A SUSTAINABLE ALTERNATIVE TO TOOTHBRUSH

Group 05

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INTRODUCTION

- Toothbrushes are widely used for dental hygiene.
- They are made using different types of plastics

<u>Why this project is important?</u>

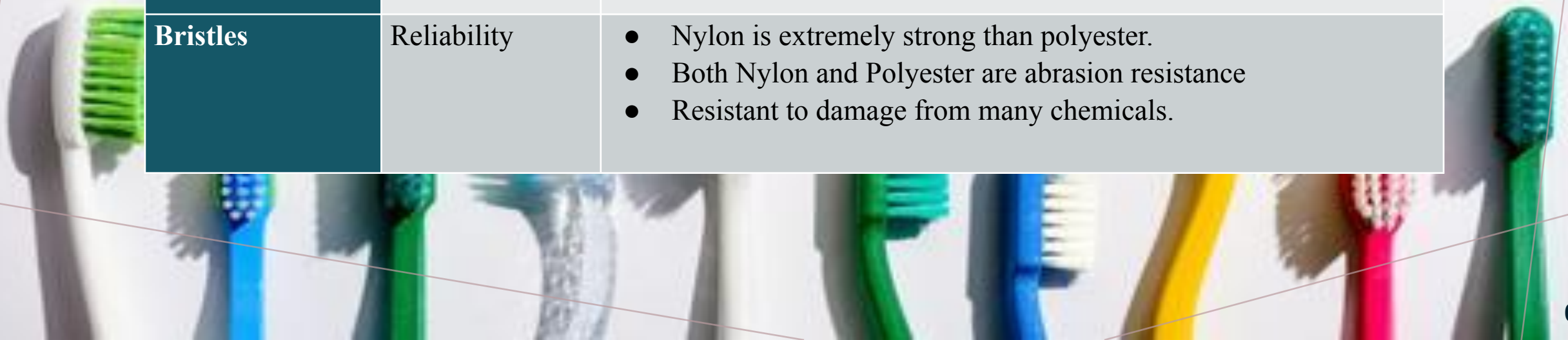
- Reduce the impact on environment
- Therefore Implementing a sustainable substitute is necessary

Ingredients of a Toothbrush

Ingredients	Percentage	Renewable	Non-Renewable
Nylon 6 / Polyester	4-5%		✓
Polypropylene	40-60%		✓
Polyethylene	30-40%		✓
Sulfur	Less than 1%	✓	
Cis - 1,4 poly(isoprene)	10-20%	✓	

Properties of a Toothbrush

	Properties	Description
Bristles	Softness	• Reduces the damage to the teeth.
Rubber grip	Flexibility	• Rubber is flexible because it has the elastic properties • Makes it easy to firmly grip by hand
Plastic handle (Polypropylene, Polyethylene)	Moisture resistance	• Water repellency due to its structure. • Polypropylene plastics offer higher moisture resistance. • Helps to hold the toothbrush handle without slipping
Plastic handle (Polypropylene, Polyethylene)	Durability	• The structure of plastic is made from carbon-to-carbon bonds and these bonds make plastic durable.
Bristles	Reliability	• Nylon is extremely strong than polyester. • Both Nylon and Polyester are abrasion resistance • Resistant to damage from many chemicals.



Properties of the Ingredients

Ingredients	Softness	Moisture resistance	Flexibility	Durability	Reliability
Nylon 6 / Polyester	✔	✔	✔	✔	✔
Polypropylene		✔		✔	
Polyethylene		✔		✔	
Cis - 1,4 polyisoprene		✔	✔		
Sulfur			✔		

