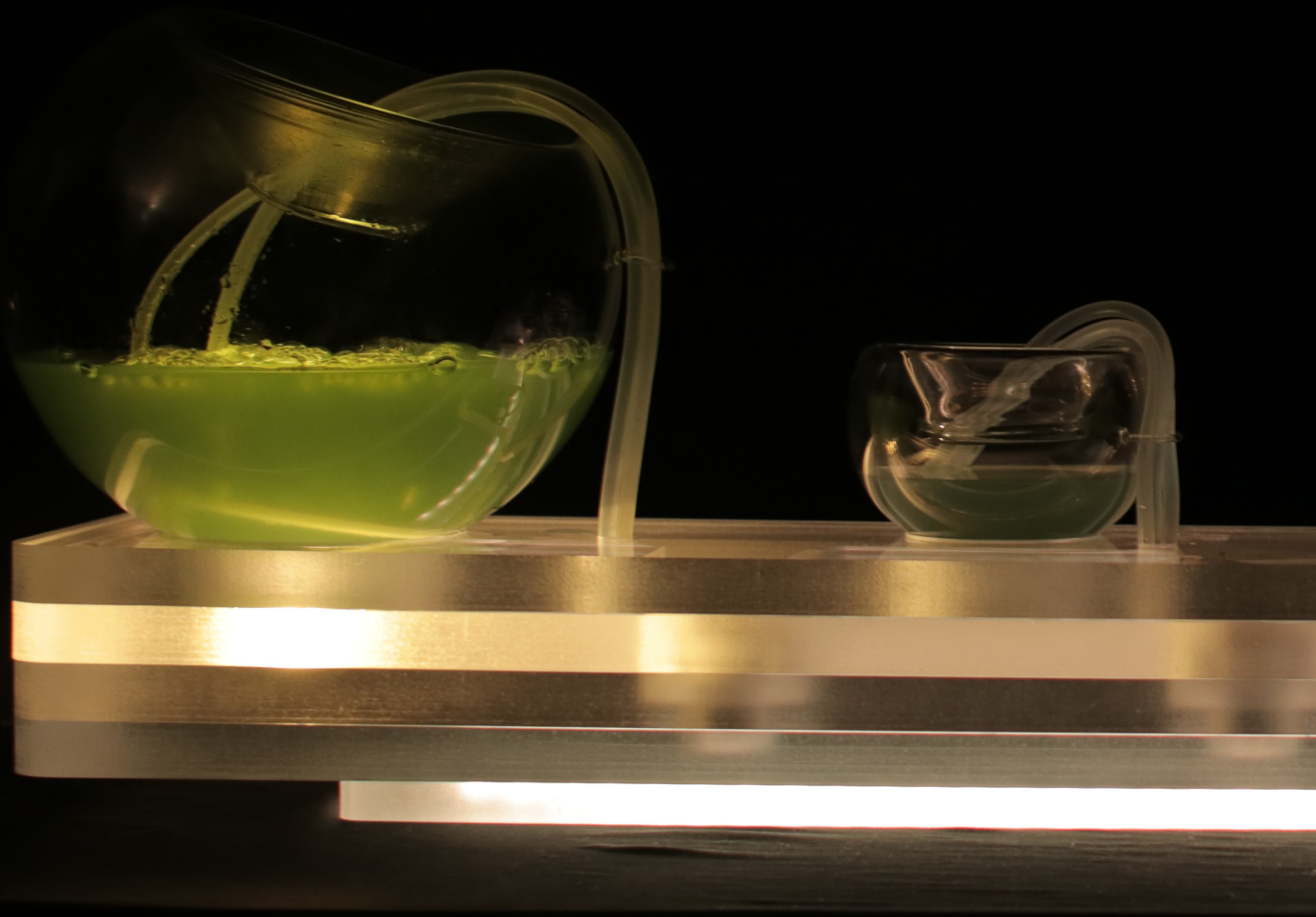


Sphira

THE NEW URBAN FARMING PHOTOBIOREACTOR





SPIRULINA

WHAT IT IS

Spirulina are organisms belonging to the group of cyanobacteria. This type of microscopic organism that live in fresh water lakes or artificial containers that are made specifically for them to develop.

Spirulina has been recently recognized as one of the top superfoods on the global market. This is mostly due to its high nutritional content and health benefits. Some of the these properties are that it detoxifies heavy metals, eliminates candida, helps prevent cancer, lowers blood pressure, reduces cholesterol, lowers chances of strokes, speeds up weight loss and alleviates sinus issues among other things. (Boldt, 2017)



Boldt, Ethan. "Spirulina Benefits: 10 Reasons to Use This Superfood." Dr. Axe, 10 Aug. 2017, Retrieved from www.draxe.com/spirulina-benefits/.

