ULST Timisoara
Multidisciplinary Conference on Sustainable Development
15-16 May, 2025

In vitro evaluation of hybrid vanadodrugs as hepatocellular carcinoma therapeutics

Georgios Lazopoulos, Sevasti Matsia, Efrosini Kioseoglou, Athanasios Salifoglou
Laboratory of Inorganic Chemistry and Advanced Materials, School of Chemical Engineering, Aristotle University of Thessaloniki, Thessaloniki 54124, Greece
E-mail: glazopou@cheng.auth.gr

Abstract: Evaluation of the *in vitro* profile of two well-characterized hybrid peroxido vanadodrugs was studied in our Laboratory. To delineate the complete cytotoxicity profile of the materials as potential anticarcinogens, beyond viability assessment, the morphology, and chemotacticity was also evaluated. To achieve a cytotoxicity profile of higher biological value, 3D spheroids were cultured, to better mimic the complex tumor microenvironment. The cell models chosen were HepG2 and Huh7 cell lines. The results reveal significant anticancer potency at short timeframes and low concentrations, in 2D-3D hepatocellular carcinoma.

Introduction

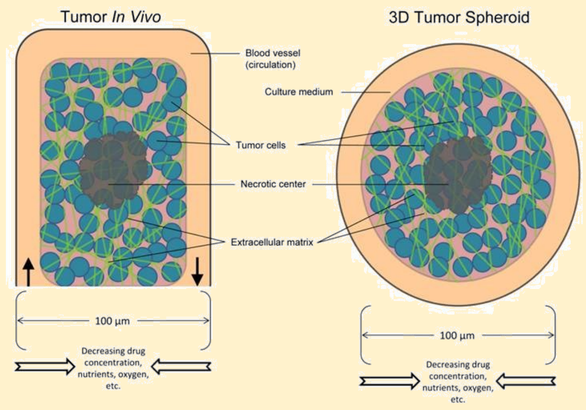
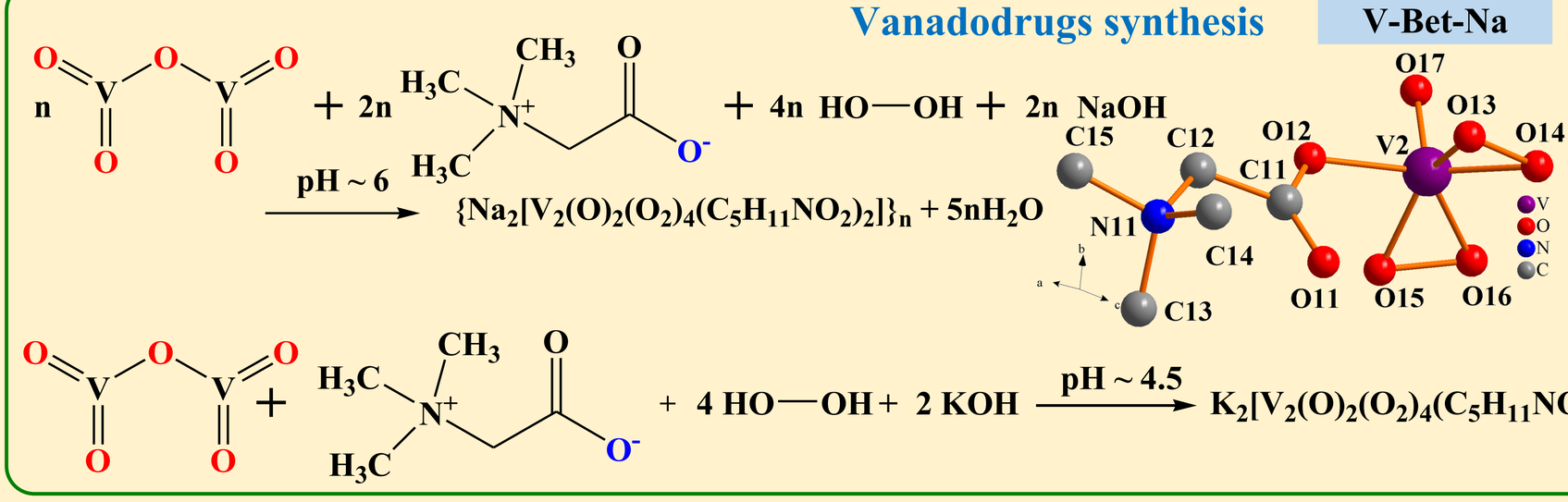


