Security Evaluation for Electric Batteries

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biobide *Your Zebrafish Partner*

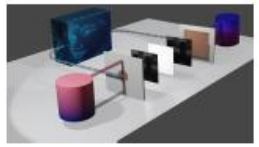
VANILLAFLOW
HORIZON-EIC-2022-PATHFINDERCHALLENGES-01

Call: — HORIZON-EIC-2022-PATHFINDERCHALLENGES-01

Horizon Europe

THE NEXT EU RESEARCH & INNOVATION PROGRAMME (2021 – 2027)

European Commission



Horizon Europe Programme

Standard Application Form (HE EIC PATHFINDER CHALLENGES)

VanillaFlow – Technical description (Part B)

Version 2.0
15 June 2022

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Sustainable energy is the holy grail of the European energy policy. The main challenge we have to face is to deposit the surplus energy from renewables in storage facilities such as mechanical, physical, thermal or chemical storages on a mid or even long term.

Among those options, flow battery technology has made significant progress in the past years: **Flow batteries** have some fundamental differences to the conventional batteries as the design of power and capacity can be scaled nearly independently and is mainly restricted by economic considerations. But classical flow batteries based on Vanadium and others generate highly toxic components harmful for the environment and very toxic to humans.

Organic flow batteries on the other hand represent a rather novel approach that has the potential to make a difference in flow battery technology.

VANILLAFLOW aims at proving a sustainable and scalable solution, which is based on raw materials widely available in the EU and using sustainable processes to convert them into electrochemically active components for flow batteries, which are inherently safe to use and to operate.

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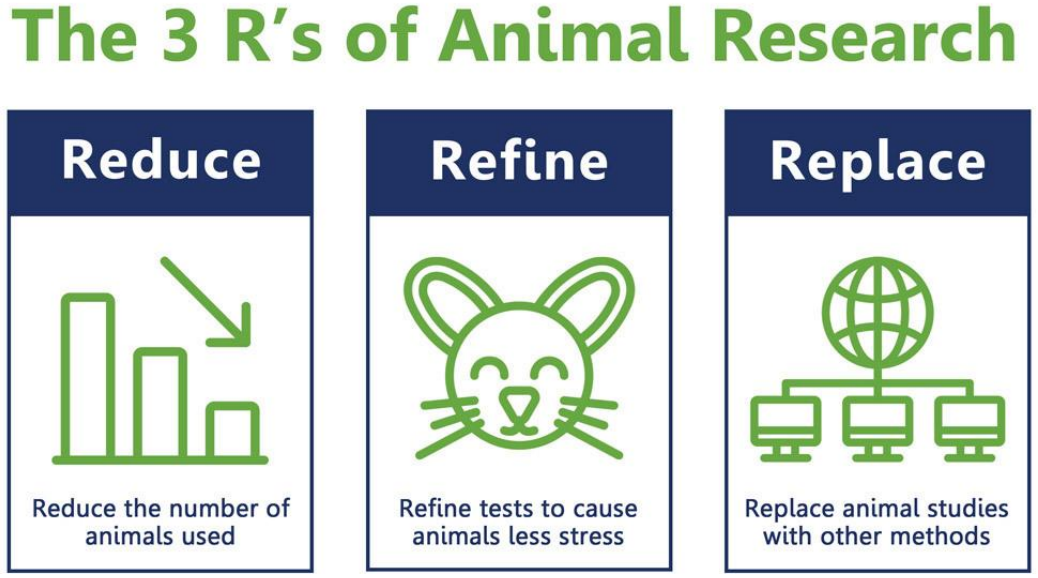
Biobide in VAINILLAFLOW