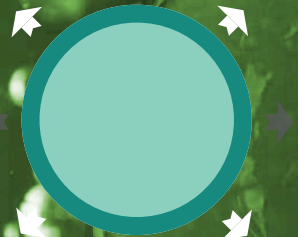
WHAT IT IS

Direct spherification mixes sodium alginate directly into the liquid, forming a viscous by-product that is dripped into a water bath of calcium chloride forming the spheres. Reverse spherification mixes calcium chloride with the desired liquid and is then dripped into a viscous water bath of sodium alginate. By controlling the extraction and manipulation method of spirulina we have developed a closed ecosystem with an end result of what we call spirulina caviar.

SPHERIFICATION



DIRECT



REVERSE

Sphira

Is a multi-scalar apparatus that focuses on bringing public attention to the portable cultivation and innovative consumption of spirulina. By combining a working photo-bioreactor with the modern gastronomy process of spherification, this study seeks to find the best possible solution to an edible sphere by product. This fully automated device controlled by an interactive mobile application produces spheres containing high concentrations of live spirulina mixed with organic flavourings.. By having a closed system with precise nutrient controls our bioreactor attempts to produce spirulina void of flavour.

This allows us to add various components such as coconut-pineapple juice to a concentrated spirulina solution that can then be formed into edible spheres. This study, although in its infancy, attempts to conceptualize an apparatus that highlights the functional and aesthetic attributes of cell structures. By exposing internal functions and accentuating mechanical processes. Sphira will develop a commentary on the adaptability and integration of cell-mimicry in tangible, functional objects. This study will highlight the importance of multi-cell relationships working as a cohesive unity by incorporating varying glass containers within a stream-lined apparatus

URBAN FARMING



THREE PERSPECTIVES

According to our study, we distinguish three main perspectives on urban agriculture. Each one provides a contribution towards the new alternatives of development policies for the implementation of healthy and environmentally friendly crops with respect to urban agriculture.



Economic

Small family businesses or farms managed by associations of local producers are involved, where the economic perspective is related to market-oriented urban agriculture types. These, usually have a good economic impact to be under a controlled environment and smaller scale, avoiding the risk of water pollution and soil due to the intensive use of agrochemicals, health risks from the use of contaminated water for irrigation and risks of disease transfers between humans and animals.

