CitEuroPass 2024, 2nd wave

Level-Zero - H2wOw

Frugal innovation – Erasmus+ project

Nathan Malbranque

Richard Klein

Alexandra-Ioana Simon

Cătălin Arsene

Samuel Štefek

Nikolay Stoimenov

Adrian Mînzat

Stoyan Cholakov

18. 04. 2024

Table of contents

1 Introduction

Dirtiness of the water is the main problem we, as humans, face. One of the four people across the globe lacks access to safe drinking water. This is a major health risk because unsafe water is responsible for more than a million deaths each year. This issue brings us to the need of controlling the safety of the water we drink daily. For this, we can find in the world multiple solutions, for example: detection of water pollution: developing low-cost biosensors that use microorganisms or specific proteins to detect the presence of contaminants in water. These biosensors could be integrated into portable devices or easy-to-use test kits for local population. Other solutions include chemical immediate tests in order to check water and pollution.

Most of the products on the market are costly in terms of resources and time. CITEUROPASS focuses on frugal innovations – by frugal, we mean, characterized by or reflecting an economical approach in the use of resources. As a process frugal innovation discovers new business models, reconfigures value chains, and redesigns products to serve users who face extreme affordability constraints, in a scalable and sustainable manner. It involves either overcoming or tapping institutional voids and resource constraints to create more inclusive markets.

Simply said, frugal innovation provides functional solutions through few resources for the many who have little means. Our goal, through the CITEUROPASS project is to provide a non-chemical, eco-friendly and frugal solution to the problem of water testing.

2 Company information

Name of the company: Level-Zero, PLC.

Type of the company: Public Limited Company

Logo:

Logo info: The green atom-like elements of the logo suggest a focus on environmental science and technology, fitting for a company producing ecological products. The green color is often associated with sustainability and eco-friendliness, while the orbiting rings and central nucleus symbolize a scientific approach to ecological issues. The modern font used for "Level-Zero" conveys a sense of innovation and forward-thinking, which aligns with our values and the development of cutting-edge tools for detecting water pollution. This logo communicates a commitment to environmental health and a scientific foundation in product development.

Motto: „H2wOw – Safe water at home“

Headquarters Office: 339 Avenue Centrale, 38400 Saint-Martin-d'Hères, Grenoble, France

Founders of the company: Nathan Malbranque, Richard Klein, Alexandra-Ioana Simon, Cătălin Arsene, Samuel Štefek, Nikolay Stoimenov, Adrian Mînzat, Stoyan Cholakov

Name of the product: H2wOw

3 Product information

3.1 General idea

Detection of water pollution and developingn low-cost biotech that use microorganisms or specific proteins to detect the presence of contaminants in water was the main issue our project wants to solve. By using microorganisms the prototype could be integrated into portable devices or easy-to-use household test kits for local populations.

How is biotech used we in this idea?

Biotechnology can be designed to target different types of contaminants, such as toxic chemicals, heavy metals, pathogenic bacteria or pesticides. The micro-organisms or proteins used are selected for their ability to interact selectively with the target contaminants, enabling accurate and sensitive detection. They can then produce a luminescent response, change colorimetry, or pH in the presence of certain pollutants, or specific antibodies can be used to detect the presence of toxins in water.

How do we turn this idea into a saleable product?

The key advantage of biosensors is their low cost and ease of use. By integrating these biosensors into portable devices or easy-to-use test kits, they can be deployed in the field to carry out rapid and accurate water quality tests.

Why is it frugal?

We are responding to a primary human need: hydration. It's a sustainable project, because it uses biotechnology rather than technological tools.

We are making this product accessible and affordable:

- Either through open documentation to make it accessible by publishing plans and detailed instructions on how to make and use the device in open access, to enable other communities to reproduce and modify the device to suit their own needs and resources. By using a simplified design so that it can be made with simple tools and skills, such as basic carpentry or light welding, to facilitate manufacture in contexts with limited resources.
- Or by selling it at a very accessible price

3.2 H2wOw – the product

The prototype called **H2wOw®** is a new innovative product that consists of several components. You can read more information in the chapter *3.4.2 – User manual*