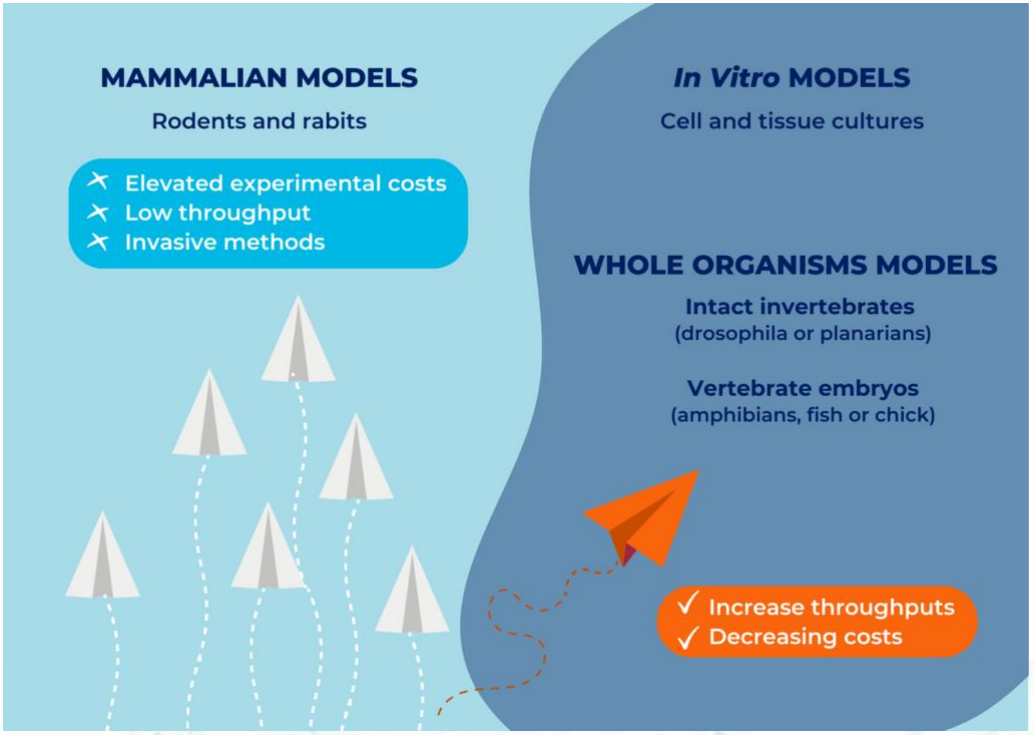
In a previous project (SABATLE - Safety assessment of flow battery electrolytes), Biobide elucidated the toxicity of 2-methoxyquinone and 2-methoxyquinone, and concluded that these compounds are neither teratogenic, mutagenic nor endocrine disruptors. Therefore, one aspect of VanillaFlow is to *assess the toxicity* of the novel redox-active molecules as well as of solutions thereof. Both, **human toxicity and ecotoxicity** of electrolyte solutions will be assessed using **algae**, **daphnia**, and **zebrafish** biological models.

VANILLAFLOW for Biobide means that it could establish itself as a **main actor in the field of toxicology assessment** in energy storage systems and flow battery technology with an **AI approach**.

Biobide's Team presents deep knowledge on human and ecotoxicity testing using model organisms such as Daphnia, Zebrafish and Algae for instance, using also AI in the toxicity analysis.

MARKET: 3Rs and NAMs (New Approach Methods)





Directive 2010/63/UE do not consider animals **zebrafish embryos** (till 5 days post fertilization)

ZF gathers together all in one the **best features of in-vitro and in-vivo testing**.

WHY using Zebrafish assays?

