

## Fabrication of porcine DNA biosensor based on ruthenium bipyridine complex

### ABSTRACT

Electrochemical DNA biosensor for detection of porcine oligonucleotides based on ruthenium (II) as label redox complex has been developed. The system of biosensor is based on the modified screen printed carbon electrode (SPE) with goldnanoparticles (AuNPs) as transducer immobilized with poly(n-butylacrylate-N-acryloxysuccinimide) microsphere and porcine DNA probe sequences was attached onto it via the covalent bond. The ruthenium(II) complex,  $[\text{Ru}(\text{bpy})_2\text{PIP}]^{2+}$  PIP = 2-phenylimidazo[4,5-f][1,10-phenanthroline] intercalator has been used to determine porcine DNA. The biosensor was measured and optimized by cyclic voltammetry (CV) and differential pulse voltammetry (DPV). The interaction of  $[\text{Ru}(\text{bpy})_2\text{PIP}]^{2+}$  with various DNA with different sequences, i) single stranded probe DNA, ii) after hybridization with its complementary DNA and iii) after hybridization with mismatch complementary DNA were studied. The results indicated that the interaction of  $[\text{Ru}(\text{bpy})_2\text{PIP}]^{2+}$  with hybridized complementary DNA gave the highest response. Thus, development of porcine DNA biosensor and influences of many factors such as  $[\text{Ru}(\text{bpy})_2\text{PIP}]^{2+}$  complex and DNA probe concentration, DNA probe immobilization and hybridization time, pH, ionic strength, buffer concentration and temperatures were also studied to evaluate the performance of biosensor. The concentration of  $[\text{Ru}(\text{bpy})_2\text{PIP}]^{2+}$  complex and DNA probe were found to be optimal at 50  $\mu\text{M}$  and 2  $\mu\text{M}$ , respectively. The optimal time for DNA probe immobilization and hybridization were 7 hours and 60 minutes, accordingly. The optimal condition of pH, ionic strength, buffer concentration and temperatures were at pH 7.0, 1.0 M NaCl, 0.05 M of Na-phosphate buffer and 25  $^\circ\text{C}$ , respectively. The linear range of different concentration complementary DNA was within the range between  $1.0 \times 10^{-13}$  M to  $1.0 \times 10^{-8}$  M. This study was first reported the used of  $[\text{Ru}(\text{bpy})_2\text{PIP}]^{2+}$  for detection of porcine oligonucleotides.

**Keyword:** Biosensor; Porcine DNA; Ruthenium bipyridine complex