Fig. 1: Tumor Microenvironment Comparison

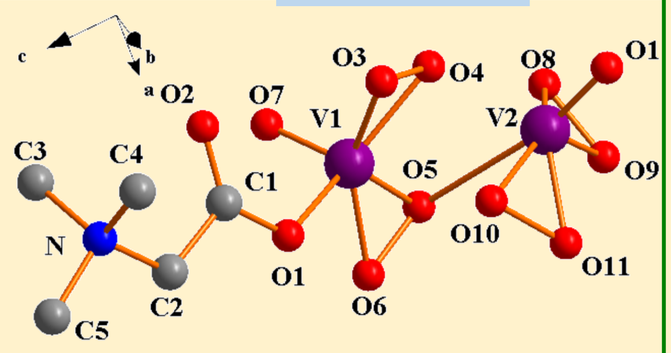
Hepatocellular Carcinoma (HCC) affects over one million people annually worldwide, with the majority of the cases being a late diagnosis due to the aggressiveness of the disease.[1] The therapeutic approaches are limited, with the complex tumor microenvironment being the determining factor for the effectiveness of each treatment (**Fig. 1**). Vanadium is an early first row transition metal of high physiological importance. The various oxidative states (V(III)-V(V)), in addition to their ability to coordinate various ligands of high biological value (such as glutathione and amino acids) leading to distinct coordination geometries, provide flexibility and specificity towards numerous pathologies.[3-5] As a result, hybrid vanadium complexes exhibit, amongst others, cytostatic activity *in vitro* and *in vivo*, interacting with various immune response molecules, such as B-cells, T-cells and numerous transcription factors. To that end, research was launched in our Lab to delineate the *in vitro* potency of two well-characterized peroxido vanadium hybrid materials against HCC, with Huh7 and HepG2 as models cell lines, in 2D-3D spheroids, using a scaffold-free method to increase the biorelevance to the cytotoxicity profile.

