Interaction of trinuclear ruthenium complexes with azanaphthalene ligands and HSA

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Introduction: The most abundant protein in blood plasma is albumin (HSA), which operates in several physiological processes, such as the regulation of the osmotic pressure, transport, distribution and metabolism of various ligands, and it is responsible for regulating blood pH[1]. Fluorescence spectroscopy is widely used to study interaction with proteins such as HSA. Fluorescence quenching highlights the area where changes are occurring and the nature of the interactions involved[2]. This work aims to investigate the interaction between HSA and the complexes $[Ru_3O(CH_3COO)_6(5\text{-amiq})_3]^+$ (A), $[Ru_3O(CH_3COO)_6(5\text{-nitro})_3]^+$ (B) and $[Ru_3O(CH_3COO)_6(thiq)_3]^+$ (C) using fluorescence spectroscopy technique and Stern-Volmer mathematical model. **Results and Discussion:** The complexes were previously synthesized and characterized[2], Figure 1. Fluorescence emission spectra were obtained by the titration of a trizma buffer solution of HSA with a stock solution of the complexes. Ksv values denote the magnitude of fluorescence quenching, which is correlated with the interaction strength. In all cases, Ksv value decreases with temperature increase, and this indicates a static quenching. The Kb values show that the complexes strongly interact with HSA, since the values reported in the literature[3] are around 10^4, and the observed values in this work range from 10^4 to 10^9. The analysis of the thermodynamic parameters shows that hydrogen bonds / Van der Waals force are predominant in the complexes (A) and (C), and electrostatic interactions for the complex (B), and reveals that the complexes interact with the protein spontaneously. **Conclusion:** The results of these studies are important to define the mode of distribution and transport of the complex in blood plasma, and as first expeted by the authors, the azanaphtalene ligands work as hydrophobic bridges to interact with biomolecules. **Keywords:** Ruthenium, trinuclear ruthenium complexe, human serum albumin, fluorescence quenching. **Financial support:** CNPq, CAPES, FAPESP.

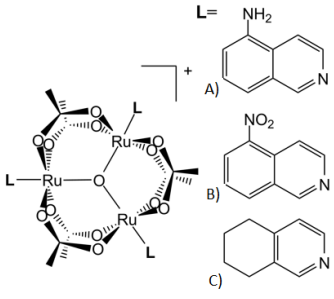

Table 1: Stern-Volmer (K_{SV}), binding constants (Kb) and thermodynamic parameters of the complexes

	(A)			(B)			(C)		
T(K)	K_{sv} ($molL^{-1}$)		K_b ($molL^{-1}$)	Ksv ($molL^{-1}$)		Kb ($molL^{-1}$)	Ksv ($molL^{-1}$)		Kb ($molL^{-1}$)
298	$7,37x10^7$		$28,1x10^6$	$2,89x10^7$		$20,8x10^4$	$6,19x10^7$		$3,71x10^9$
304	$6,06x10^7$		$37,1x10^6$	$1,95x10^7$		$1,82x10^4$	$5,26x10^7$		$5,88x10^6$
310	$5,47x10^7$		$1,07x10^6$	$1,79x10^7$		$166x10^4$	$4,29x10^7$		$7,24x10^4$
T(K)	ΔS ($Jmol^{-1}K^{-1}$)	ΔH ($Jmol^{-1}$)	ΔG ($Jmol^{-1}$)	ΔS ($Jmol^{-1}K^{-1}$)	ΔH ($Jmol^{-1}$)	ΔG ($Jmol^{-1}$)	ΔS ($Jmol^{-1}K^{-1}$)	ΔH ($Jmol^{-1}$)	ΔG ($Jmol^{-1}$)
298			$-4,95x10^3$			-4,14			-5,32
304	-27,79	$-13,36x10^3$	$-5,1x10^3$	45,54	-9,67	-3,66	-103,66	-36,25	-4,83
310			$4,61x10^3$			-4,71			-4,07

Figura 1: Complexes structures: $[Ru_3O(CH_3COO)_6(5\text{-amiq})_3]^+$ (A), $[Ru_3O(CH_3COO)_6(5\text{-nitro})_3]^+$ (B) and $[Ru_3O(CH_3COO)_6(thiq)_3]^+$ (C).

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