Creating a product for oyster reef restoration out of the BESE-reef paste

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Natural oyster reefs are practically extinct in Europe, but have a great positive influence on our water quality, biodiversity and shoreline protection (Ysebaert et al., 2019). In order to restore these reefs hard substrate is necessary at the bottom of our seas, for oysters to attach to. Currently concrete is implemented at sea, to provide this hard substrate, which is not a sustainable artificial reef.

This bachelor thesis is carried out in cooperation with BESE BV, which is a company that restores coastal zones by producing nature-based flood defence products. BESE developed the BESE-reef paste, which is a biobased and biodegradable material that is proven to successfully attract larvae of the European Oyster (*BESE-Reef Paste*, 2018). Besides the advantages, there are some limitations due to which the company had difficulties creating a product out of this material. The material does not harden out properly with thicknesses over 5cm and the material strength is not fully understood yet. Selling the BESE-reef paste as a product is something BESE wants to achieve, which is why the research question of this thesis is: *How can a product be created out of the BESE-reef paste, for the potential restoration of European Oyster reefs?*

Approach

Relevant information was gathered about oyster reefs, the companies wishes, existing oyster reef restoration products and potential customers. The research showed that the most influential design components during the design process are easy production and cheap implementation, as these have the biggest effect on the product's cost. More elements are important for the final design, such as: stability on the seabed, safety against predators, no sand buildup and the provision of habitat for fish. All requirements were defined to which the final product must adhere. With these requirements multiple concepts were created and assessed with a multi criteria analysis. Eventually, the 3 concepts portrayed in figure 1, showed the most promising results which were evaluated further.

Multiple experiments were done, which were necessary to better understand the production process and the limitations of the material. With the knowledge gained from these experiments, simulations and prototypes of the concepts were developed to decide on the final product. This decision was mostly based on the production and implementation ease.

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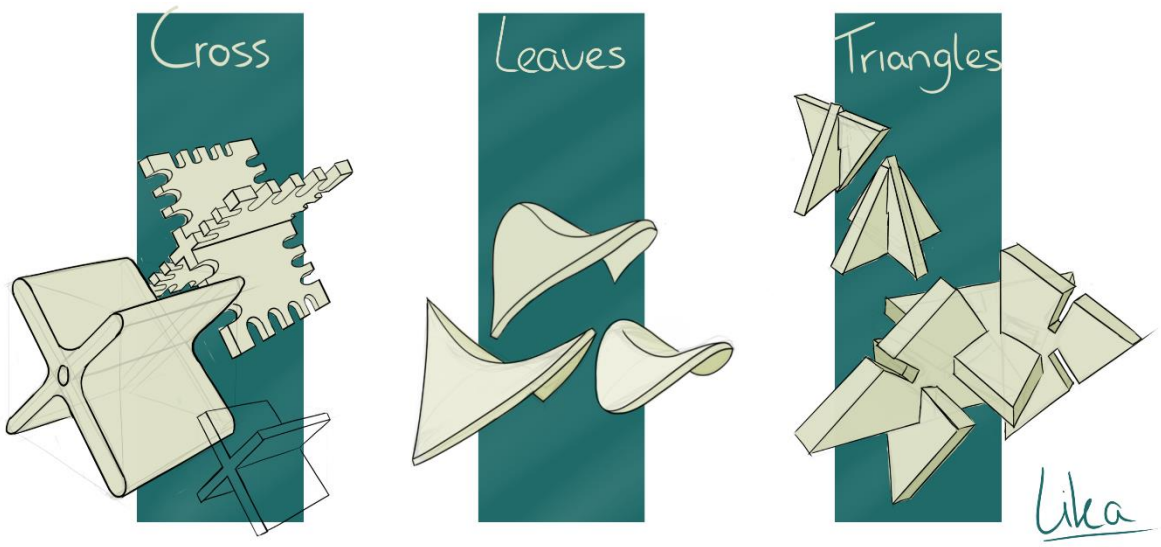

Figure 1: Drawings of the 3 best evaluated concepts

Results

The leaf was chosen as the final design, which is called the BESE-leaf. Optimizations of the concepts were necessary to improve the design according to the requirements. From creating the first prototype it was concluded that the product can be improved by adjusting the dimensions of the product and the shape of the mould. Holes and textures were added to increase the attractiveness of the BESE-leaf for fish. Figure 2 shows the prototype that is made of the final design, showing that the BESE-leaf is a feasible design and dries out properly.

To produce the BESE-leaf, a mould needs to be created into which the BESE-reef paste can be poured and into which it will dry. For this, air needs to be able to pass through the mould, which can be done in different ways with multiple materials. Creating moulds out of wood and thin metal wire was successful and they can be produced on large scale for less than €15 euros per mould. Implementing the leaves can be done by throwing them overboard, making the implementation significantly faster and cheaper than current artificial oyster reefs.

Figure 2: Final prototype of the BESE-leaf

Conclusion & Recommendations

All requirements that could be verified in the available time have been met, making the BESE-leaf has a high potential for future implementation for oyster reef restoration. Research and experiments demonstrate that the design is producible, by creating a mould with simple materials. However, the BESE-leaf needs further research before implementing it in marine environments. Some necessary experiments regarding the strength and the stability of the product, could not be performed. Further experiments are recommended to verify this.

References

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