Social

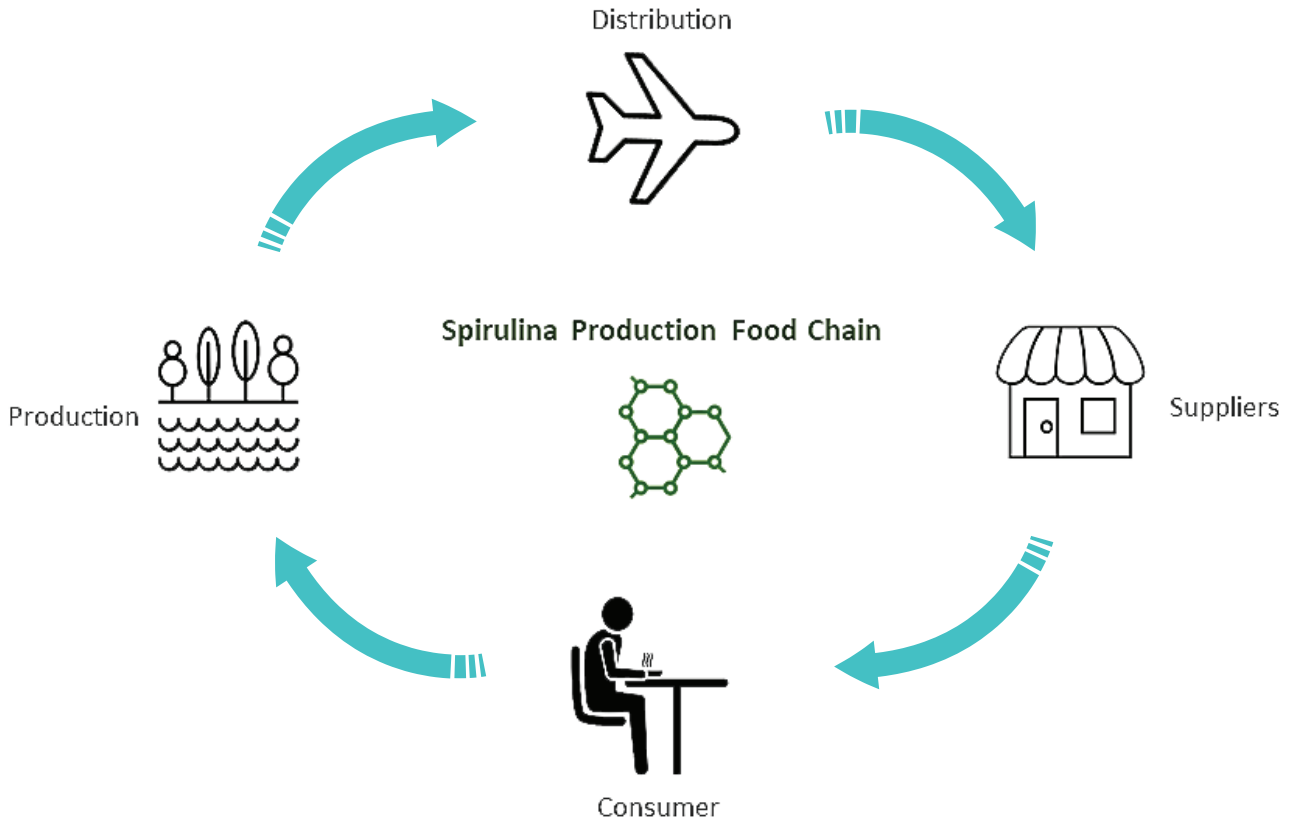


We can boost the production of food and medicinal plants for domestic consumption in low-income urban households, increasing social impact such as home gardening, community gardening, institutional gardens in schools and hospitals, and open-field agriculture on a micro scale with low levels of investment, obtaining greater food security and social inclusion.

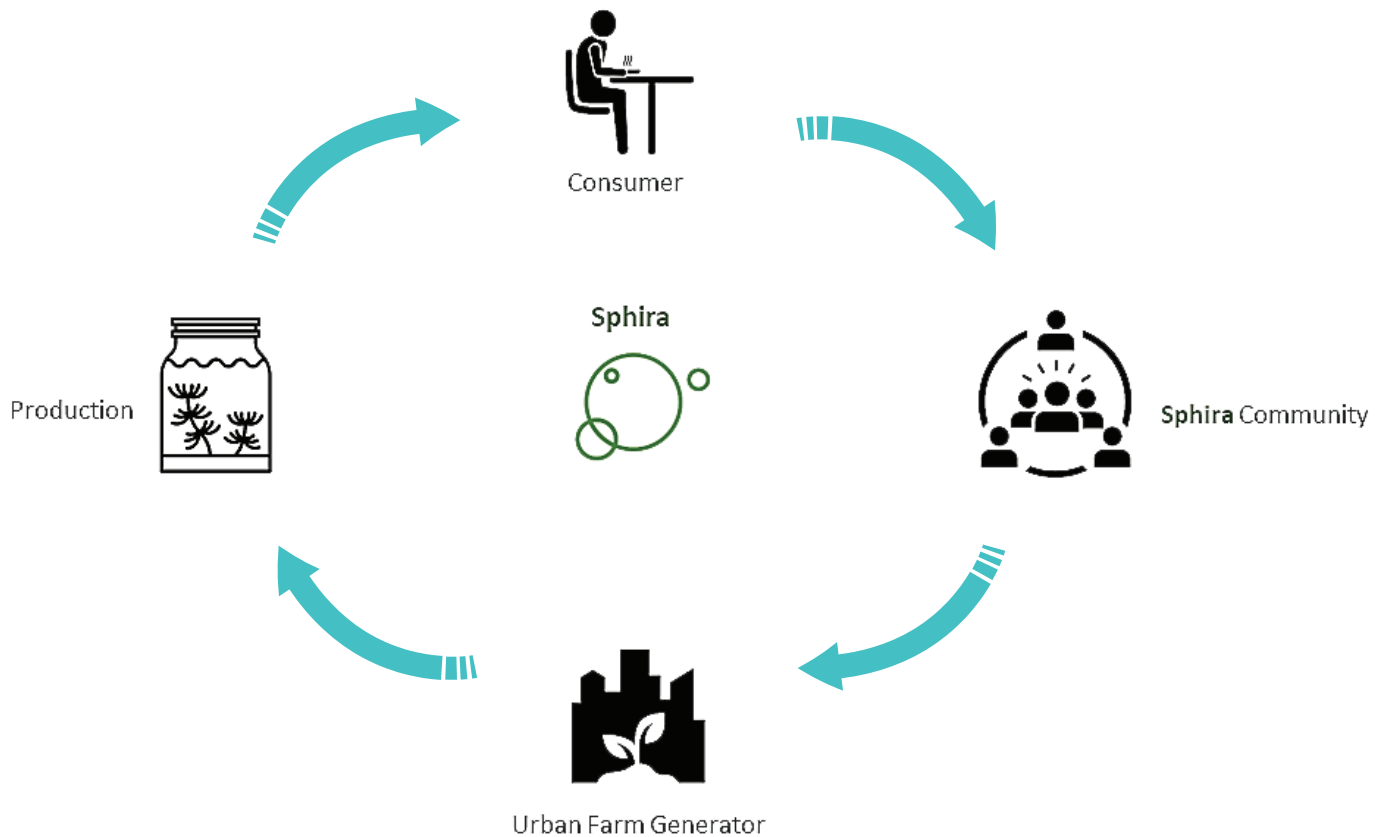
Ecological



It has a multifunctional nature, since in addition to providing food, income is also generated; promote recycling through the reuse of organic waste and wastewater. In addition, through the collective development of urban farmers, urban greening, improvement of the urban climate, provision of opportunities for recreational activities and promotion of recycling culture are achieved.

