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Neptune Plastics: A single-use, biodegradable and compostable plastic film

The Problem: Petroleum-based plastic is a material that is hard to avoid in our everyday lives, whether it be packaging for an online order, a water bottle, or even the bus seat on your commute to work. The vast uses of plastic, and its inability to biodegrade after disposal, result in plastic being one of the leading causes of pollution. It pollutes our land and waterways worldwide, and harms our wildlife.

Bioplastics, which are plastics made from renewable sources, are one way of combatting pollution. They have broad appeal in today's market due to their promise of environmental friendliness and sustainability. However, there is a vast disconnect between industry biodegradability standards and consumer expectation.¹ Most consumers are not aware that many bioplastics are chemically identical to their petroleum-based counterparts. Bio-based polyethylene is made by fermenting plant matter into ethylene, which is polymerized into polyethylene. The advantage this provides is that the plastic comes from a renewable source and is recyclable, but it has no effect on the biodegradability of the plastic. The majority of compostable plastics will only break down rapidly in an industrial composting facility and behave identically to petroleum-based plastics in the environment. "Biodegradable" shopping bags have been found to be fully functional bags even after having been buried for three years.

¹ Allen, Katie, et al. B.A.N List 2.0. 2018,

http://static1.squarespace.com/static/5522e85be4b0b65a7c78ac96/t/5acbd346562fa79982b268fc/1523307375028/5Gyres_BANlist2.pdf.

Many of the eco-friendly packaging products available today end up disappointing consumers because they fail to deliver the value of true eco-friendliness. These products, even those labeled as compostable, leave behind microplastics in the environment. Microplastics, or fragments of plastic smaller than 5mm, have been observed to travel up the food chain once introduced to an environment. The particles are capable of crossing into the circulatory system from the gastrointestinal tract, where they can remain for months.²

Within the plastic manufacturing industry, biodegradable polymers that are used to produce plastic do exist, but there are limitations with the current technology. Different types of bio-based polymers have been identified as having physical properties similar to that of polyethylene and polypropylene, but none of them have been adopted by the industry. This is because these types of polymers cannot be injection-molded, extruded, or blown. No industrial process exists to manufacture these types of films. Furthermore, these polymers typically cannot be heat sealed to convert the plastic films into usable packaging products, and they tear more easily than petroleum-based films.

The Solution: To address the problem of widespread plastic pollution, the Neptune Plastics team invented a starch-based single-use plastic film, so it is thereby biodegradable, compostable, water soluble, digestible by wildlife, and can be used as a fertilizer for soil after decomposition. It looks, feels and acts like petroleum-based plastic, but is 100% petroleum-free. It does not require an industrial composting facility to be broken down quickly, and it leaves behind no microplastics. The team's plastic film is also printable, transparent, and low-cost, with a high tensile strength that is identical to that of polyethylene. The unique blend of starch and protein makes it possible for the film to be sealed using heat, much like traditional petroleum-based plastics. This allows Neptune's film to be converted into packaging and shipping materials, such as single-use poly bags.



Neptune plastic is currently developed for packaging, specifically polybags.

² Browne, Mark A., et al. "Ingested Microscopic Plastic Translocates to the Circulatory System of the Mussel, *Mytilus Edulis*(L.)." *Environmental Science & Technology*, vol. 42, no. 13, 2008, pp. 5026–5031., doi:10.1021/es800249a.

Commercialization: The Neptune Plastics team has a provisional patent filed for their invention and they are currently manufacturing their plastic film and selling it to early customers in the form of poly bags to be used for packaging and shipping. The team opted to manufacture their film themselves because they wanted to be heavily involved with the process design. They first plan to be a vendor of plastic packaging before eventually transitioning into a supplier of plastic film once they are producing at a larger scale.

The team's company operates out of a 2,000 square foot warehouse space where their manufacturing process consists of creating the liquid solution, curing it into rolls of film, and then forming the film into products such as poly bags. They are currently marketing and selling their poly bags to customers, such as those who sell products on platforms like Etsy and eBay who need to purchase their own packaging and shipping materials.

As they move into the future scaling up of their manufacturing, the team looks forward to partnering with companies to get their solution implemented as quickly as possible. For any inquiries, please visit <http://neptuneplastics.co>.