3.3 Prototype production

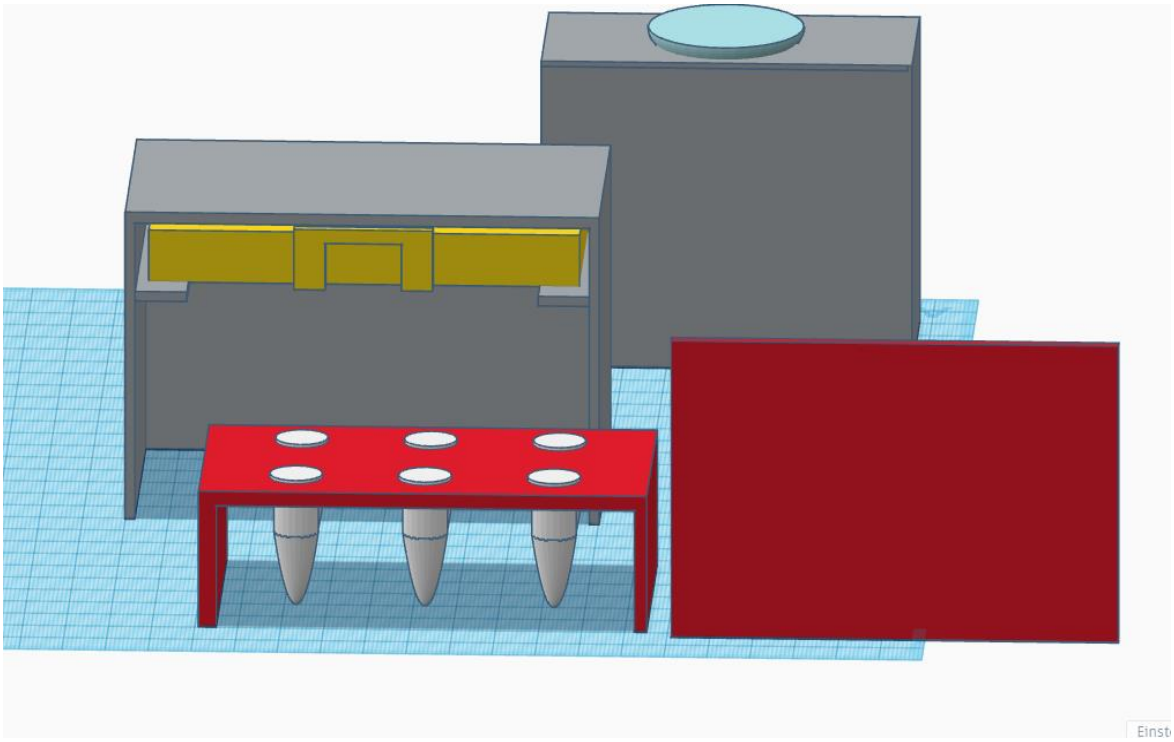
This part of the document explains the product itself, the features of the prototype, how this prototype was created, the 3D model itself, the instructions for use for the potential buyer and its usability in everyday life.

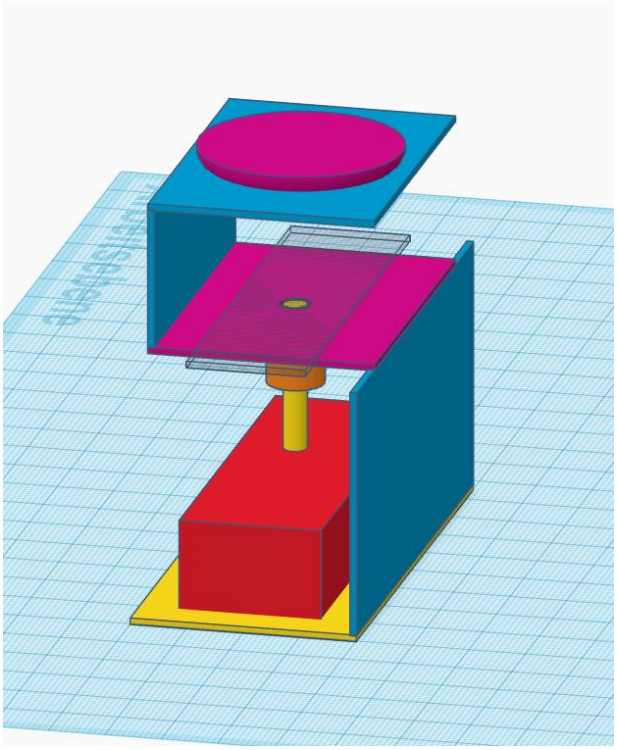
3.3.1 The 3D model

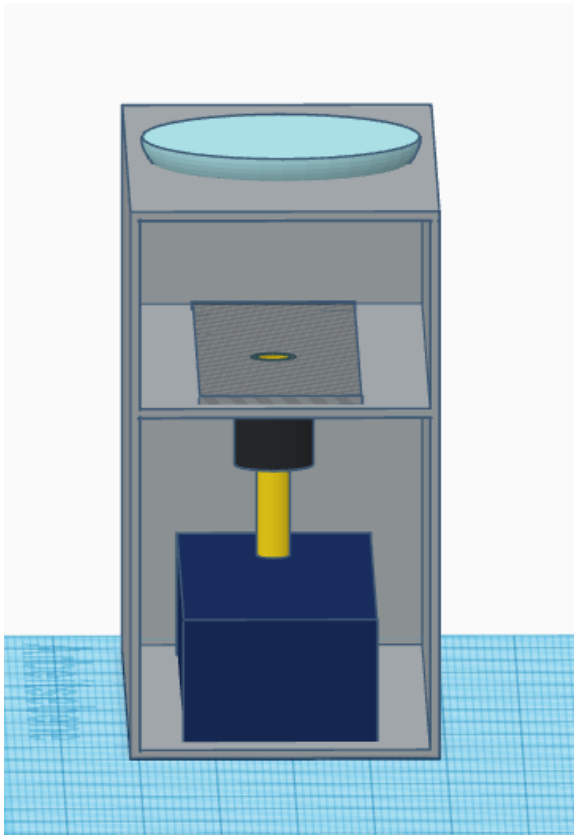
The 3D model is made from recyclable degradebale plastic that is produced by a 3D printer.

