

Biodegradable & Food-Safe Toothbrush

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Introduction & Background

Traditional Manual Toothbrush

1 billion toothbrushes are thrown away in the US every year.

50 million pounds of toothbrush are added to landfills in the US annually.

50% of total ecocost of manual toothbrush occur during manufacture and distribution process.

64% Americans are willing to pay more for sustainable products.

78% Americans are willing to purchase environmentally friendly products.

Nylon Manufacturing Nylon creates nitrous oxide, which is **310 times more potent** than CO₂.

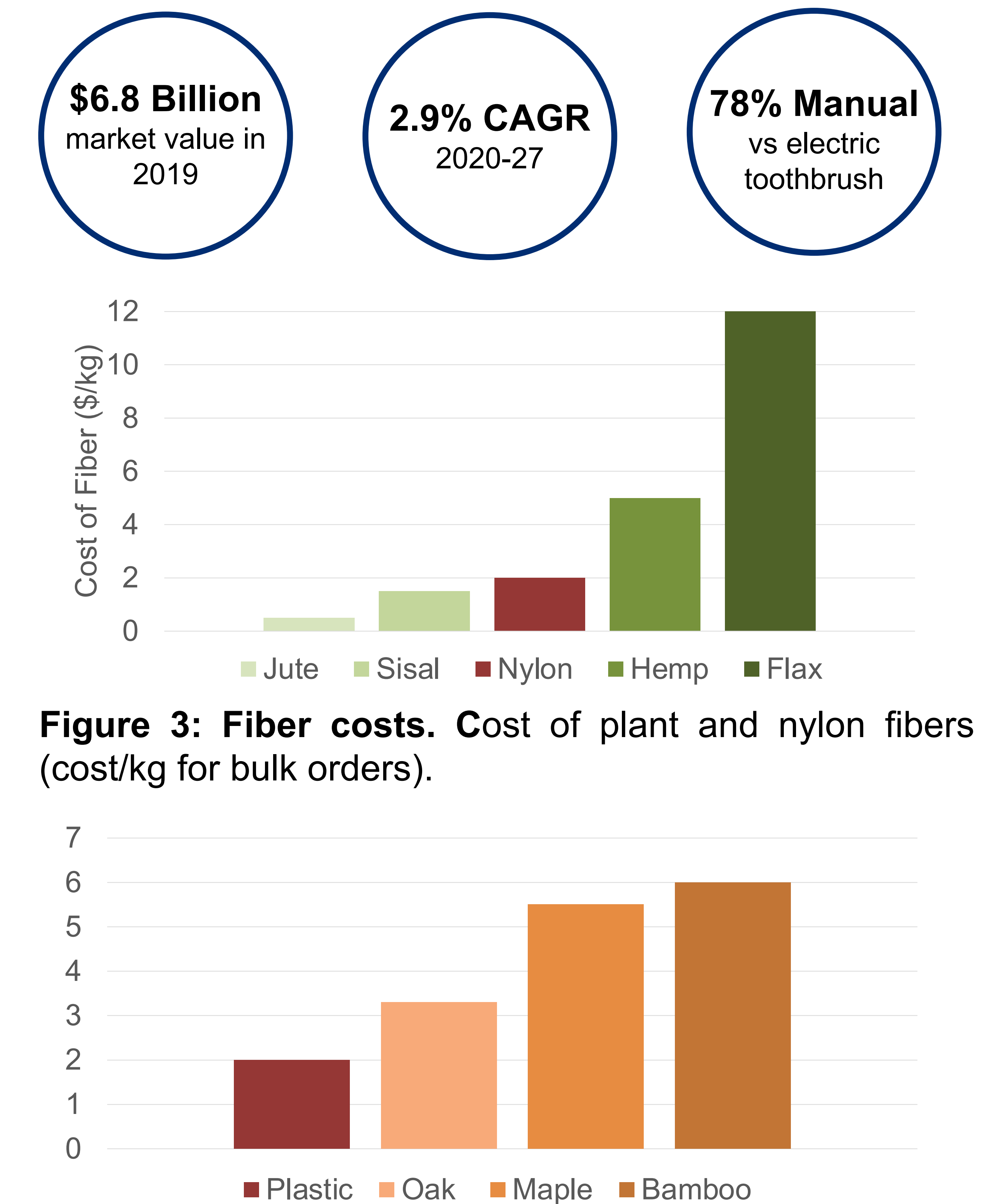
Propylene Plastic Toothbrushes end up in **waterways and oceans** where marine creatures mistake them for food.

Product Overview

Figure 1: Toothbrush schematic. Our design features waterproof beeswax coating the wooden body, plant-based bristle fibers, and food-safe dextrin glue.

Figure 2: Bristle attachment. Our method of attaching bristles without using any other materials while maintaining strength and durability.

Economic Analysis



Goals and Objectives

Create a "fully" biodegradable, food-safe, and environmentally friendly toothbrush

- Identify** viable materials to replace nylon bristles and plastic handles
- Design** a biodegradable toothbrush that performs comparably to traditional plastic toothbrushes that are not biodegradable
- Test** the toothbrush against traditional plastic toothbrushes for strength and durability

Table 1: Comparison of plant fibers. We performed several tests (water, strength, shape retention) on hemp, jute, and sisal fibers. This table shows comparisons between each fiber tested.

Nylon (Control)	Raw Long	Combed Hemp Light	De-gummed Hemp	Combed Hemp Dark	Hemp Combed Top Roving	Jute	Sisal
Plasticity, stiff, soft, straight, 1.5 cm	Wirey, stiff, long fibers, wavy, 10 cm or longer pieces	Cotton fibery, soft, stronger than degummed, 13 cm	Cotton bally, soft, not strong, hard to measure	Fibery, less soft, wavy, stronger than degummed, 6 cm	Fibery, soft, wavy, stronger than combed light, thick braids	Originally bundled, comes in long rope form, stiff	Twisted bundle, comes in long rope form, stiff and hay-like

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