SUMMARY

Cigarette butt waste is one of the most commonly found plastic items during urban and coastal clean-ups since the 1980s. [1] To this day, the pollutant, however small in its size, is still a cause for many environmental problems, containing many toxins and adding to the challenge of microplastics found in nature.

The filter in cigarettes is made of the spun fibres of a plastic called cellulose acetate. After smoking, the filter becomes toxic due to the captured chemicals that are produced during the cigarette's burning process. In recent years, there have been some attempts in raising awareness about the problem cigarette butts pose in Estonia, in hopes to prevent smokers from littering their cigarette ends, however, there are no effective solutions proposed, which would eliminate the litter's issue. Giving cigarette ends value by using it as a resource, could be an efficient way towards the solution. There are several examples from around the world, which show that it is possible to set up a functioning cigarette butt collection scheme together with a recycling line, giving the waste new value by directing it back to the material cycle.

The scope of this thesis was to research and experiment with ways how to recycle cigarette butt waste into a bioplastic material suitable for common plastic processing methods, using the cellulose acetate filter part as the main component. As a result, 9 bioplastic blends with different characteristics were successfully composed. Additionally, the method for separating the filter part from the rest of the cigarette butt and the washing process of it were explored and established. Further studies of the composed plastic blends included deternining suitable plastic processing temperatures, the melt flow index, injection moulding parameters, tensile strength and water absorption behaviour. The properties were compared with a commercial plasticized cellulose acetate brand Mazzucchelli. Furthermore, visual characterisation of the composed blends was conducted.

Four successful bioplastic recipes showed very promising results, suitable for injection moulding and presumably for other common plastic processing methods as well. The mechanical strength and melt flow properties of said blends proved to be comparable with commercially available conventional plastics. The bioplastics displayed hydrophilic and somewhat water-soluble properties. However, it was evident that the source of cigarette butt waste determines the quality of the composed blends, thus may result in heterogeneous results when composing same recipes from various sources of cigarette butt filter waste due to the contamination and composition of different filters.

While the thesis work reached its set objectives, further research, testing and development could be carried out with the composed bioplastics. Additional tests for toxicology and

biodegradation rate would be suggested to further understand the blends' properties and make any changes in the establish process, if necessary. Additional studies could also go into the means of recycling the paper, tobbacco and ash separated from the filter material, as these could as well be recycled into new products.

In conclusion, with further extensive research, it is possible to propose a functioning cigarette butt recycling scheme to produce new materials from discarded cigarette butt filter litter. Together with a cigarette butt collection set-up, it could be possible to establish a bioplastic production line to help solve the cigarette butt litter problem.

REFERENCES

[1] "Tobacco and its environmental impact: an overview," 2017. [Online]. Available: https://apps.who.int/iris/bitstream/handle/10665/255574/9789241512497-eng.pdf. [Accessed 21 03 2021].