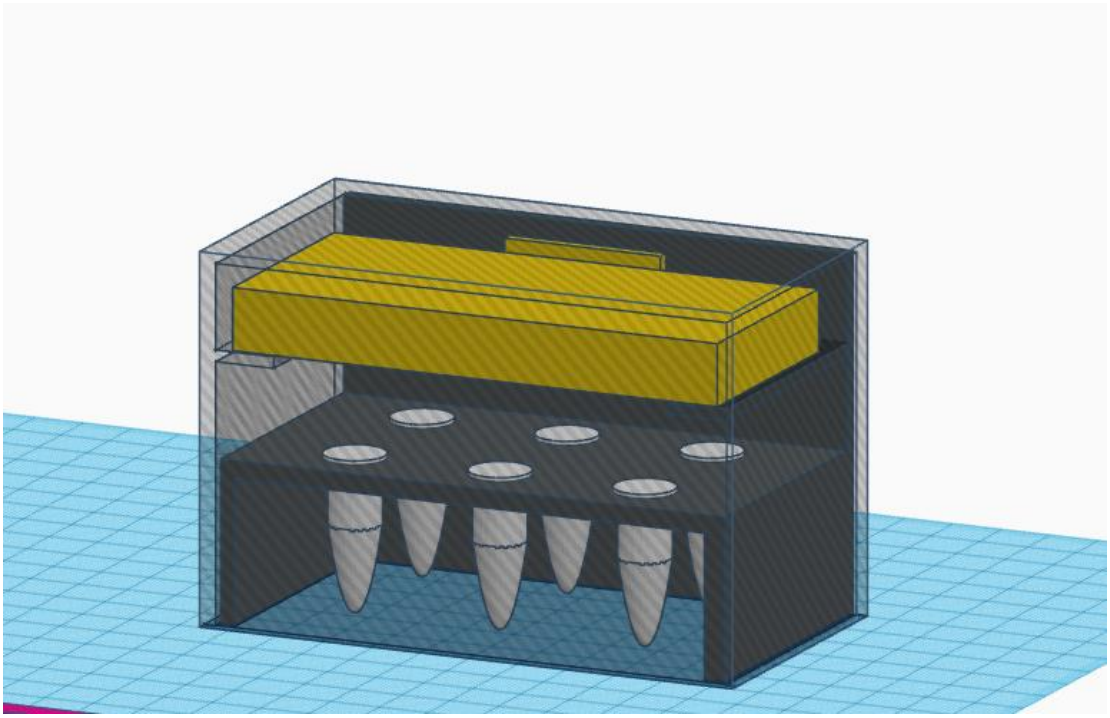
We will observe the artemias in a micro-reduced microscope and use our smartphone light to arthemias to be visible:

- it is a holding element for the microscope observation glass slides,
- it has light LED + battery at the bottom,
- on top of that comes the glass sliders with the microorganisms,
- on top it has a lens.









3.4 How the prototype works

3.4.1 Parts of the prototype

The box or packaging is symbolysed by the transparent rectangle:

Storage of the eggs (in red):

The eggs need a part where they can be put when they are in their dormant state. We need to inquire info on what do we have to do to keep them in this state in good conditions

An incubator (in blue) :

provide controlled temperature conditions during cyst hatching and toxicity testing. Incubators are generally set at specific temperatures to promote the growth and development of test organisms, ensuring optimal conditions for successful testing.

A pipette (and the small triangles represent the notches that fix it to the box)

They enable the chemicals to be tested, the dilution solutions, the culture media and the test organisms themselves to be accurately dosed into the containers.

Growth Patterns (in grey)

all the information and illustrations of the different reactions of the artemias : how are they evolving depending on the quality of the water. It includes all the explanations on what state equals in term of water quality

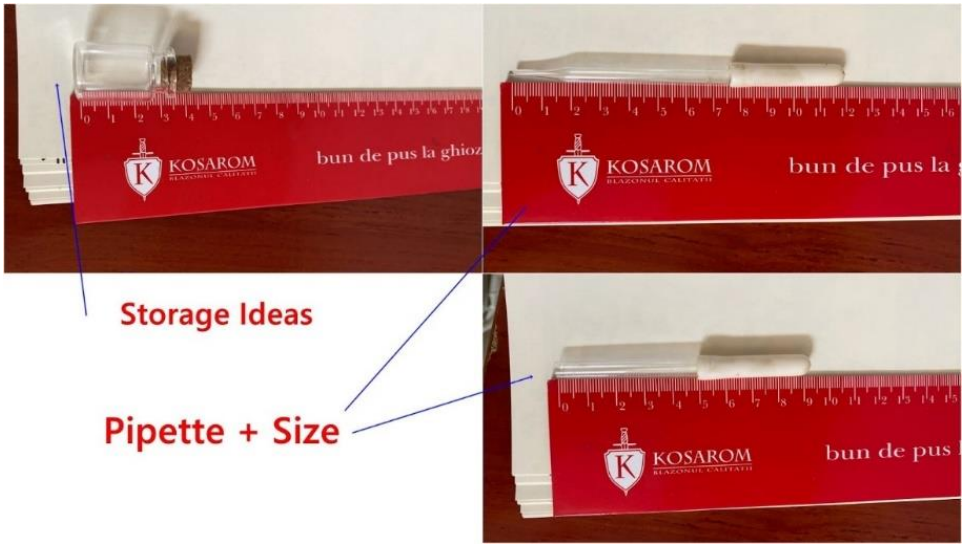
Microscope (in yellow)