Vanadodrugs synthesis



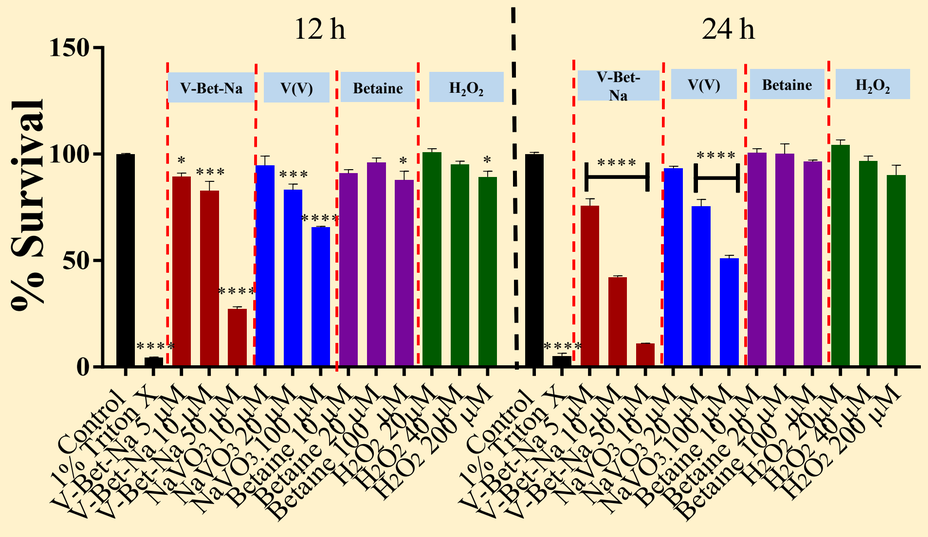
V-Bet-Na

V-Bet-K

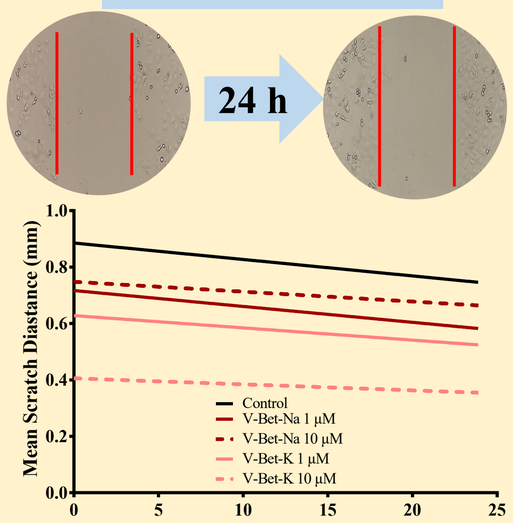


Results and Discussion

V-Bet-Na Huh7

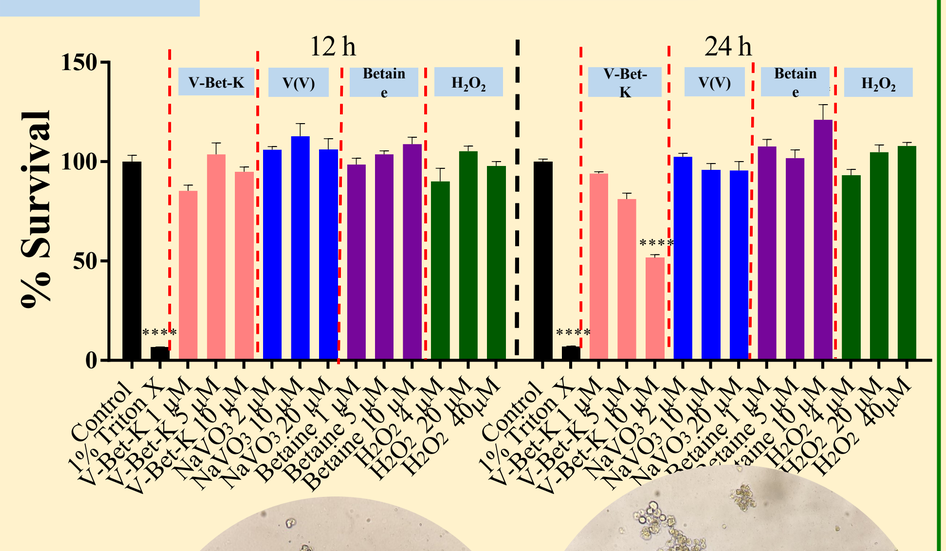


Control (Huh7)