Manufacturing Process

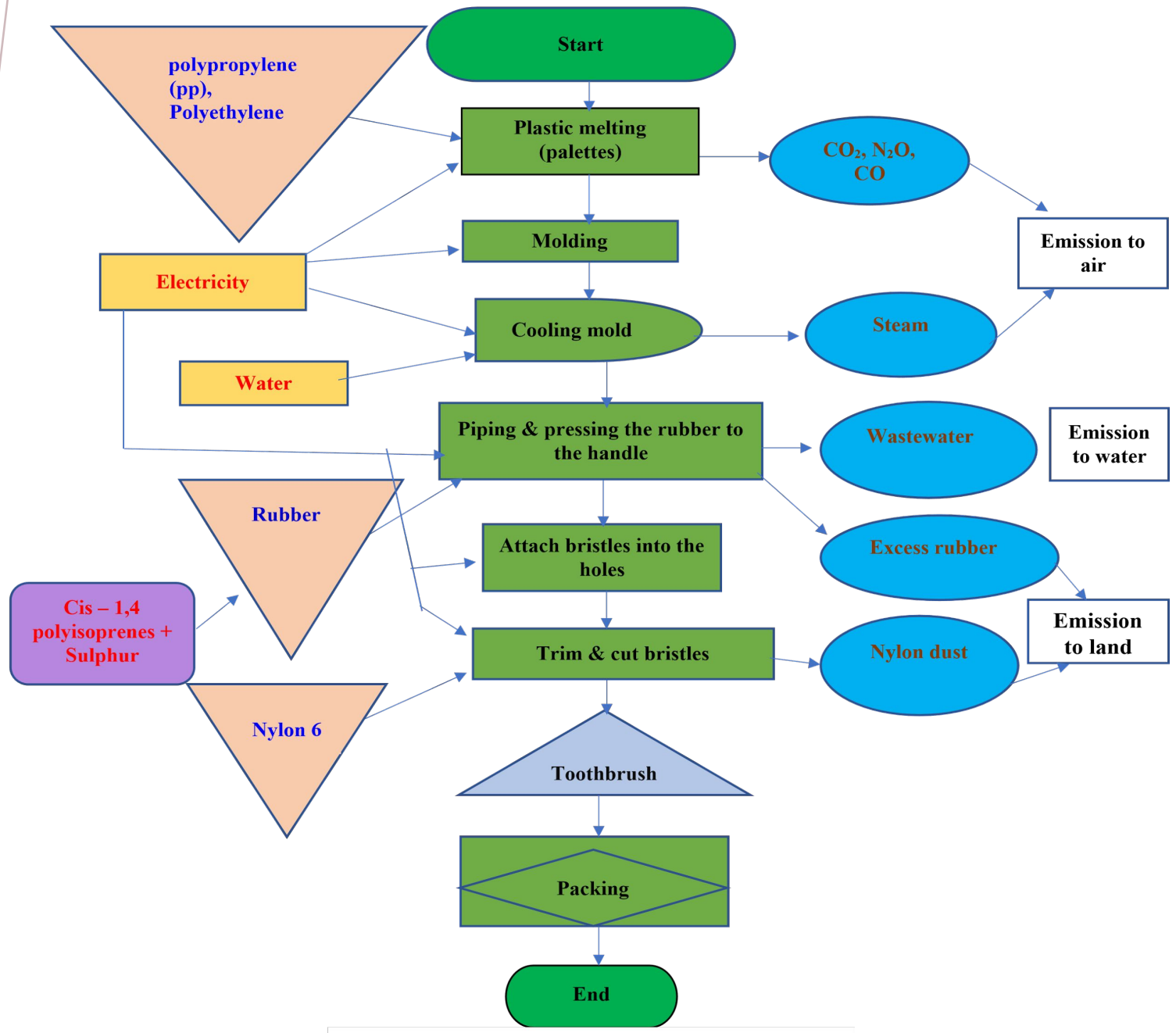


Figure 01: Manufacturing process of the toothbrush

Figure 2

USES & APPLICATIONS OF A TOOTHBRUSH

USES/APPLICATIONS

•Helping to remove bacterial plaque that causes tooth decay and gum diseases.

- Brushing teeth

ALTERNATIVE APPLICATIONS

- Cleaning the grout grime on tile floors
- Applying hair dye
- Refreshing a comb
- Cleaning the shoe soles
- Removing marks on the floor
- Cleaning hairbrush

Problems with the Toothbrush

Extraction of Raw materials

- **Environmental problems**- Biodiversity damage
  Natural habitat destruction
- **Social problems**- Poor governance
  Weak institutional and legal frameworks
  Labor-intense process
- **Economical problems**- Waste of non-renewable sources
  Have to spend money for some cases

Manufacturing process

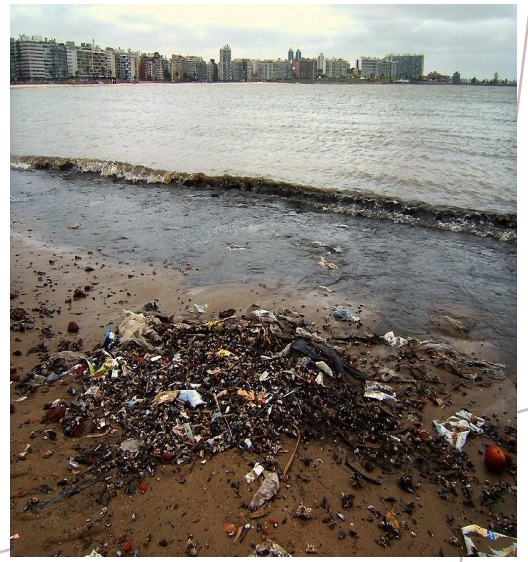
- **Environmental problems**- Environmental pollution(water, air, land)
- **Social problems**- Sound pollution due to machines
  Causes respiratory diseases from harmful gases
- **Economical problems**- High level of energy use
  High cost in repairing machines
  Government labour laws and taxation policies