It is the most important part : We put the eggs in the incubator thanks to the pipette. Then we take some with the pipette again, and analyse with the microscope. To know how to interpret the data, just compare with the exemples that are compiled in the book

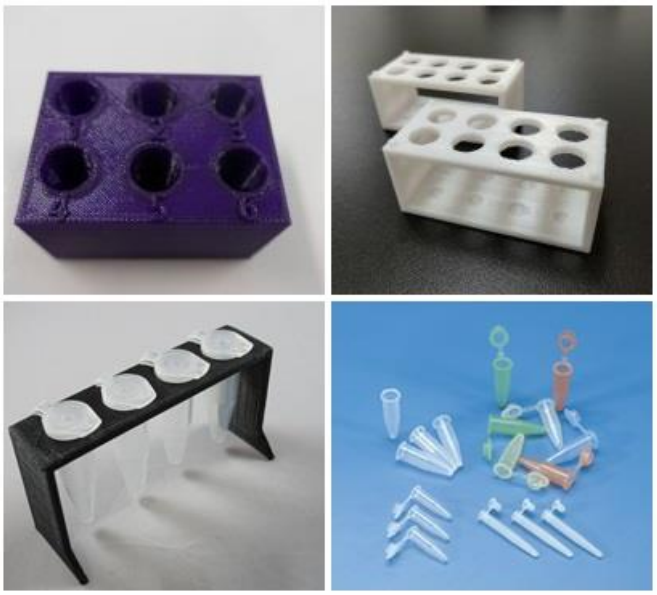
Artemias - test organisms are supplied in the form of dormant or immobilized cysts that can be stored for months and activated at the time of ecotoxicological testing, Read more information in chapter *4 – Biological background – Artemias.*

3.4.2 User manual

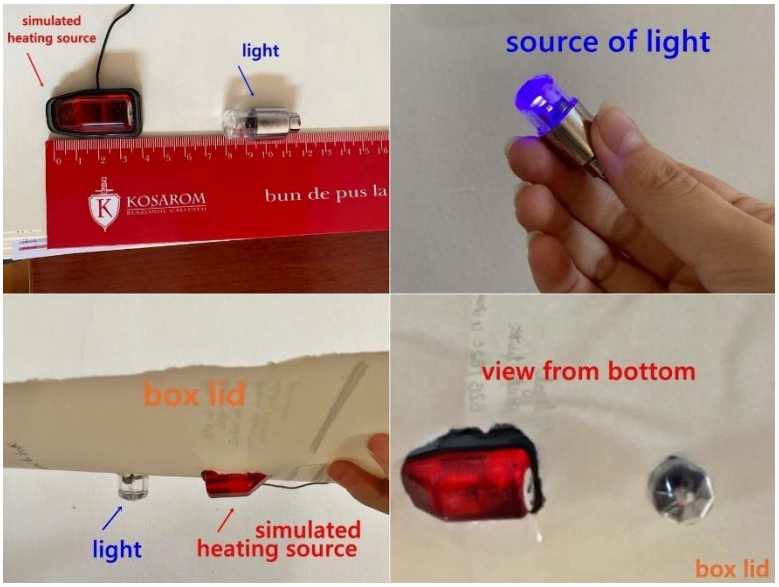
1. **The Artemias Eggs** - coming already premixed with seasalt, it will be needed to put them into the prototype a with a pipette.