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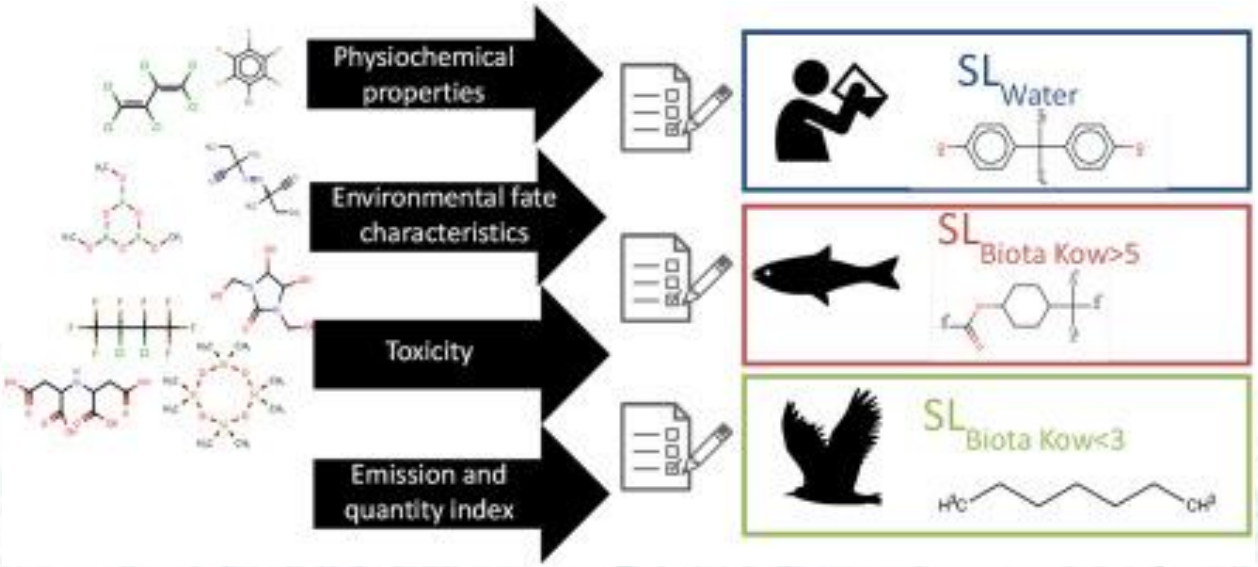
- ✓ **“SCREENING CHEMICAL COMPOUNDS: ferlizers, biocides, plant-growth agents, soil conditioners and other chemical products”**
- ✓ **“REGULATORY REQUIREMENTS FOR REGISTRATION OF NEW CHEMICAL PRODUCTS”**



Main ADVANTAGES of Zebrafish Models

- ✓ **High-Throughput Screening (HTS)**: high embryos reproductivity (100-300 eggs/week/couple). Very high “n” for experimental data.
- ✓ **High genetic homology with human beings >80%:** good for teratotox, ED (Endocyne Disruption) and CNS assays.
- ✓ **Toxicity Model**: fish in inmersion are very sensible to toxic compounds, good for screening.
- ✓ **Transparent**: AI (Artificial Inteligence) with images
- ✓ **Aligned with 3Rs**: not considered animal < 5dpf

	In vitro	Drosophila/Worm	Zebrafish	Mammals
Cost	€	€€	€€	€€€€
Capacity	+++++	++++	++++	++
Biologic Relevance	+	+	+++	++++

Zebrafish development / Assays

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ACUTETOX ASSAY

TERATOTOX ASSAY

Heart formation
CARDIOTOX ASSAY

Innate immune system
IMMUNOTOX ASSAY

Kidney developed
NEPHROTOX ASSAY

CNS developed
NEUROTOX ASSAY

Neuromast developed
OTOTOX ASSAY

Functional liver
HEPATOTOX ASSAY

*larvae start feeding independently = animal

Animal Welfare Legislation (EU Directive 2010/63/EU)

2 hpf | 48 hpf | 72 hpf | 120 hpf*

Embryo — *3 dpf* — **Larva** — *29 dpf* — **Juvenile** — *89 dpf* — **Adult** — *2 years*

hpf: hours post fertilization; dpf: days post fertilization

WHAT Zebrafish assays?

