Novel and Versatile Solid-State Chemiluminescence Sensor Based on TiO_2-Ru(bpy)$_3^{2+}$ Nanoparticles for Pharmaceutical Drugs Detection

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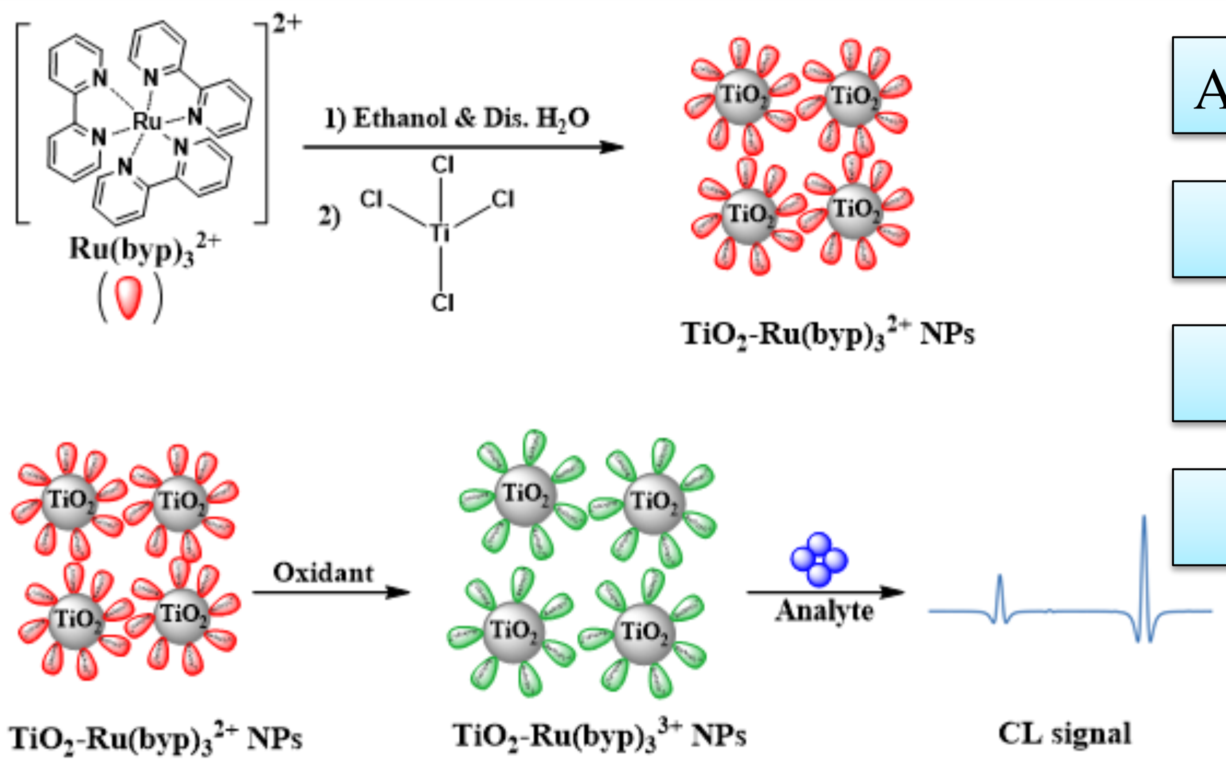
Introduction

A solid-state TiO_2-Ru(bpy)$_3^{2+}$ hybrid NPs as a novel chemiluminescence (CL) sensor for analyte detection as oppose to electrogenerated chemiluminescence (ECL).