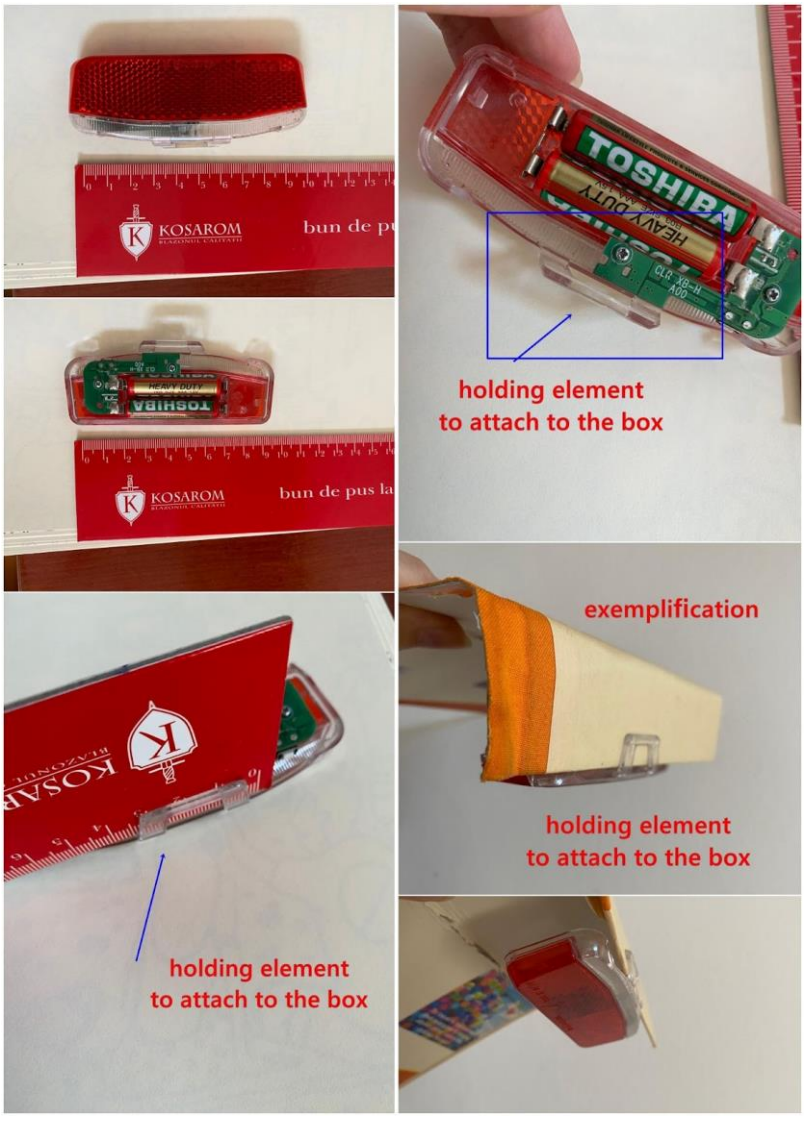


2. **A microtube rack** - easily made, there are templates already out there on the internet because the microtubes are standardized



3. We put the premixed artemias and sea salt with water in a microtube and then in the rack. They need to stay and hatch for 24 hourw in light and warmth by using the light heater.

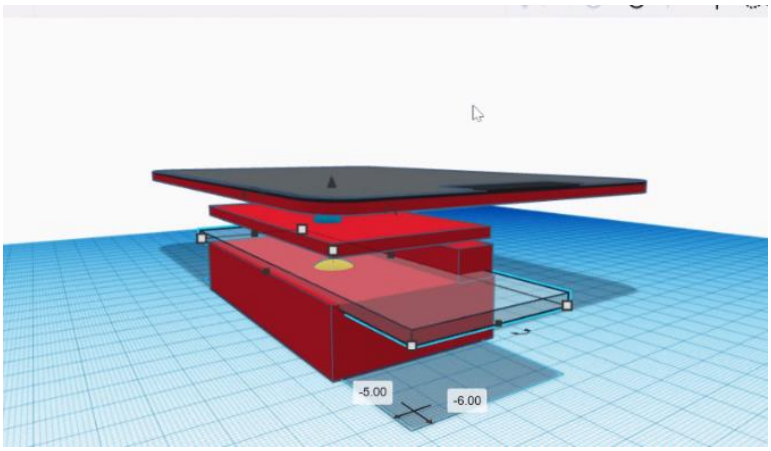


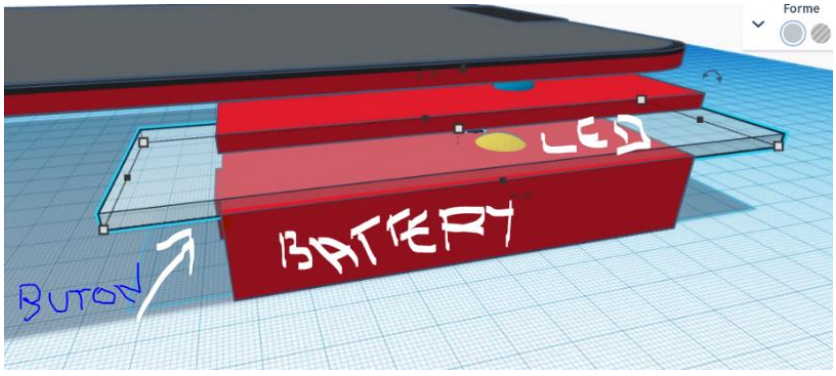


4. After 24 hours, in which the Artemias had received light and heating, we can observe them. We will pick them up from the microtube with a pipette and put them.

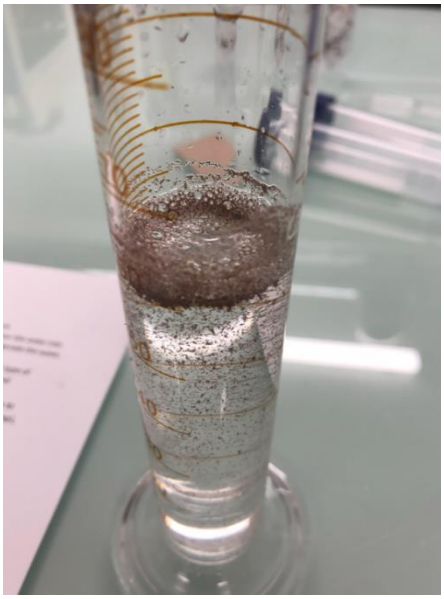
5. Here comes the fun 3D part. We will observe the Artemias in a MicroReduced Microscope and use our smartphone torch.

