Interaction of Oxovanadates and Vanadium Dipicolinate Complexes with Lipid Interphases

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Abstract: Modeling the interaction of vanadium complexes with lipid interfaces may provide information on how insulin-enhancing vanadium complexes interact and traverse membranes. Using reverse micelles as a model system, the work reported here explores the impact of the charged surfactant headgroups at a self-assembled interface on a $[VO_2dipic]^-$ coordination complex using multinuclear NMR spectroscopy. For comparison, measurements were also carried out probing the interaction of the $[VO_2dipic]^-$ and vanadate with a model cationic surfactant headgroup, tetramethyl ammonium bromide and the anionic standard reverse micelle system (AOT). The impact of the environment is gauged by changes in the vanadium-51 chemical shift, lifetimes and proton NMR pulsed field gradient measurements. These measurements suggest that while interface component parts, as modeled by the dispersed systems, interact with the $[VO_2dipic]^-$ complex, the interfacial environment perturbs the complex much more strongly than the sum of each components alone. The vanadium complex studied in these experiments serves as an excellent probe to investigate how charged metal complexes interact with lipid interfaces, and based on our studies both the complex and oxovanadate show the strongest interaction with a more ordered structure with less fluidity.