composites were used to directly extract doxycycline from spiked pig plasma samples and quantify the antibiotics based on the quenched fluorescence signals. Recoveries of doxycycline were found in the range of 88–107%.