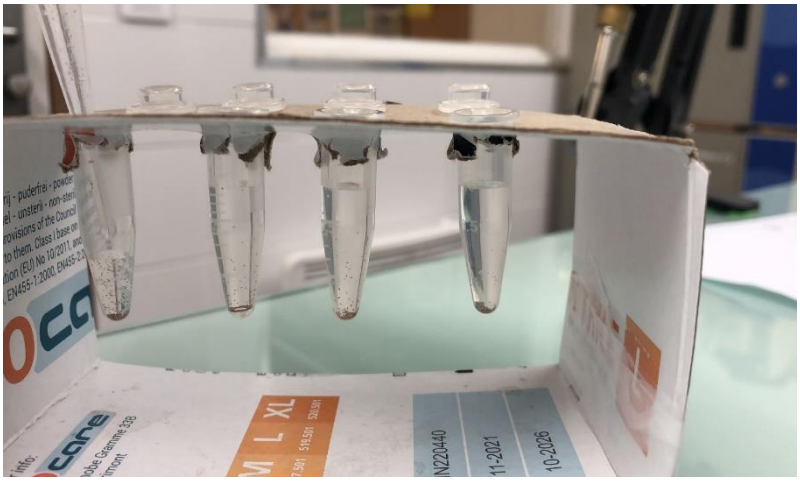
- it is a holding element for the Microscope observation glass slides
- it has light LED + battery at the bottom
- on top of that comes the glass sliders with the microorganisms
- on top it has a lens

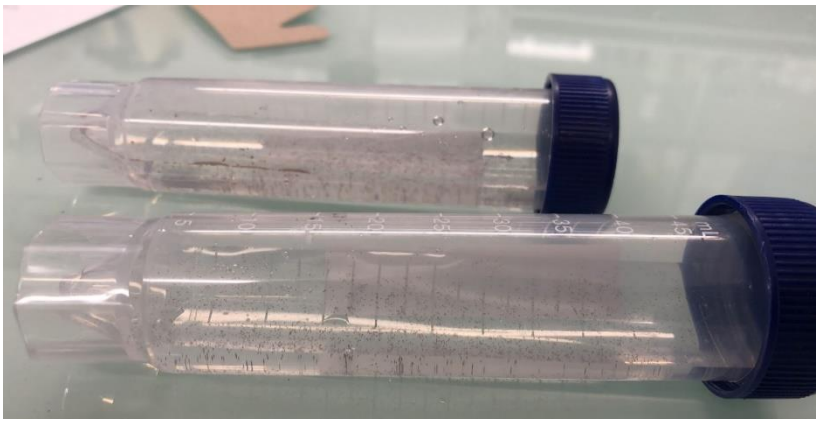




Pictures of the first test of hatching artemias in microtubes







3 STEPS TO TEST YOUR WATER

1 ARTEMIAS PREMIX + WATER

- prepare your water sample and the testing tube
- add 1 pack of Artemias premix to 45ml. water in the testing tube

2 INCUBATE 24 HOURS

- turn on the light and the heating source of the incubator
- lay the testing tube with the water + Artemias in the incubator
- wait for 24 hours

3 OBSERVE THE RESULT

- use the pipette to put a drop of the tested water on the microscope lens
- turn on the observing light
- see if there is any movement in the sample

CAN YOU OBSERVE MOVING ORGANISMS?

→ ✗ **THE WATER IS NOT SAFE TO DRINK**

→ ✓ **THE WATER IS SAFE TO DRINK**

4 Biological background

4.1 Detection of Water Pollution

We aim to create low-cost biosensors for detecting water pollutants. These sensors, using microorganisms or proteins, would respond to contaminants with a visible change, facilitating easy and accurate water quality assessment. The goal is to integrate these biosensors into portable devices or test kits for widespread use, particularly benefiting hikers and rural communities.

Feasibility and Suggestions:

- **Bioindicator Prototyping:** Focus on developing bioindicators as a viable prototype. Consider the feasibility and sustainability of "frugalizing" this technology to offer an innovative solution compared to existing methods.
- **Organism Storage:** Address the challenge of storing living organisms. Research organisms that undergo natural desiccation, allowing for easy rehydration and indicating water quality through growth patterns. This could bypass the need for costly lyophilization processes. The best possibility are Artemias.
- **Comprehensive Testing Kits:** Despite the existence of similar kits, none offer a comprehensive, all-in-one device. Aim to develop a simple, affordable device that congines all necessary features for water quality testing without requiring lab equipment.

4.2 Artemias

Artemias, also known as Artemia, are small aquatic crustaceans belonging to the genus Artemia. They are commonly referred to as brine shrimp due to their ability to thrive in saline environments. Artemias are notable for their adaptability to extreme conditions, particularly high salinity levels, which allows them to inhabit saline lakes, salt flats, and coastal saltwater bodies.

These microorganisms are significant in aquaculture and scientific research due to their unique biological characteristics. One of their notable features is their ability to produce dormant eggs known as cysts, which can remain viable for extended periods under adverse environmental conditions such as desiccation or freezing. When conditions become favorable, these cysts hatch, releasing nauplii (larvae) that rapidly grow into mature brine shrimp.

5 Commercial parts

5.1 Business model

The business model we decided on is a variation of the product-based business model, specifically focused on a consumables or subscription model.

Product-Based Model: Our core product is the water testing kit, which includes a set number of tests (in our case, 5-20 tests). This kit is a physical product that customers purchase initially to conduct water testing individually in their household or outside.