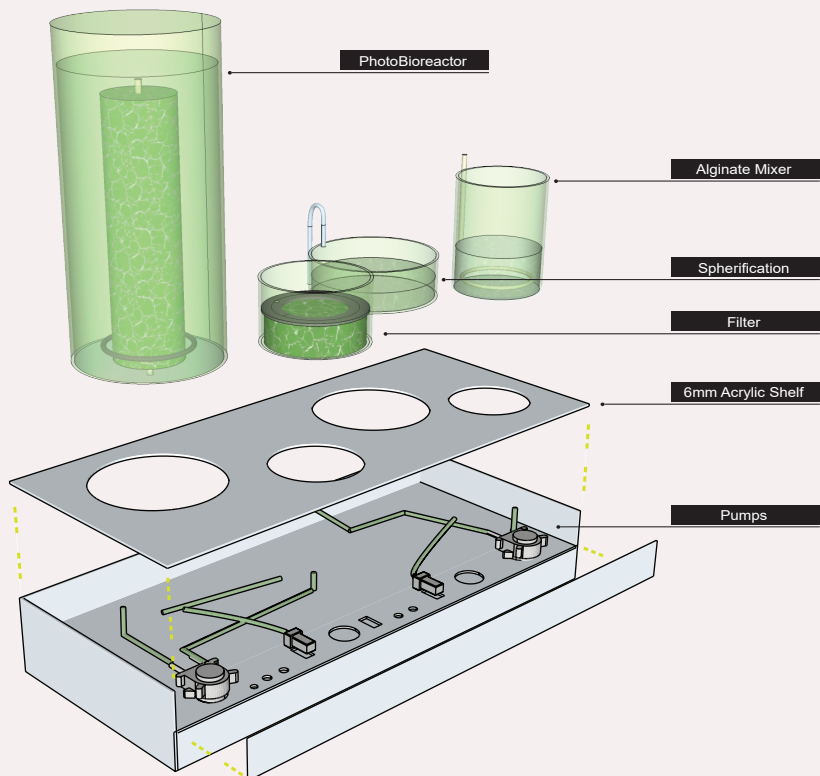


Sphira's design aims to short cut the spirulina urban production loop with the domestication of growth and production in the hands of the consumer. This will subsequently cut out the "middleman" as well as become a new urban farm generator.

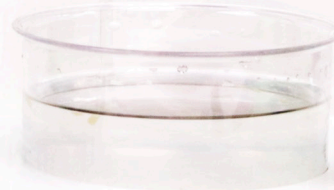


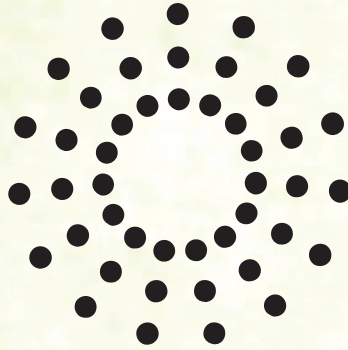
The commercial production of spirulina involves cultivation on large pieces of land which is then transported to different suppliers over hundreds of miles at times. This makes it possible for the consumer to purchase the micro-algae from different suppliers at marked-up costs often times.

The new developed device combines the spirulina bioreactor with spherification in a fully automated Android Mobile Application controlled prototype. The bio- reactor works similarly to the first prototype with timed LED lights and aeration to maintain constant agitation for optimized spirulina growth. When there is a certain density of spirulina within the bioreactor extraction begins. This utilizes a peristaltic pump that fills an adjacent container. This container is fixed with a 5 micron stainless steel filter that allows water to pass through its membrane. When enough of the solution is collected the mixing stage is initialized on the mobile application.



This utilizes a second peristaltic pump that moves the solution to the mixing container where concentrated spirulina is mixed with the sodium alginate solution and flavouring (coconut water + pineapple juice). When the drainage stops, the mixing stage is initialized on the App which in turn initializes an air pump. When the solutions are combined the mixing stage is stopped on the app and the spherification process begins. This happens when the resultant liquid is pumped through a tube, with the quantities of liquid controlled by a mechanical valve. The spherification "fountain" drips into a calcium bath forming the spheres that are rinsed with fresh coconut or spring water and finally ready for consumption.

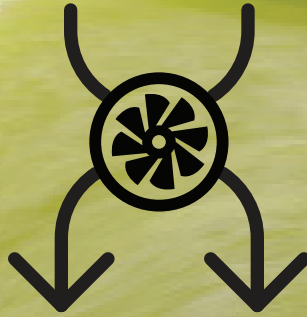





LED horticultural lighting in a controlled environment (photobioreactor) then helps minimize the risk of contamination and maintain a monoculture. Using the LED as a light source, the producer reduces the tension in his culture to optimize the development. Spirulina is cultured under a combination of red and blue LEDs to obtain the fast growth rate. For better growth the PhotoBioreactor needs 12 hours lights cycles to allows the spirulina rest and growth with stability.