Advantages over solid-state ECL

1- Simple

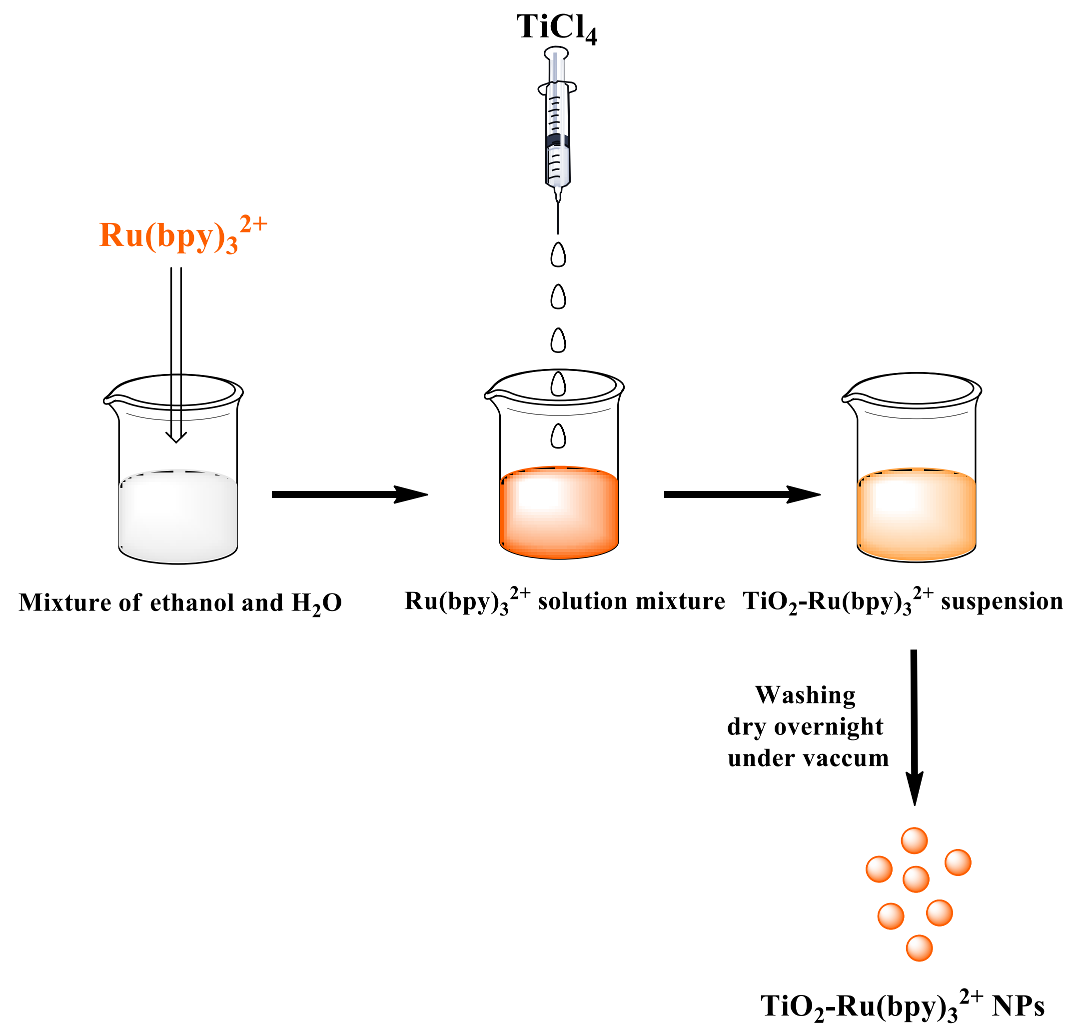
2- Low Cost

3- No electrical components

Objectives

- Synthesis and characterisation of TiO_2-Ru(bpy)$_3^{2+}$ hybrid NPs.
- Optimisation of the new detection system.
- Detection of two pharmaceutical drugs: imipramine and promzaine.

