Technology Offer

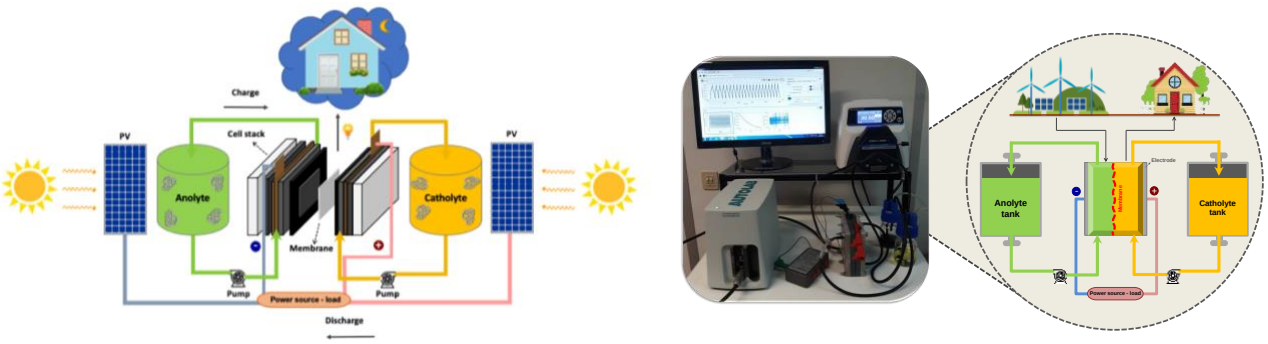
Water-Soluble Tryphanthrin Derivatives for Redox Flow Batteries

KEYWORDS: Artificial Int All Organic Redox Flow Batteries; Light Activated Materials; Tryptanthrin Derivatives.

Redox flow batteries (RFBs) are an emerging and highly promising technologic source of storaging electrical energy that is obtained from renewable sources like wind power and solar energy, as disclosed in Winsberg et al, TEMPO/Phenazine Combi-Molecule: A Redox-Active Material for Symmetric Aqueous Redox-Flow Batteries. ACS Energy Letters 2016, 1 (5), 976-980. RFBs are frequently described as affordable, reliable (with extremely long charge/discharge cycle life) and eco-friendly depending on the materials used, according to several fonts, for example: (a) D. Pinheiro, M. Pineiro and J. S. Seixas de Melo, Sulfonated tryptanthrin anolyte increases performance in pH neutral aqueous redox flow batteries Communications Chemistry, 2021, 4, 89; (b) Lin et al, Alkaline Quinone Flow Battery. Science 2015, 349 (6255), 1529-1532; (c) Wang et al, Recent Progress in Redox Flow Battery Research and Development. Advanced Functional Materials 2013, 23 (8), 970-986; (d) Chen, R., Redox Flow Batteries for Energy Storage: Recent Advances in Using Organic Active Materials. Current Opinion in Electrochemistry 2020, 21, 40-45; (e) Liu et al, A Sustainable Redox Flow Battery with Alizarin-Based Aqueous Organic Electrolyte. ACS Applied Energy Materials 2019, 2 (4), 2469-2474.

Problem: To increase the efficiency of aqueous all-organic RFB to made the technology competitive and sustainable. Conventional RFB already in use nowadays are based on all-vanadium materials. Despite the advantages of this implemented technology it uses inorganic materials, whose substitution for organic (environmental friendly) active materials is a competitive challenge.

Solution: We wish to proceed with the development of this prototype with other active molecules, membranes and solvents. Our goal is in-line with the main challenges for the development of all-organic RFBs, i.e. to identify redox pairs with sufficient high stability and that can reach cell potentials above 1.0 V (this is nowadays a limiting value in water). We also emphasize that our system works at neutral pH values, which constitutes an advantage relative to conventional batteries that work in alkaline or acidic media. The characteristic parameters of the RFB obtained (storage capacity, coulombic, energetic and voltaic efficiencies) are promising relative to other conventional RFBs. We have recently proposed the use of a water soluble organic active material (tryptanthrin derivative) working at a neutral pH and showing long-term stability. This constitutes a low-cost, environmentally friendly and safe alternative energy storage development that our group aims to pursuit.



Conversion of solar radiation into electrochemical energy with a redox flow battery (RFB) replacing vanadium (inorganic) with all-organic active compounds | Fully organic solar powered redox flow battery prototype and proof of concept from University of Coimbra

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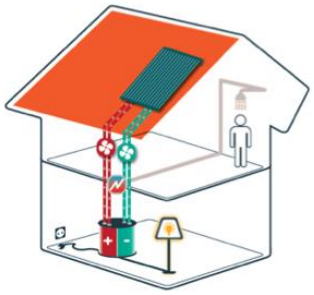
ADVANTAGES	APPLICATIONS
• Organic Solution, Sustainable & Green Solution. • Circular Economy. • Low-cost, environmentally friendly. • Safe alternative energy storage development.	 **Sunlight** -> storable electrochemical energy and heat

STAGE OF DEVELOPMENT: TRL 3

IPR LEGAL STATUS: Patent Pending n.° PCT/IB2021/058195 filed on 09/09/2021.

OWNERSHIP: The rights to the technology are held by the University of Coimbra.

COLLABORATION SOUGHT:

- Technology Scale-up (development support) from laboratory to pre-industrial scale;
- In-house test-bed (in industrial environment) and proof-of-concept testing in a familiar house;
- Technical engineering support and technology adaptation/orientation up-to-market.

CONTACTS:

- **Innovation Manager: Ricardo Dias** ricardo.s.dias@uc.pt | +351 239 247 741
- **IP Manager: Laura Alho** lauraalho@uc.pt | +351 239 247 815

Cofinanciado por: