



Hybrid V(III) and V(IV) complexes with natural substrates as potential therapeutic agents

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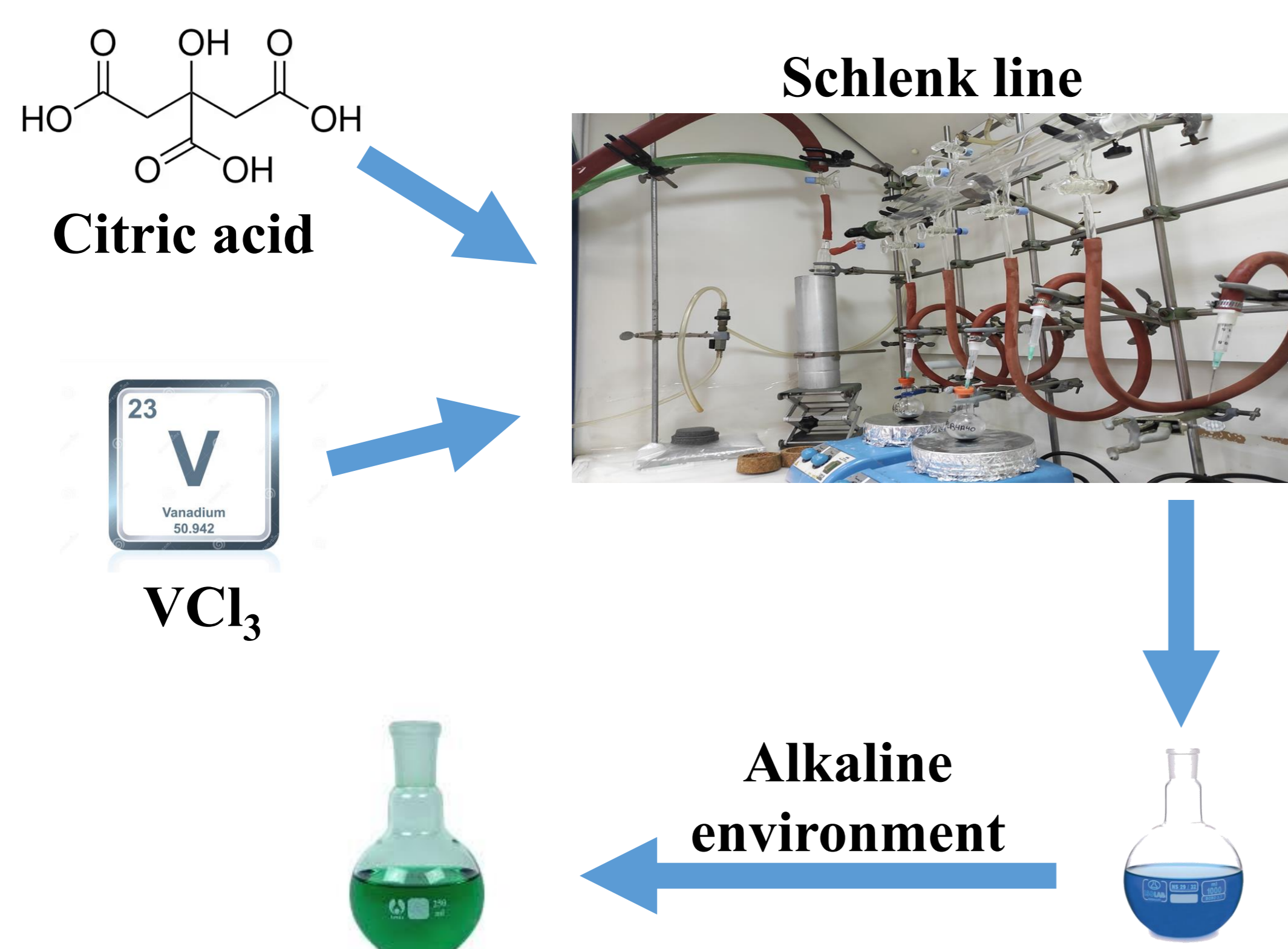
Abstract: The clinical translation of vanadium metallodrugs is often hindered by a limited understanding of their precise bioactive species, ambiguous pharmacokinetic profiles, and narrow safety margins. To overcome these limitations, our research group focuses on the rational design and synthesis of novel vanadium complexes, using natural α -hydroxy acids to enhance both biological efficacy and clinical viability. Employing targeted, redox-driven strategies, we successfully isolated new V(III,IV) and V(IV,IV) dinuclear complexes coordinated to citric and tartaric acid ligands. The structural and physicochemical properties of these novel compounds were then comprehensively characterized utilizing elemental analysis, single-crystal X-ray diffraction, EPR, UV-Visible, and FT-IR spectroscopies, supplemented by magnetic susceptibility measurements.

