BRIGHT CARBON DOTS FROM CORK INDUSTRY WASTEWATER AS SENSORS OF HEMEPROTEIN

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SUMMARY

Carbon nanodots are a recent class of spherical-shaped nanosized carbon materials reaching average typical diameters < 10 nm and a variety of methods for their synthesis and applications thereof have been reported [1,2]. Sustainable production of high-valued carbon materials from industrial low-valued and problematic wastes materials is particularly appealing and highly desirable. Following eco-friendly and expedite hydrothermal processes, we have been able to synthesize highly luminescent carbon dots (C-dots) directly from cork industry wastewater (CIWW) in the presence of ethylenediamine at 200ºC in excellent yields [3].

Herein we report the sensing abilities of as-synthesized C-dots toward haemproteins (haemoglobin, myoglobin and cytochrome *c*) in aqueous medium via direct turn-off fluorescence-based titration experiments [4].

DETECTION OF HAEMPROTEINS

Development of highly sensitive and selective sensorial probes for direct detection of proteins is in great demand given their important roles in certain disease events of living organisms. Studies conducted in phosphate buffer (pH=7.2) displayed a significant performance of C-dots as biosensors for haemeproteins (Table 1 and Fig.1). On the contrary, no measurable quenching activity was observed for a non-heme protein (lysozyme) [4].

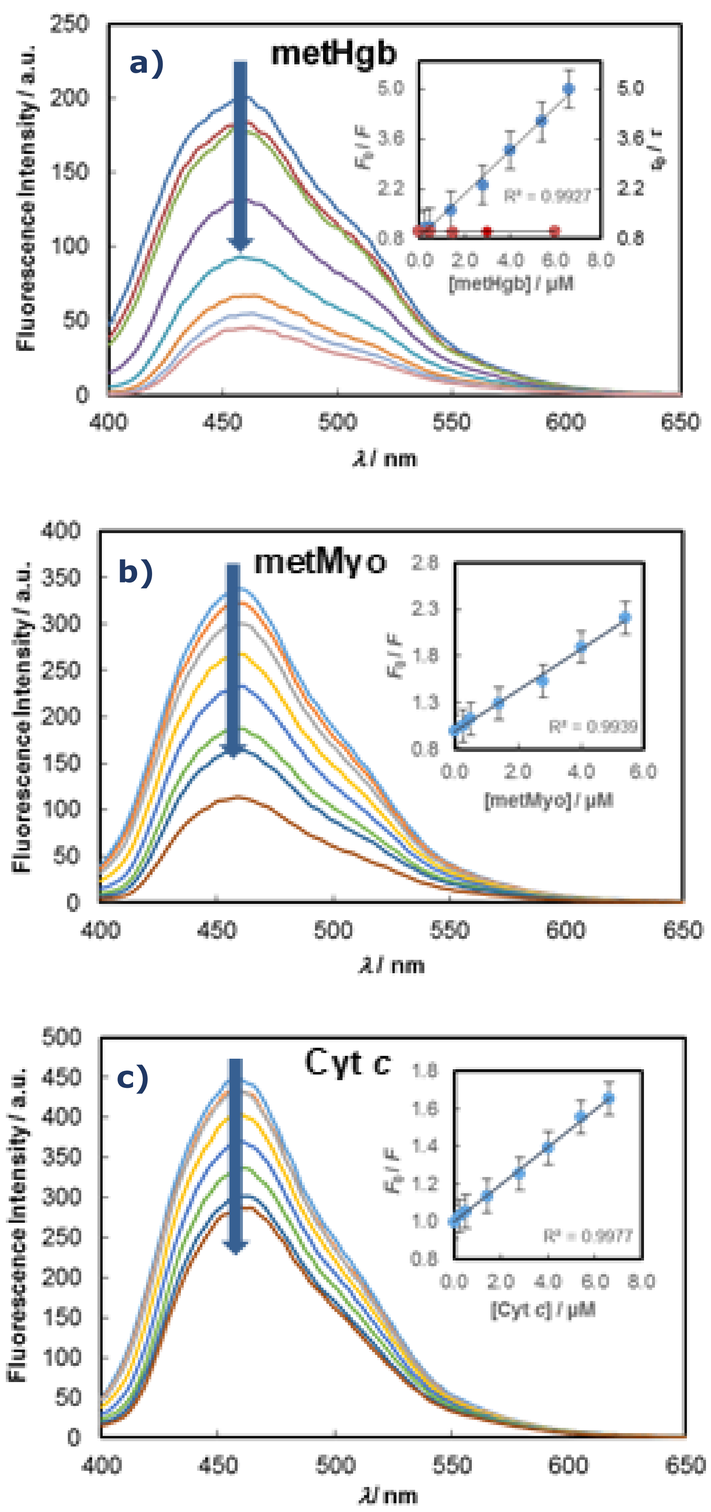
Table 1. Stern-Volmer constant (K_{SV}), limit of detection (LOD) and limit of quantification (LOQ) for haemeproteins.

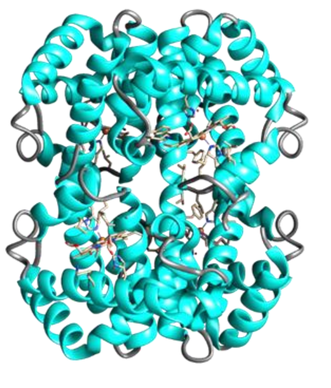
	K_{SV} (M^{-1})	LOD (nM)	LOQ (nM)
Haemoglobin	6.1×10^5	7.8	26.0
Myoglobin	2.2×10^5	21.5	71.5
Cytochrome *c*	1.0×10^5	47.6	158.6

CONCLUSIONS

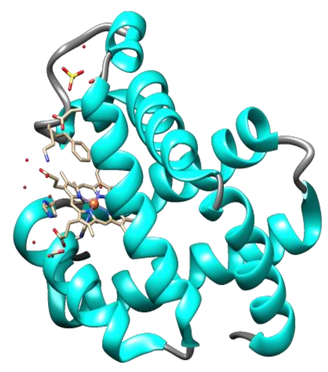
- **Quenching efficiencies achieved showed the high sensitivity of C-dots for all metalloproteins.**
- **The highest response was achieved for haemoglobin.**
- **Based on time-resolved fluorescence data, a static quenching mechanism was formulated.**

HAEMPROTEINS (3D STRUCTURES)

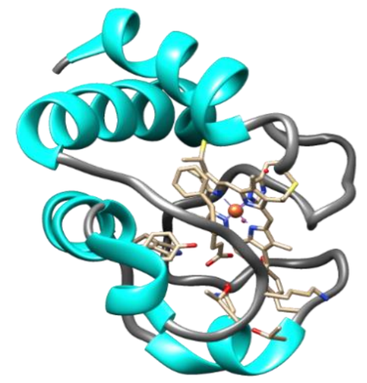




A. Haemoglobin



B. Myoglobin



C. Cytochrome *c*

Figure 1. Emission spectra of C-dots (0.2 mg/mL) upon varying the amount of each protein (0.25-6.6 μM) at pH 7.2 and 25°C. Inset (a): Stern–Volmer plots obtained from steady-state (blue dots; F_0/F; λ_{exc} = 380 nm) and time-resolved (red dots; τ_0/τ; λ_{exc} = 340 nm) fluorescence data. Insets (b,c): Stern-Volmer plots from steady-state data (λ_{exc} = 380 nm). Error bars indicate the standard error.

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ACKNOWLEGMENTS

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