
DESIGN OF A FULLY RECYCLABLE BACKPACK

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Introduction | The subject of this thesis is the design process of a fully recyclable backpack out of polylactic acid. Sustainability has an increasingly important role in the design industry. As the resources of development of products are declining and the risks are growing in the supply chains, it is important to rethink how products and materials are used. This thesis is executed on behalf of the company Arapaha. Arapaha supports the importance to rethink the way products and materials are used nowadays. They base their company on a circular business model. Developing only products that are fully recyclable and made from renewable resources wherever possible. Redesigning everyday products used in and around the house into a fully recyclable alternative. ^{[1][2]}

In this assignment the design process of a fully recyclable backpack is investigated. The knowledge obtained from this thesis will be used in future products the company will develop. With as final goal: “to fundamentally change how things you love in and around your house are made and remade.” The main research question addressed in the thesis is: “*How to design a fully recyclable backpack out of Polylactic acid (PLA)?*”.

Approach | To get a view on how the design process of a fully recyclable backpack out of PLA is done, the first steps in the design process have been carried out and follow-up steps will be determined. The first steps in the design process consist of four main phases: analysis, ideation, iteration, and finalization. The analysis on the material, company, market, and target group concludes a requirement list in which the requirements, limitations and wishes are reflected. The decisions made in the ideation, iteration and finalization phase are substantiated by the analysis. The aim is to ultimately deliver a final concept the company can use in the further development of the fully recyclable backpack made from PLA.

Results | The main result of this thesis is a final sketch and technical package of the final concept of the backpack. A technology package, also known as tech pack, is a set of instructional documents which is mainly used in the fashion industry. In here, the materials used for each part of the backpack and the specific dimensions become clear. The final concept was based on the different phases set in the design approach.

One of the main requirements for this thesis was the implementation of polylactic acid. Polylactic acid is a bio-based material made from lactic acid and can be manufactured from renewable resources, e.g., maize and sugarcane. Due to the properties of PLA, which are like the commonly used thermoplastics, PLA makes a promising alternative for these plastics. Nevertheless, the application of PLA is relatively new and has some limitations. Looking at the design of a product, in this case a backpack, the material gives some limitations regarding the brittleness of the material and the possibilities for production with the material. Therefore, different choices have been made in comparisons to



'general' backpack designs. Despite these limitations, the design must still be functional, comfortable, and aesthetically pleasing. To find the right balance between these aspects, an analysis was carried out. Resulting in a requirement list, which is the basis of the further design process.

The analysis consists of an internal and external analysis, providing Arapaha with the strategic position of the company. In addition, a style analysis of the company has been executed, and the target group has been defined. Furthermore, to accomplish comfort, guidelines on the ergonomics have been set up. Using the gathered information from the analysis and the knowledge gained from PLA, requirements for the design were formulated. Based on the formulated requirements, choices were made during the ideation and iteration phase of the design process. These choices mainly concern the appearance of the backpack, the functionality, and the closing mechanism. After the choices made, a final concept has been created. This concept has been elaborated in the form of a final drawing and the tech pack.

Conclusions & Recommendations | As a result of this thesis, a small part of the process of a fully recyclable backpack has been investigated. The complete design still needs to be explored further to create a guideline for the design process of other fully recyclable product the company wants to develop. In general, it is important to look at the possibilities of the material, PLA, and try to combine their possibilities with the function that is desired to achieve.

For the backpack, based on the tech pack, further research must be carried out to define the different applications of PLA within the parts of the backpack. Moreover, prototypes need to be developed and tested to optimize the design, production, and function of the backpack. In addition, the claim to deliver a fully recyclable and sustainable product must be validated. Lastly the marketing and collecting strategy of the backpack must be formulated, after which the product can be launched.

[1] "Home - Arapaha." <https://www.arapaha.com/> (accessed Jan. 28, 2021).

[2] Arapaha B.V, "ARAPAHA | Brandbook," no. September, 2020.