Consumables or Subscription Element: The additional revenue stream comes from selling more tests beyond the initial kit. After customers have used up the tests included in the kit, they can purchase additional test refills or packs from our website. This creates an ongoing revenue opportunity through repeat sales of the testing consumables.

Revenue Generation: Revenue is generated through the initial sale of the testing kit and subsequent sales of refill tests. The pricing strategy for the kit considers the cost of production, desired profit margin, and market competition – more details are given below, in the financial part. The pricing for refill tests is structured to encourage repeat purchases and customer loyalty.

Customer Engagement and Retention: Offering additional tests for sale promotes ongoing customer engagement and encourages repeat business. Our testing kit and refill tests are user-friendly, accurate, and provide value to customers, thereby fostering customer satisfaction and retention.

Potential for Upselling and Cross-selling and Further Development: As part of this model, there is potential to upsell or cross-sell related products or services. For example, you complementary water treatment solutions or personalized consultation services based on the test results.

Sustainability and Environmental Considerations: Given the environmental concerns associated with chemical residue from other water testing kits, emphasizing sustainable practices in our product development and marketing is for us a unique selling point, appealing to environmentally conscious consumers.

In summary, our business model combines the sale of a physical product (water testing kit) with ongoing sales of consumables (additional test refills). This model leverages initial customer acquisition to establish a recurring revenue stream, while also fostering customer engagement and potential for expansion into related offerings within the water testing and treatment sector.

5.2 Competitors and Partners

The competitors of our product split into two categories: chemical (instant or non-instant) water tests and local authorized laboratories. Further, we will shortly present how they work and their advantages and disadvantages.

Chemical water tests, whether instant or non-instant, utilize chemical elements to detect water pollutants and assess the presence of various elements in the sample. These tests can yield immediate or delayed results and typically range in price from 5 to 30€ based on our findings. However, a notable drawback is the chemical residue they leave behind, contributing to environmental concerns. Additionally, human error during handling can compromise the accuracy of these tests, posing challenges in obtaining reliable results.

One advantage of chemical water tests is their ability to quickly detect contaminants and provide prompt feedback on water quality. They offer a cost-effective option for assessing water purity, especially for routine monitoring or preliminary assessments. Moreover, these tests can be performed on-site without the need for specialized equipment, enabling convenient and accessible water testing.

Despite their benefits, chemical water tests have significant disadvantages. The chemical residue generated during testing raises environmental sustainability issues, and the production process itself may not be eco-friendly. Furthermore, the accuracy of results can be compromised by human error, impacting the reliability of the test outcomes. These factors underscore the importance of considering alternative testing methods that minimize environmental impact and enhance result accuracy.

Local authorized laboratories - water testing conducted by laboratories is essential for assessing the quality and safety of water supplies. Labs perform comprehensive analyses to detect contaminants such as bacteria, heavy metals, chemicals, and other pollutants that may pose risks to public health or the environment. They use specialized equipment and validated methods to ensure accurate results, providing valuable data for regulatory compliance and informed decision-making.

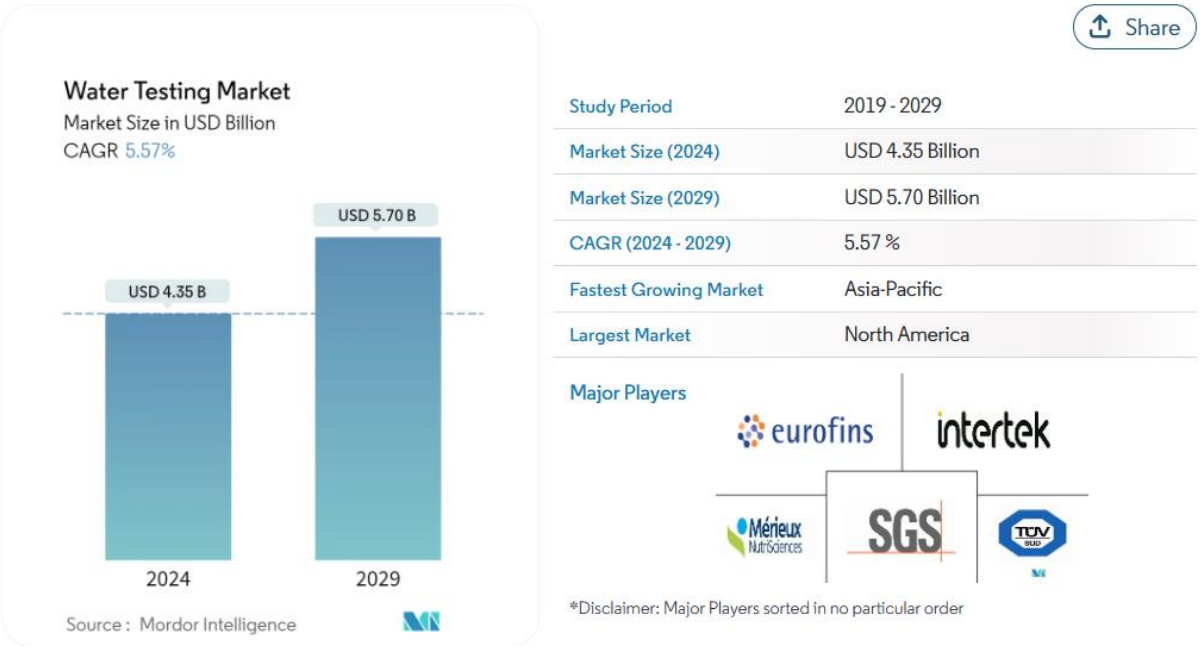
Using laboratories for water testing offers several advantages. Firstly, labs provide accurate and reliable results due to their expertise and sophisticated testing methods. This ensures that water quality meets regulatory standards and helps identify potential issues early. Secondly, labs offer comprehensive testing, covering a wide range of contaminants beyond

basic parameters like pH and turbidity. This helps in understanding the overall quality of water and any potential risks associated with its use. Lastly, labs provide guidance on interpreting results, enabling stakeholders to take appropriate actions to address water quality concerns.