Preparation of TiO_2-Ru(bpy)$_3^{2+}$ NPs



Results and Discussion

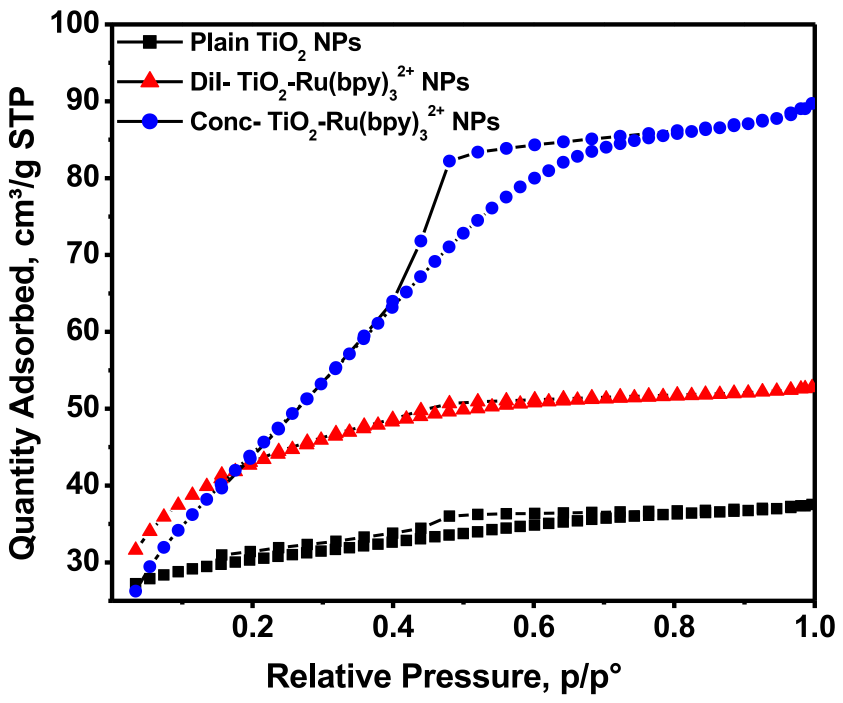
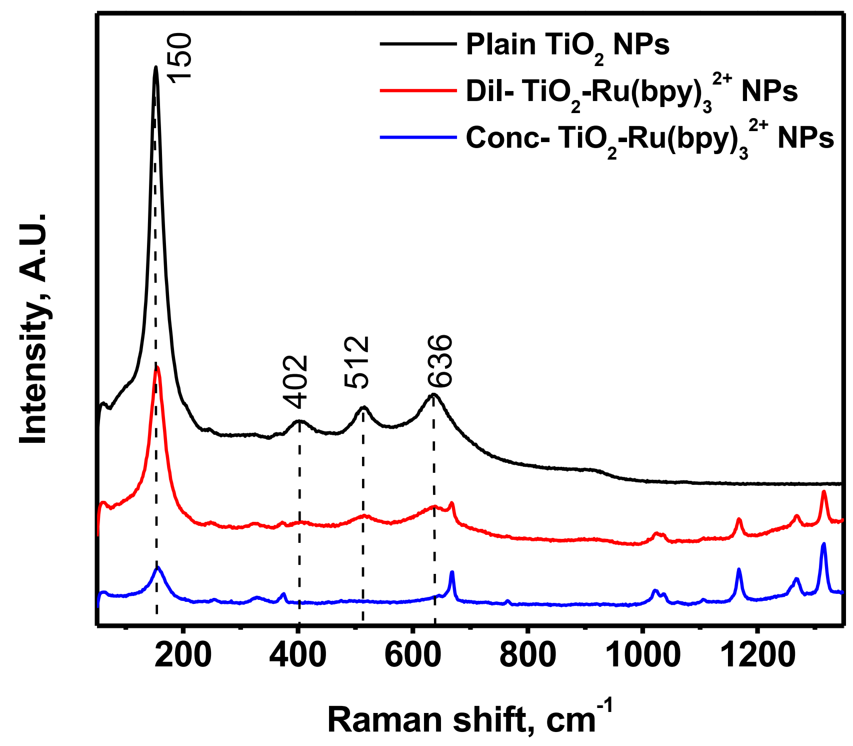


Figure 1: N_2-isotherms obtained for all samples can be ascribed as type IV. The hysteresis loop can be classified in the middle between H2 and H4 types, indicating mesoporous structure with slit-shaped pores.

