DOCTORAL THESIS

The application of iridium(iii) complexes in luminescent sensing

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Abstract

Luminescent transition metal complexes have arisen as viable alternatives to organic dyes for sensory applications due to their notable advantages. This thesis aimed to synthesize different kinds of iridium(III) complexes as chemosensors and G-quadruplex probes for the detection of metal ions, small molecules, proteins and DNA to demonstrate the versatility of iridium(III) complex in luminescence sensing.

Iridium(III) complex chemosensors were synthesized and developed for the detection of Cu^{2+} and cysteine. The iridium(III) complex plays the role of the "signaling unit", which transduces the analyte binding event into an optical (luminescent) signal and the "receptor unit" attached to the metal complex selectively binds the analyte of interest. Meanwhile, a series of iridium(III) complexes incorporating a variety of *C^N* and *N^N* donor ligands were synthesized and were shown to exhibit G-quadruplex-selective binding properties *via* emission titration, fluorescence resonance energy transfer melting and G-quadruplex fluorescent intercalator displacement experiments. These G-quadruplex-selective Ir(III) complexes were utilized as signal transducers to monitor the conformational changes of oligonucleotides in label-free oligonucleotide-based luminescent detection platforms for metal ion (Ag^{+}), small molecules (cocaine), protein (insulin and AGR2) and gene deletion.

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