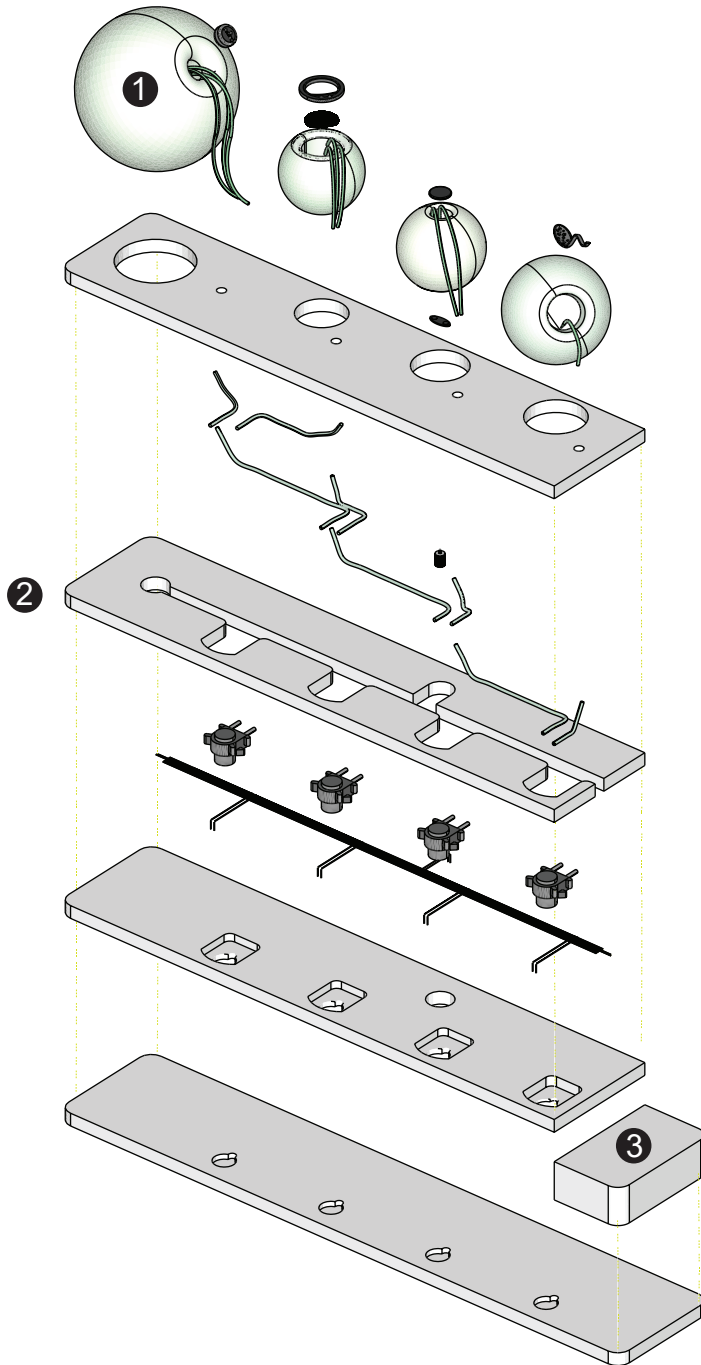
When spirulina is mature and strong (deep green colour it is ready for harvesting. Essentially, harvesting Spirulina means separating it from the growing culture. Harvesting during morning hours is best for both nutritional and practical reasons. In Sphira the harvesting is automatically done by activating the pump. The process will concentrate the spirulina in the container at the same time that returns the clean water and nutrients to the main photobioreactor.



After the extraction of the spirulina, the concentrate needs to be mixed with Sodium Alginate solution. In this solution the “flavours” could be added. To produce Basic/Direct Spherification, you need a solution with 0.5% sodium alginate (0.5g per 100g of flavored liquid) Only a few drops of flavour will be needed. PH of liquid needs to be above 3.6 that is why spherification with spirulina ($10 < \text{PH} < 14$) is ideal. You must never add a flavour that contains Calcium (as milk) as it prevents spherification.