Use of product

- **Environmental problems** – microplastics released to the environment
- **Social problems** – Some kids may chew bristles and it causes some harmful effects
- **Economical problems** – Some types of toothbrushes are expensive, and some people can't afford them

Disposal

- **Environmental problems** – Pollution of waterways
  Harming the marine life
  When burning plastics, they release hazardous gas into the air
  Soil fertility can be lost



- **Social problems** – People throw plastic toothbrushes instead of recycling
  Poor knowledge of recycling
  Overuse of the toothbrushes
- **Economical problems** – High labour cost for collecting and partitioning the toothbrushes according to the recycling number

Available Alternatives

	What previous problems are addressed by the solution	Alternative solutions
Alternative to handle	• Recyclable	PLA – biowaste plastic
	• Reusable	Stainless steel
	• Biodegradable • Minimize the land pollution • Minimize the use of non-renewable resources • Minimize the high cost	Bamboo sticks
Alternative to rubber	• Minimize the use of renewable resources • Minimize the labor-intense process	Silicone
Alternative to bristles	• increases softness • Minimize land pollution and air pollution (if burned)	Silicone
	• Minimize the use of non-renewable resources • Minimize the land pollution • Minimize the high cost	Bamboo strands
	• Biodegradable • Effective at removing plaque and bacteria	Boar bristles
	• Minimize the use of renewable resources • Reduce the high level of energy use	Castor oil

Best Alternative Product to Replace the Original Product

Selected Alternative- Bamboo sticks to the plastic handle and Bamboo strands to bristles

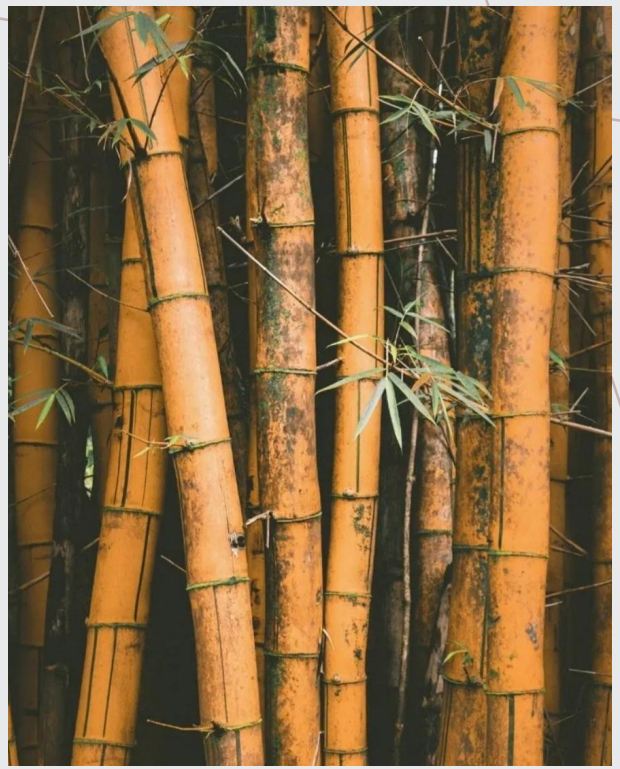
Why plastic handles and bristles can replace with bamboo?

- The most sustainable option for plastic toothbrush handles is bamboo sticks.
- Bamboo has many properties and it is good for the oral cavity.
- Plastic can replace with this rapidly growing renewable resource and it can be fully composted.

Targeted problem to solve

- Preventing the waste of non-renewable sources
- Reduce the damage of biodiversity
- Minimize the waste of non-renewable sources
- Minimize land pollution, water pollution, and air pollution

Benefits to achieved



Bamboo is;

- Fast growing
- Not very expensive
- Lightweight
- Durable
- Strong than plastic
- Biodegradable
- Can be composted
- Can recycle and reuse
- Have a smaller ecological footprint than plastic
- Reducing the Carbon footprint and Water footprint
- BPA-free

Discussion

	Description
Rubber grip replace with Silicone	• Silicone rubber is highly flexible
Plastic handle replaces with the bamboo stick	• Bamboo sticks are more durable • Waterproof handle than the plastic
Bristles replace with bamboo strands	• Very soft than plastic • Gentle on our gum tissue and enamel • More eco-friendly

- The bamboo toothbrushes are natural and biodegradable rather than plastics
- Using a bamboo toothbrush makes oral hygiene routine more environmentally friendly rather than nylon
- Minimize use of non-renewable sources and CO2 emission
- It fulfills the needs of the customer while being more sustainable

Conclusion

- Learning to apply sustainable concepts to Engineering projects
- Learning to make formal reports
- Working according to a rubric
- Experience to do research
- Working on time as a team

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Thank You!