• Introduction

Transition metal-based metallodrugs offer highly specific therapeutic alternatives for complex metabolic and malignant pathologies. Notably, vanadium coordination complexes demonstrate broad biochemical reactivity with significant clinical potential. In metabolic applications, V(IV) species coordinated to endogenous substrates, like α -hydroxy acids, effectively mitigate hyperglycemia in Type 2 Diabetes mellitus [1,2]. Furthermore, these compounds exhibit potent antineoplastic activity, inducing severe cytotoxicity in malignant cells via oxidative stress-mediated apoptosis [3].

• Materials and methods

All synthetic manipulations were conducted under an inert atmosphere, employing standard Schlenk techniques.



• Results and Discussion

New dinuclear V(III)-V(IV) based compounds have been synthesized through aqueous synthetic speciation. They were further characterized in the solid-state and in solution, as shown in Fig. 1.

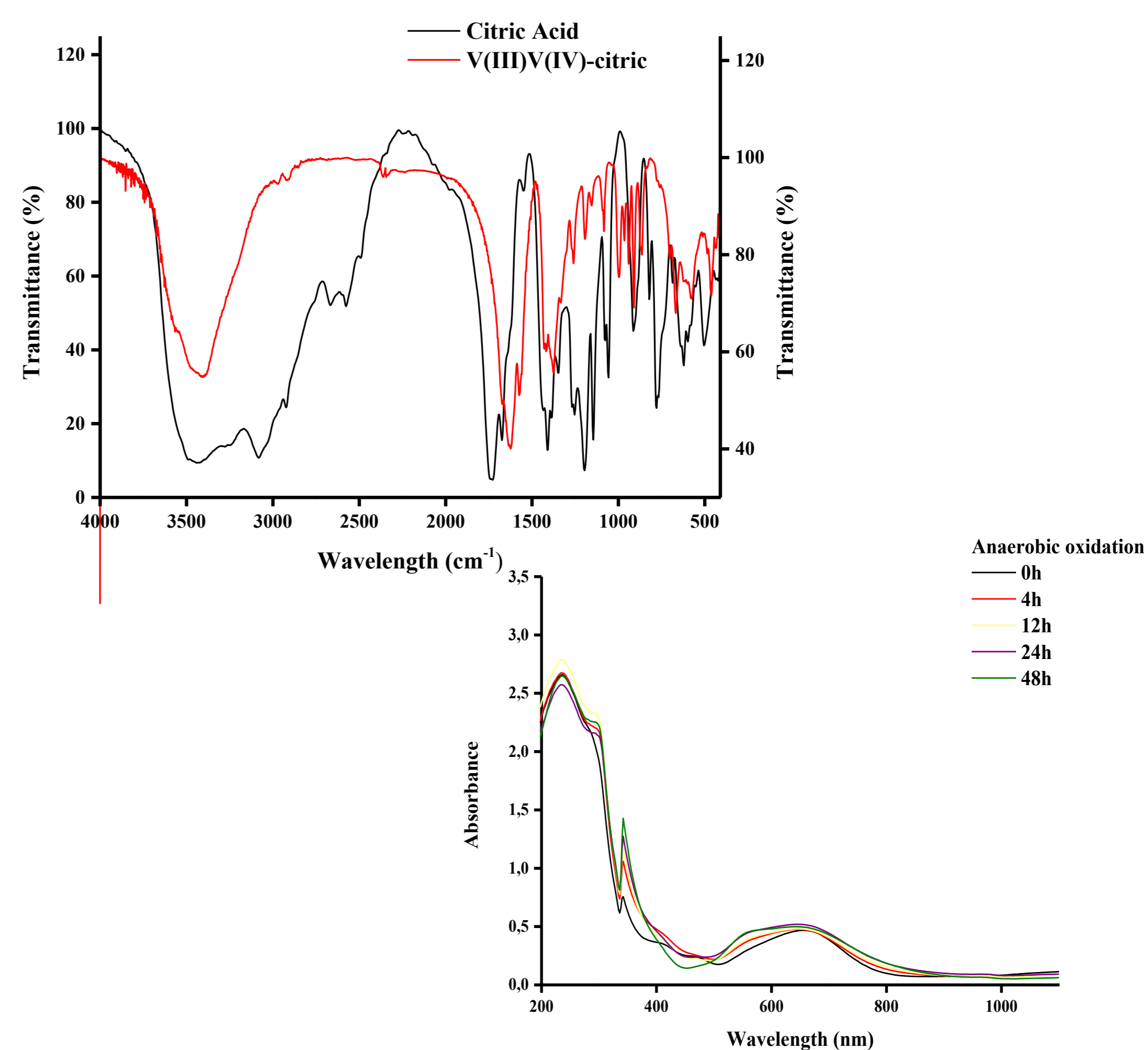


Fig. 1: FT-IR and UV-Visible of V(III,IV)-compounds

Conclusions

- The binary complexes have been designed and synthesized in a metal:ligand molar ratio of 1:1.
- The resulting dinuclear assembly exhibits a higher oxidation rate under aerobic conditions compared to anaerobic conditions.
- The new V(III,IV) material oxidizes in air to produce a V(IV,IV) dinuclear species, stable at pH 7.4.
- The aqueous speciation of the binary V-hydroxycarboxylic acid system merits further consideration in biomedical applications.

References:

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