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Water soluble Ir-complexes for ECL signal amplification in pathogens detection

Luigi Menduti,[a] Nicolò Quadrio,[b] Ariadna Lazaro,[b] Giorgio Facchetti,[a] Isabella Rimoldi,[a] Luisa De Cola[b,c]

[a] *Department of Pharmaceutical Science, Università degli Studi di Milano, Milan 20133, Italy.*
[b] *Institut für Funktionelle Grenzflächen (IFG), Karlsruhe Institute of Technology, Eggenstein-Leopoldshafen 76344, Germany.*
[c] *Department of Biochemistry, Istituto di Ricerche Farmacologiche Mario Negri IRCCS, Milan 20156, Italy.*
luigi.menduti@unimi.it

Electrogenerated chemiluminescence, also called electrochemiluminescence (ECL), is the generation of excited states upon recombination of oxidized/reduced species generated at the electrode and reduced/oxidized species produced by a chemical reaction.

In the past decades, ECL-active molecules have been employed in many applications such in systems for the detection of viruses/bacteria.[1] However, despite the increasing demands for accuracy in diagnostics, the sensitivity of ECL in immunoassays, already in the picomolar range, can still be improved by designing emitters with higher emission quantum yields or by thinking of multiple emitter for a single analyte.

As an example, a known strategy to increase the sensitivity of bioassays is the construction of multi-labeled systems, such as the one developed by Roche, PolyRu, consisting of 8 units connected to the same antibody. Such multiple Ru(II)-based emitters are connected to the detecting-platform which in turn binds one equivalent of analyte. This multi-labeled system allows to get considerable signal improvement since each detected analyte can be marked by the ECL-signal produced by several emitters, however the emission intensity is not as expected increased by 8 folds as should be.

Indeed, the maximum signal increase achievable is 30% due to the self-quenching of the (spatially-closed) emitters anchored on the detecting-platform surface. To overcome this problem and improve the signal increase, our strategy is to build systems in which ECL-emitters are anchored on a platform by a suitable linker allowing their release in solution under a certain stimulus . Beyond the tuning of the detecting-platform architecture, the replacement of the commercial ECL emitter $[Ru(bpy)_3]^{2+}$ with more efficient[2] and easily-color-tunable[3] emitters such as water soluble Ir(III)-complexes,[4] represents a promising tool to further improve the signal-to-noise ratio.

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