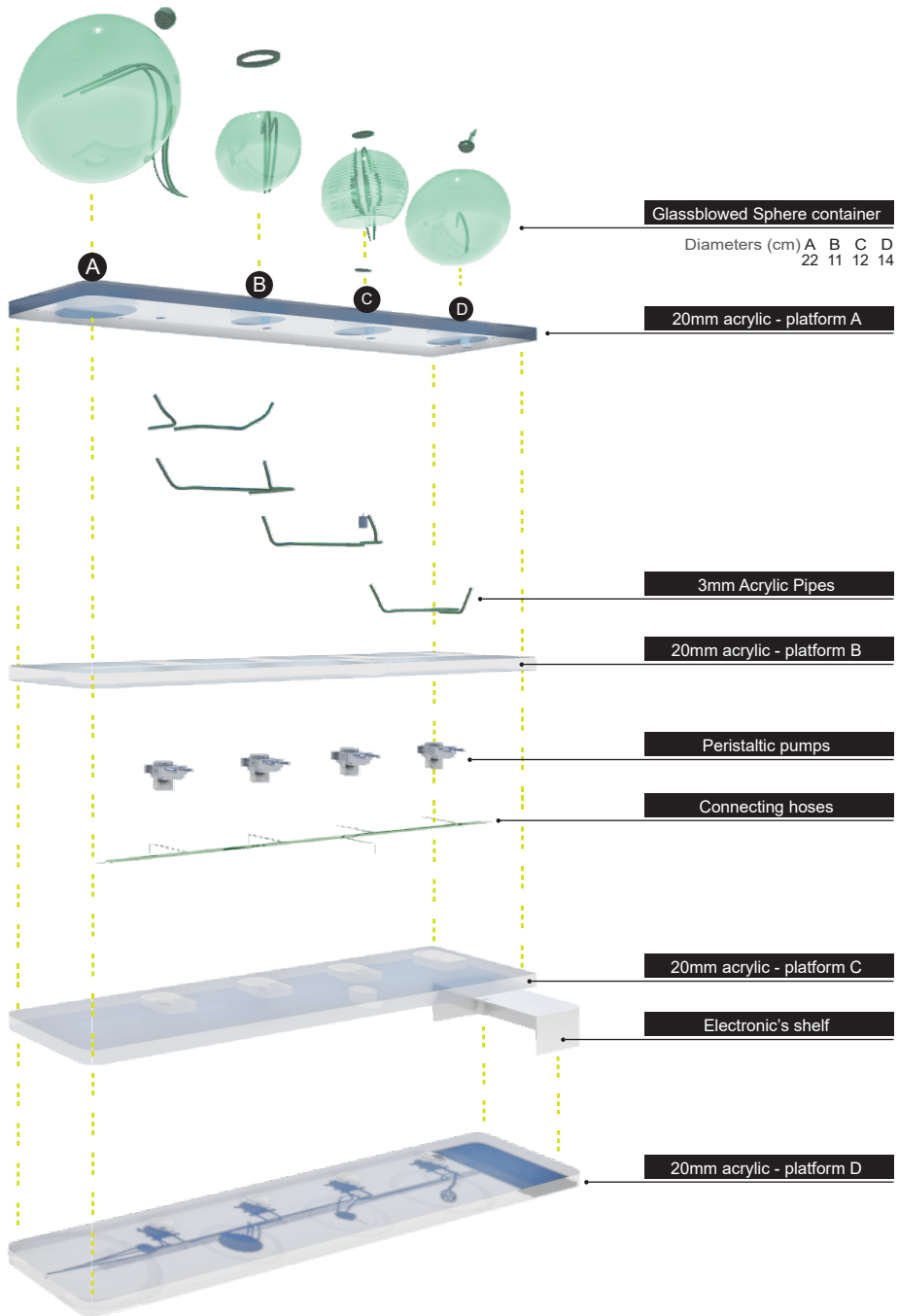


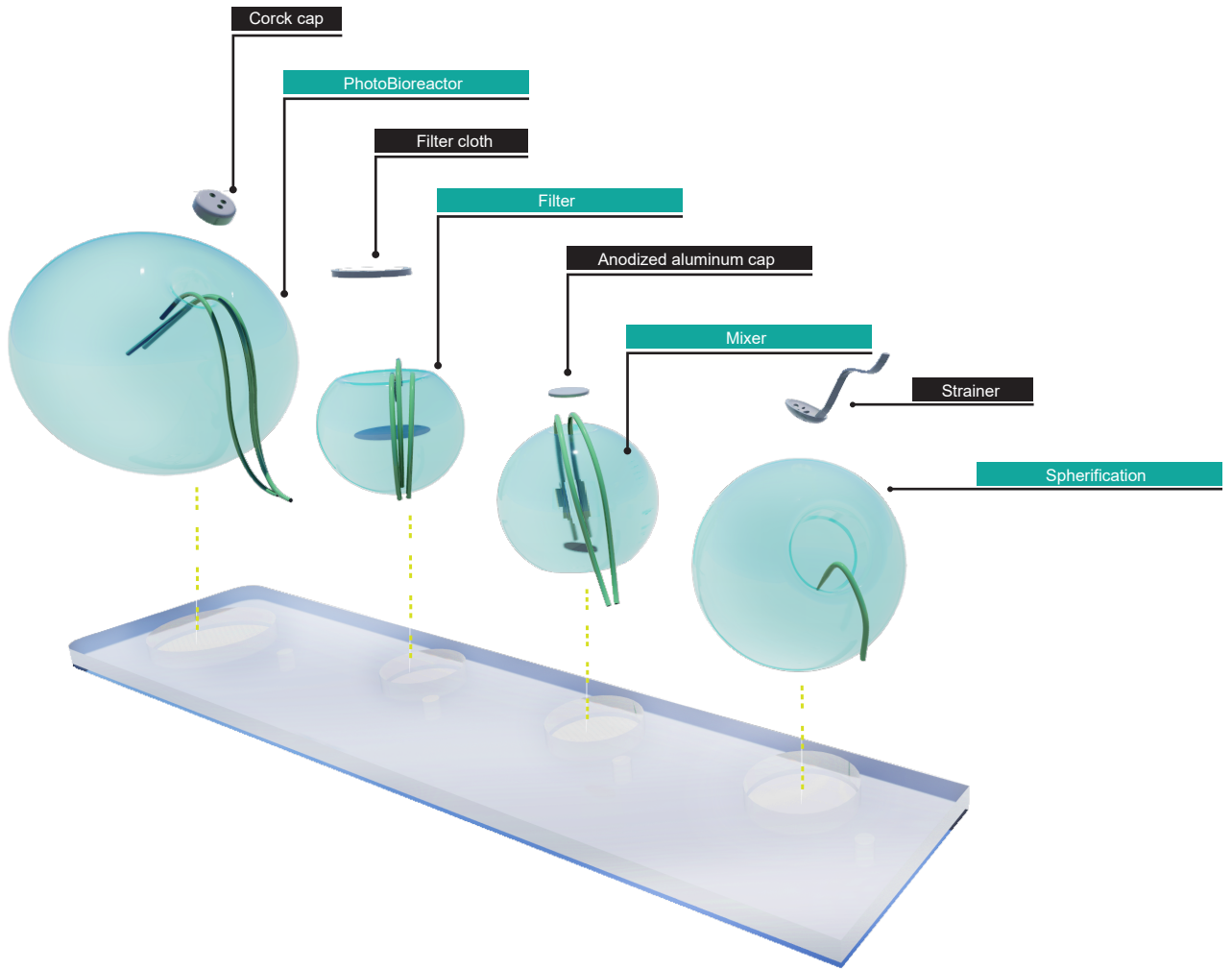
Create droplets by activating the spherification button. Long press will produce bigger and surprising shapes of spheres and short press will produce caviar spheres. If making caviar wait for about a minute and if making large spheres wait for about two minutes. The longer you wait the thicker the gel that will form. Before spherification, we must prepare the calcium bath by dissolving the calcium salt in a bowl to obtain a solution with 0.18% calcium. Now add colours to the mixture and try new and impressive combinations of flavour and colours.



The device has a series of platforms that display the main components embedded in the 20mm acrylic sheets ② in order to protect and expose the operation of each stage of the process.

The other electronic components are located on the side, covered by an acrylic box ③ that is integrated into the device and in turn, allows it to be removed for maintenance. In the upper part, the spherical glass containers are supported; ① Each one with a different diameter measure and function connected to each other to carry out the cyclic process from the cultivation of spirulina to its spherification.