Table 1: N_2 sorpometry measurements in revealed that the incorporation and the concentration of Ru(bpy)$_3^{2+}$ with TiO_2 NPs caused a detrimental effect on the specific surface area of the hybrid NPs.

NPs	Pore size (nm)	Pore volume (cm³/g)	Surface area (m²/g)
TiO_2	3.12	0.15	197.8
Diluted TiO_2-Ru(bpy)$_3^{2+}$	2.18	0.081	149.6
Concentrated TiO_2-Ru(bpy)$_3^{2+}$	2.94	0.027	36.9

Figure 2: Raman spectrum of plain TiO_2 NPs was dominated by four active modes detected at 150, 402, 512 and 636 cm^{-1}. However, additional peaks at 1021, 1168 and 1353 cm^{-1} were observed in TiO_2-Ru(bpy)$_3^{2+}$ NPs spectra, which can be attributed to the presence of Ru(bpy)$_3^{2+}$ in the TiO_2 NPs.



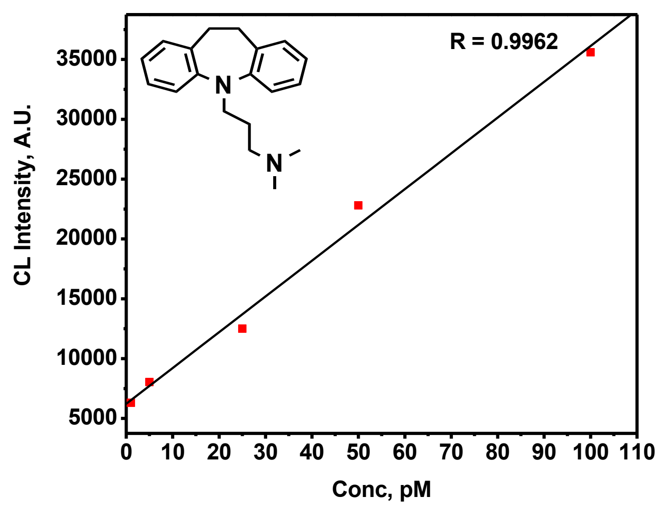


Figure 3: Detection of imipramine with linear range of 1-100 pM and LoD of 0.1.

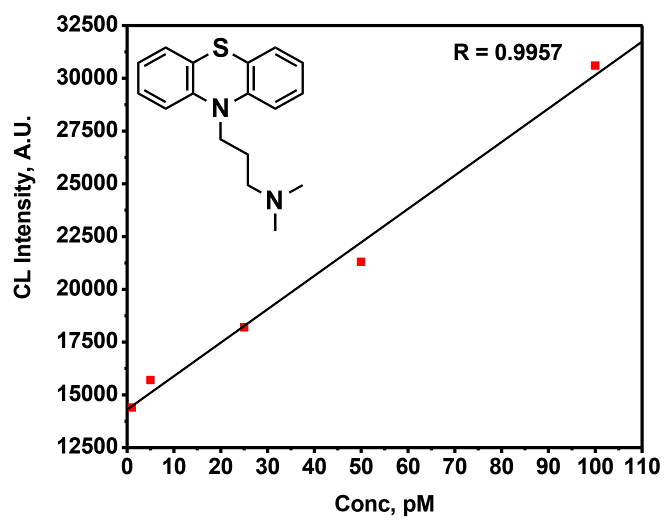


Figure 4: Detection of promazine with linear range of 1-100 pM and LoD of 0.5.

Conclusion

- A simple, rapid and low-cost detection system based on solid-state CL as opposed to ECL has been lucratively developed.
- The TiO_2-Ru(bpy)$_3^{2+}$ NPs have been prepared, characterised and used for an enhanced CL detection of imipramine and promazine.

Acknowledgments

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