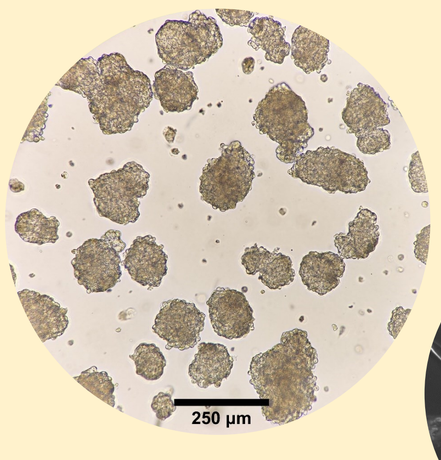


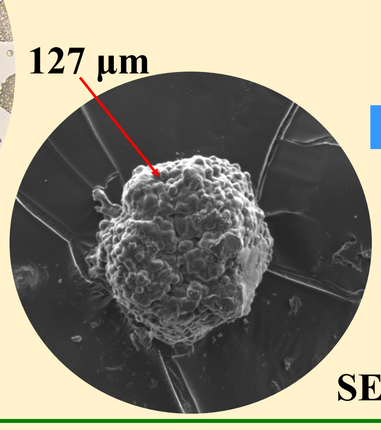
2D

V-Bet-K HepG2

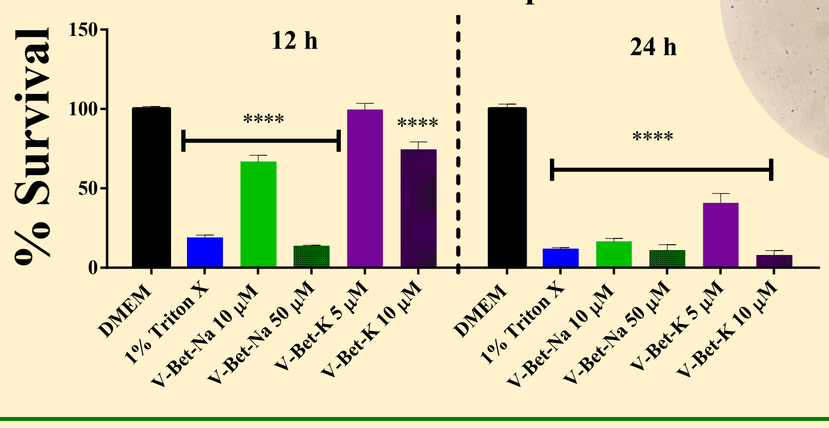


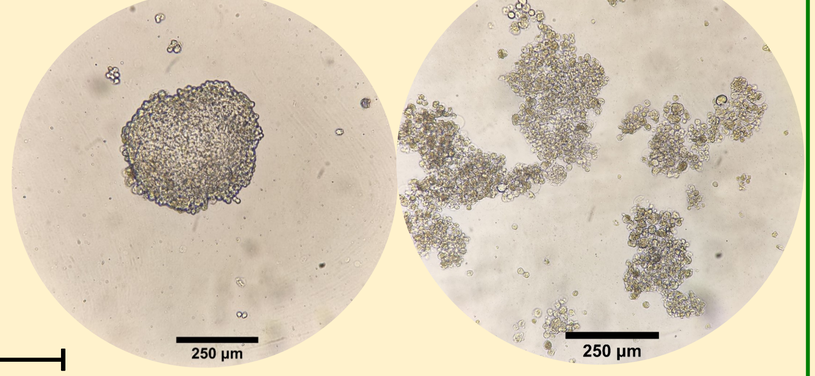
3D





V-Bet-Na/K 3D Spheroids





Control

V-Bet-Na 50 µM 12 h

Conclusions

- ✓ Two hybrid peroxido vanadodrugs with betaine, as a ligand, exhibit significant anticancer activity in models of HCC, at short timeframes and low concentrations.
- ✓ Huh7 3D spheroids were designed, formed, and characterized.
- ✓ The two hybrid materials reveal anticancer potency against the 3D model, at similar concentrations and timeframes with the 2D results.

Literature

[1]. Z. M. Jilkova, K. Kurma, T. Decaens, Cancers 11(10) (2019) 1487.
[2]. E. Kioseoglou et al., Coord. Chem. Rev. 301-302 (2015) 87-105.
[3]. O. Tsave et al., Oxid. Med. Cell Longev. 2016 (2016) 4013639.
[4]. J.M. Llovet et al., Nat. Rev. Dis. Primers 7(1) (2021) 6.
[5]. Q. Liu et al., Meta-Radiology 2(3) (2024) 100098.