Terpene flavours & aroma



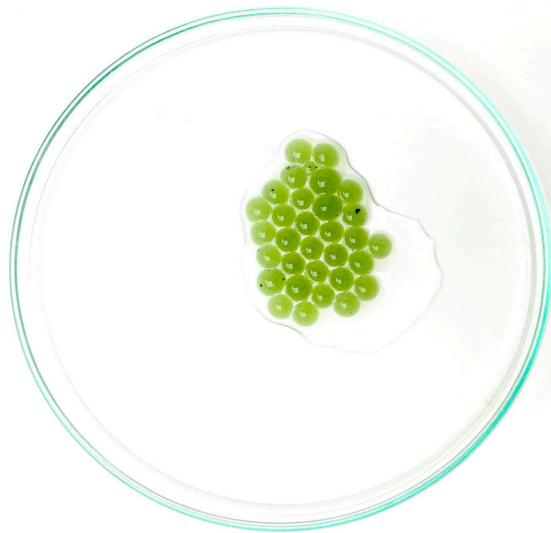
In order to further hack the flavour of spirulina cannabis (thc free) terpenes have been incorporated to develop an aromatic complexity. Terpenes are pungent oils that are secreted from various plants, conifers, and cannabis with distinctive flavours ranging from berries, citrus, mint and pine. Cannabis uses terpenes for adaptive purposes attracting pollinators and deterring predators. One drop of any one of the three concentrates is added to the 1000ml of the sodium alginate and juice solution.

Caviar Spheres



The spherification process in the apparatus gives a wide range of caviar sizes depending on the consistency and flavouring of the mixture. This makes it possible to accommodate and hack the flavour and textures to each person's needs and preferences.

Spherification



By controlling the extraction and manipulation method of spirulina we have developed a closed ecosystem with an end result of what we call spirulina caviar. Utilizing spherification we can extract spirulina in its purest form whilst combining the taste enhancers.

