

# Bio-bristles for the TIO toothbrush



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Two designers wanted to develop a toothbrush that combined sustainability and the best possible materials. It turned out to be much more difficult than first thought—but by chance they came across biobased VESTAMID® Terra from Evonik.

„As a designer, you influence consumers’ buying decisions quite often,” says Benjamin Beck. Over the course of his career that started to bug him: „Persuading people to buy a product through appealing design is not enough for me.” Beck wanted to do something different: He wanted to develop a product that made sense — an exciting design that is balanced with sustainable benefits. Initially he didn’t have toothbrushes in mind.

„The toothbrush is a really interesting object,” Beck says today. Everyone uses a toothbrush several times a day, and although people dispose of them every two to three months, they perceive it as being of comparatively high quality. People use around 400 toothbrushes during their lifetime, which produces the corresponding amount of waste. “Couldn’t this be done more sustainably?” Beck and his design student friend Fabian Ghoshal asked themselves. There are eco-toothbrushes on the market that use animal hair as bristles, for example. „But such hairs split after a while, so bacteria can colonize” Beck learnt. This is where bio-plastics could score as a sustainable alternative.



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In 2013, Ghoshal and Beck discussed issues surrounding sustainable materials while on vacation. It was the nucleus of an idea that today has become TIO, a company for sustainable toothbrushes.

#### THINKING ABOUT THE FUNCTION, YOU GET THE SHAPE

At the beginning, it was not the material that mattered, but the design. The first designs were overdone, Beck admits retrospectively. The two founders considered whether the sustainable toothbrush might be shaped like a leaf. „In the end, though, we ended up following Ferdinand Porsche,“ Beck says: „If you think long enough about the function of a product, the shape follows.“ The TIO toothbrush does not look groundbreakingly different from other toothbrushes. However, there are many ideas in the product that are derived directly from its function: „The most hygienically sensitive part of a toothbrush is the head with the bristles,“ says Beck. It has to be changed regularly. The shaft, on the other hand, can be used for much longer - and this is also the case with the TIO models. That alone saves on waste. This consistency continues for the packaging, only the head is wrapped in a sterile sleeve. „The large blister packs seen for many toothbrushes are often marketing-driven,“ says Beck.

The next challenge faced by Beck and Ghoshal was the material. With no material, there is no product. Two coincidences helped the two designers. They make the acquaintance of Volker Dreher, a trained toolmaker and at that time managing director of a mold making company. He had already considered biobased plastics for

toothbrushes, but his company rejected the idea: too expensive, no demand. Dreher had the know-how and expertise, Beck and Ghoshal contributed the enthusiasm and start-up will. „Suddenly we had contacts with material and toothbrush manufacturers,“ Beck describes. However, the injection mold to produce the first batch of toothbrushes was expected to cost close to 40,000 euros. Money for an upfront investment the two friends didn't have. The second happy coincidence was the German launch of the crowd-funding platform Kickstarter, which was looking for flagship projects to promote its crowdfunding business model. There, people were taken with the idea. „In general, I would say that the sustainability aspect has opened quite a few doors for us in our startup,“ says Beck: „The topic is clearly gaining interest.“ A Kickstarter campaign was created, and the two designers produced a video with the help of a cameraman friend to get customers excited about their idea. In the end, they got their start-up capital together - financed exclusively by end customers.

#### BRISTLES MUST BE ABRASION RESISTANT AND ELASTIC

There's no question that TIO toothbrushes are currently more expensive than a conventional toothbrush. „But that's also due to our smaller quantities,“ says Beck. Many traditional companies won't make the leap to biobased plastics because they still see growing customer interest as irrelevant: „But you have to give customers the choice.“ TIO now produces batches in the range of 100,000 units - five times its initial production.



For the TIO toothbrush, the two founders looked for different biobased plastics for the head, handle, and bristles. And quickly landed on VESTAMID® Terra for the bristles. In addition to the plastic being derived from castor oil, its properties are impressive: „We’re talking about long-chain, semi-crystalline polyamides here,“ explains Johannes Krampe, Manager Filaments in the High Performance Polymers Business Unit at Evonik: „The filaments that are made from them are high-performance, for example, in terms of abrasion resistance.“ And that, in turn, is a decisive advantage for toothbrush bristles. At the same time, the bristles made from them are flexible and elastic, so they set up again and don’t get out of shape or break. „It was important for us to offer a solution that is at least equivalent to conventional toothbrushes,“ says Beck. Users should not feel that they are getting an inferior product with a sustainable brush, or that they are in any way entering into an experiment.

### CARBON DIRECTLY FROM THE PLANT

The more he looks into the subject, the more clearly Beck realizes how much work is done in the field of toothbrushes with design features that are intended to arouse curiosity among buyers or strengthen brand recognition. The bristles made of VESTAMID® Terra from TIO don’t look flashy, but they are based on the research findings of Stefan Zimmer, a professor at the University of Witten-Herdecke, Germany, who uses brushing robots to research sensible dental hygiene. An additional plus: The biobased material is also suitable for different diameters, i.e., for softer or harder bristles, depending on customers’ taste. „Evonik’s portfolio was really perfect there,“ says Beck.

The designer is now invested in everything to do with bioplastics. For him, the first decisive factor was that VESTAMID® Terra is plant-based: „In other words, the carbon comes from the atmosphere,“ he emphasizes: „Even if the toothbrush is subsequently burned, carbon ends up back in the atmosphere as it was before.“ It is even better if the plants from which the plastic is made are not monocultures that could also be used as fodder crops. VESTAMID® Terra is made from the oil of the castor bean plant, which is inedible to many animals and grows mainly in arid regions. Evonik developed VESTAMID® Terra more than ten years ago, with the idea in mind that crude oil is finite. The plastic can be used in many industries, for example, in the fashion industry. For some years now, Evonik’s product managers have been registering growing interest.

### PERFECT BRISTLES FROM THE START

At the same time, it is anything but trivial for a new producer to work with plastics. The two TIO founders have also noticed this: „With every plastic, there is a different shrinkage behavior during the process, and they contract in different ways,“ reports Beck. After all, not only the bristles of their toothbrushes are made of bioplastic, but also the handle and the detachable heads, though not yet from VESTAMID® Terra. This caused the designers quite a headache, after all, the injection molding machines must be individually fine-tuned to account for this. Small hairline cracks were found in the very first batch of brushes produced — which Beck only noticed when he was getting the brushes ready for shipment. The company founders had to completely remanufacture. „It was a two-year development effort until everything was a final fit,“ Beck says. „The only thing that was a super fit right from the start was the bristles.“

Meanwhile, the products of TIO are listed in their first supermarkets. The company’s reputation is slowly beginning to spread. „We still want to improve,“ Beck says expressing his entrepreneurial spirit: He wants to continue experimenting with bioplastics

and is definitely interested in using VESTAMID® Terra for other components of the toothbrush. Initial trials are underway for the handles and heads as well. A uniform material for the entire brush would bring it one step closer to recyclability, another aspect of the sustainability concept.

„I’m really impressed with Evonik,” says Beck. The Group took the route toward biobased plastics so early on and Beck was able to approach the product managers directly: „It’s not a matter of course for a large corporation to provide such support and access for small entrepreneurs.” Ultimately, he sees himself confirmed above all in the vision he had before starting the company: „There is a real tailwind for sustainable products. And I can do meaningful things as a designer.”

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