

Development of the Sustainable Powered Toothbrush

Submission Sustainability Degree Show Prize

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Project summary

In light of an increasing awareness of the impact of human activity upon the environment in terms of greenhouse gas emissions and inadequate waste disposal, it is of considerable importance to consider and prioritize the sustainability of products within their design. With around 101.84 million Americans reporting the use of one (U.S. Census, 2017). With a recommended brush change of 3 months (Tangade et al. 2013), and an average life cycle of 2 years (Oral-B®, no date) this would theoretically result in the annual disposal of around 407.46 million brush heads and 51 million brush handles in the U.S. alone. Given this potential to produce high volumes of waste, this project shall focus on the redesign of the powered toothbrush.

The objective of the project was to design a powered toothbrush that is more sustainable than current models on the market, with regards CO₂ emissions, energy use and waste potential.

Background research of the current power toothbrush market and user tests identified that the sustainability of current power toothbrush models was significantly compromised by the presence of their electrical components. User interviews brought to light that these are inadequately disposed, preventing recycling of valuable materials.

Research and calculations of alternate materials and concepts were then conducted to identify a feasible and sustainable alternative design method, which did not require electrical components.

Conceptualisation and tests provided the most feasible concept to be that of a spiral torsion spring, combined with energy input through string pulled torsional rotation.

An embodiment design was developed and tested along the benchmarked product. Resulting in a potential improvement in sustainability of 63% in terms of CO₂ emission and energy consumption



Figure 1: Rendering final design concept

How does it work?

The brush is designed around the idea that you feel engaged in the energy you use in daily life. Before brushing the user has to charge the brush by human power. The user pulls a string to rotate the bottom of the enclosure, thereby tensioning the spiralling spring on the inside. Just like one would with a toy (Figure 3). after 10 pulls, the brush is fully charged and ready for use. With the use of the brush, comes the feedback of their work. The rotations of the spring results in rotations of the gear mechanism. These gears speed up the brush head and are made of nylon in different colours. As the handle enclosure is made of recycled PET bottles, the user can see the brush working internally.

The brush head moves at 3500 oscillations/min, a speed proven to give optimum cleaning power.(Kulkarni, Singh and Jalaluddin, 2017) Showcasing that a sustainable product does not necessarily has to trade off performance. As the brush is made out of metals and recycled thermoplastics, the brush can be disposed of in common household waste, without trading of the recyclability like the electric brush does. Resulting in a product that requires 63% less energy and 64% less CO2 to produce, compared to conventional electronic brushes. (Figure4)



Figure 3: Spinner using string pull mechanism

Figure 2: Exploded view final design concept



Figure 4: comparison El. Vs spring brush