WE HAVE A WEBPAGE & APP FOR YOU



URBAN PHOTOBIOREACTOR

HISTORY

MANUAL

GALLERY

SPHIRA

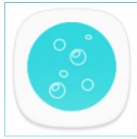
THE NEW URBAN FARMING PHOTOBIOREACTOR

WELCOME TO SPHIRA

[DOWNLOAD THE APP](#)

On our website you can find more information about the project; From the history, scientific data of the study, image gallery, animations and videos that show the process and the operation of the **Sphira** device.

← Sphira

**Sphira**

The New Urban Farming PhotoBioreactor



5.0 ★

**VaccSelector**
Eco Healthcare

5.0 ★

Sphira is also an application for mobile devices that you can download for free, this allows you to control the device and its multiple components through a connection via Bluetooth.

Through the application you can find the guide and understand how the device works as well as share your experience through social networks.

**VR**
VR

4.4 ★

**Biomate India**
Handbook Catalog 2018

5.0 ★

**Bioresources and Bioprocessing**
Springer



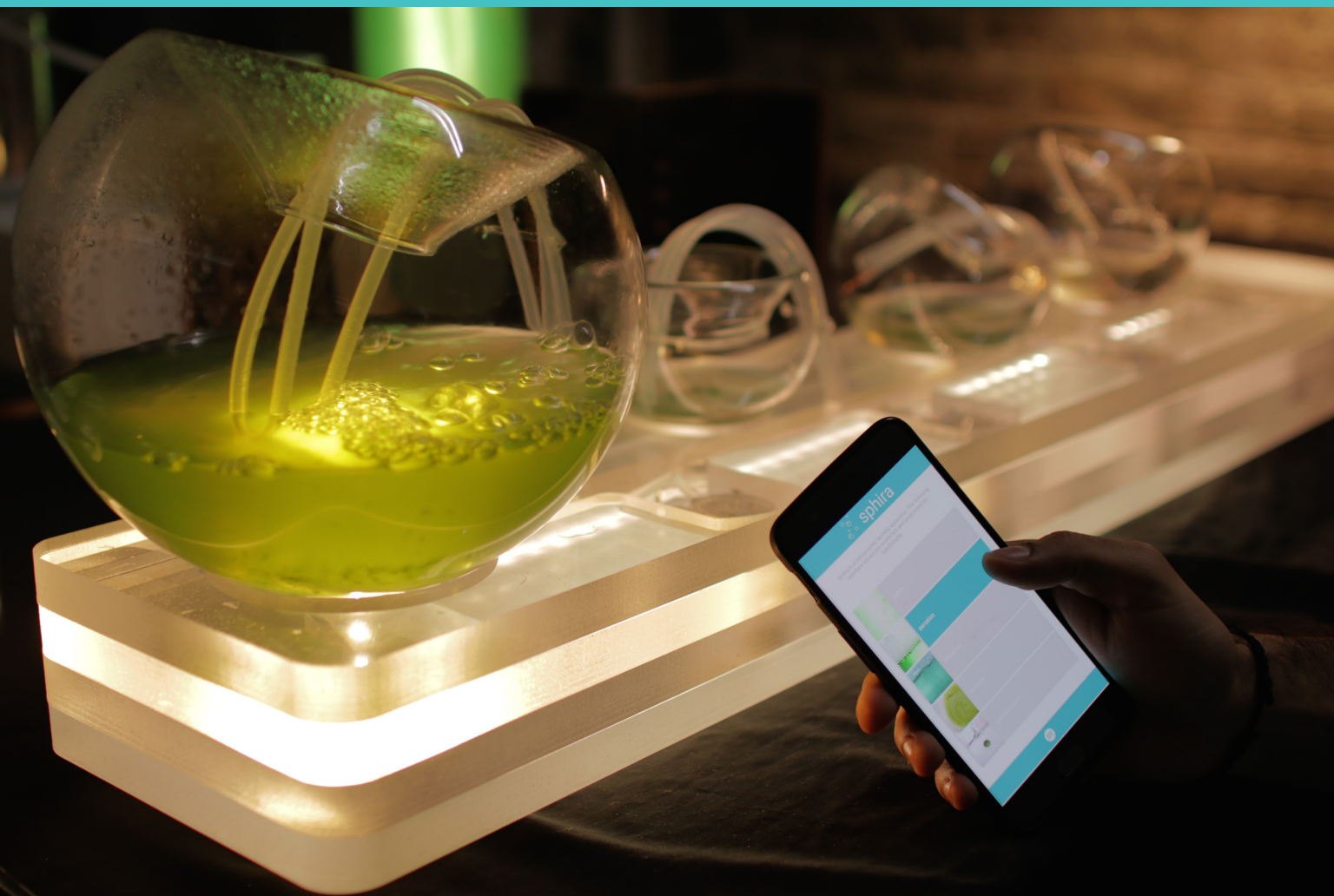
Sphira Guide

Connect to Device

Share the Experience!

switch on bluetooth

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of Catalonia | BARCELONA



Master in Advanced Architecture

Introductory Studio

Faculty

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SPHIRA - The New Urban Farming Photobioreactor

Master in Advanced Architecture 2017-2018