Despite these advantages, there are some drawbacks to relying on labs for water testing. Cost is a significant factor, as professional testing can be expensive, especially for comprehensive analyses or specialized testing. Additionally, the process can be time-consuming, involving sample collection, transport to the lab, testing, and result reporting, which may delay response to urgent water quality issues. Lastly, interpreting complex results may require expertise, posing a challenge for non-experts who rely on lab reports for decision-making.

5.3 Marketing strategy

The Water Testing Market size is estimated at USD 4.35 billion in 2024, and is expected to reach USD 5.70 billion by 2029, growing at a CAGR of 5.57% during the forecast period 2024 – 2029.



The COVID-19 pandemic had a significant impact on the global water testing market as it affected consumers' lifestyles and increased their chances of spreading coronavirus. Thus, the water and supply chain industries were impacted as consumers became more concerned regarding the security and safety of water-based products. Additionally, in the wake of the pandemic, government bodies, agencies, and Non-Government Organizations have also been contributing significantly to the rising demand for safety across the country.

Over the long term, in developing countries like India, consumable water is expected to be safe and of high nutritional value due to increasing consumer awareness. The rise in consumption of bacteria- and chemical-free water is driving the demand for water testing equipment across the globe.

5.4 Target Audience

PERSONA

We want to revolutionize the way households and businesses perceive water safety. We firmly believe that our product is a must-have in this day and age. We want to create a water quality standard that can clearly tell the customers that the business regularly does check-ups of their water so they know what they are drinking. Our recommendation for hotels and restaurants is to perform 3 check-ups on a weekly basis, for households every two weeks. For example in many countries, tap water is being served by defaul with each meal.

- Every household
- Restaurants
- Hotels
- Small businesses/office

5.5 Financing

You can find the information about the costs of the material in the following table:

Item	Price (in Euros)
Box	2,00 €
Heater	2,50 €
Light	1,50 €
Lens	0,50 €
Eprubete	0,20 €
Pipete	0,20 €
Microscopic glass	0,20 €
Instruction paper	0,20 €
Artemis	0,20 €
Labour	1,00 €
Transportation	0,75 €
Advertisement	0,75 €
Storage	0,75 €
Profit	**5,00 €**
Taxation – (net price 2,60 € + labour 0,40 € + profit taxation 1 €)	4,00 €
Final price of the product	**19,75 €**

The final price of the product of the prototype is **19,75 €.** The Artemias packets: 0,05 € for artemias and salt mixture + 0,03 € for paper = 0,08 € of the costs for the packet. The selling price is 0,25 € / 1 packet.

A NOTE FOR THE FUTURE INVESTOR:

We are asking for 100 000,00 € in exchange for a 40 % stake at our company with the agreement that we can buy the minimum of 50 % of the shares back after 2 years.

6 Conclusion

Frugal innovations are extremely important in today's modern world. In cooperation with the CitEuroPass project, which enables students from foreign universities - in this case France, Slovakia, Bulgaria and Romania on the topic of "clean water". Based on foreign cooperation, we managed to create the company called Level-Zero, which developed the prototype "H2wOw", which helps determine, based on artemia, whether the water we drink daily is safe. This project, as well as the document, will serve the Université Grenoble Alpes and other institutions for review, as well as inspiration for the creation of this prototype with the investment interest of investors.

7 Sources

- ***https://www.frugal-innovation.com/what-is-frugal-innovation/***
- ***https://www.microbiotests.com/wp-content/uploads/2019/05/folder-Artoxkit-M-Artemia-toxicity-test.pdf***
- ***https://bento.bio/product/bento-lab/***
- ***chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://aqua-sci.com/wp-content/uploads/2021/11/11-Artoxkit-M-2.pdf***
- ***https://www.researchgate.net/figure/Fig-1-Different-stages-of-Artemia-life-cycle-A-higher-resolution-colour-version_fig1_340469256***
- ***https://ecotestsl.com/producto/artoxkit-m/***
- ***https://www.microbiotests.com/toxkit/marine-artemia-toxicity-test-with-artoxkit-m/#user-friendliness***
- ***https://pubmed.ncbi.nlm.nih.gov/15869192/***
- ***https://www.biotoxicity.com/index.php/60-ebpi-toxicity-tests/245-toxicity-tests-biotoxicity***
- ***https://www.renkeer.com/top-7-water-quality-sensors/***
- ***https://circuitcellar.com/research-design-hub/projects/multi-sensor-device-measures-water-pollution/***