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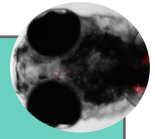
TERATOTOX ASSAY

- ✓ EC50, LC50, Teratogenic Index (TI) and NOAEL
- ✓ **>10 morphological endpoints** analyzed at 2 and/or 4 dpf

THYROID DISRUPTION



- ✓ **Fluorescence assay**: zebrafish expressing mCherry in the thyroid gland
  - Benchmark Concentration and Thyroid Disrupting Index are calculated
- ✓ Thyroid related **gene expression**

NEUROTOX ASSAY

- ✓ Locomotor activity/photomotor response tracked alterning photoperiods (dark-light)
- ✓ DanioVision System (Noldus)
- ✓ **>10 parameters** measured based on distance, velocity, movement duration and frequency

WHAT assays: ECOTOXICITY

Microplate Alga Growth-Inhibition Test

- Scaled-down version of the standard **OECD 201** carried out in microplate format. Requires low test volumes, and it is suitable for **high-throughput screening purposes**

Daphnia magna Immobilization Test

- Acute toxicity assay on Daphnia defined by the **OECD 202: Daphnia sp. Acute Immobilization Test**

Acute Toxicity Screening Assay in Zebrafish Embryo

- **Simplified Fish Embryo Toxicity (FET) Test (OECD 236):** a fast and cost/time-effective screening assay to assess the aquatic toxicity of chemicals in zebrafish embryos

Endocrine Disruption Screening Assay:

- Screening assay for the identification of potential Endocrine Disrupting substances using zebrafish embryos as vertebrate model **(Thyroids, estrogens, androgens, Steroidogenesis)**

MAIN CLIENTS

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NIH

Roche

Shell

ABAC Therapeutics

NIH NIEHS

NeuroDerm

L'ORÉAL

SERVIER

SANOFI

CORTEVA agriscience

BASF The Chemical Company

PHILIP MORRIS

BAYER

Bayer CropScience

IMPACT

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ELSEVIER

Science of The Total Environment

Volume 874, 20 May 2023, 162406

Neurotoxicity and endocrine disruption caused by polystyrene nanoparticles in zebrafish embryo

Mónica Torres-Ruiz [a], Mercedes de Alba González [a], Mónica Morales [b], Raquel Martin-Folgar [b], Mª. Carmen González [a], Ana I. Cañas-Portilla [a], Antonio De la Vieja [c]

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https://doi.org/10.1016/j.scitotenv.2023.162406 ↗

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Highlights

- Polystyrene NP neurotoxicity and endocrir
  embryos.

HOME MEMBERSHIP SERVICES COMPANY PROFESSIONAL DEVELOPMENT

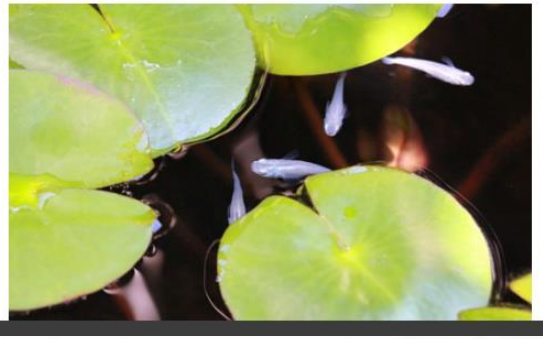
OECD publishes guideline for alternative EDC test based on fish

NEWS | 07 July 2022

Watchfrog screening method identifies chemicals targeting androgen receptors

Global | Chemical industry | EDCs | Alternatives to testing

The OECD has published a test guideline (TG) for an alternative method to screen for endocrine disrupting chemicals (EDCs) based on transgenic Japanese medaka fish embryos.



The Rapid Androgen Disruption Activity Reporter (RADAR) test, developed by French biotech
N rog, can identify
to act on androgen

Environmental Factor

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New chemical testing approach will help to replace animal use

NIEHS researchers and their collaborators developed the recently accepted nonanimal testing method, which will be used globally.

WHO? BIAT GROUP

BIAT GROUP develops and comercialices biotech assets for biopharma, agrochemical, cosmetic and chemical industry.

Under the corporate umbrella of the group holding, **Biotechnology Assets**, a global business and commercial network to promote **Biobide**, **ZIP Solutions**, and **Biat** assets.

BIAT GROUP, with facilities in Spain (San Sebastián, Barcelona y Jerez) and delegation in USA (Boston), has international top clients in diferent business areas.

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