A Roadmap for Bioplastics Adoption in Food Packaging

Mehran Ghasemlou, PhD

Alfred Deakin Research Fellow
Deakin University, Waurn Ponds, Geelong
Former Scientist at Cardia Bioplastics

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Bioplastics

- Materials made of biobased or biodegradable or both (European Bioplastic definition).
- Common bioplastics are starch, PBAT, polylactic acid (PLA) and polyhydroxyalkanoates (PHA)
- Bioplastics are not a single bullet to plastic waste but likely better than current traditional plastics!

Difference between food Packaging and other materials

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- Materials that are food-safe
- Materials that provide barrier against moisture, oxygen and light
- Materials that maintain freshness and prevent contamination
- More emphasis on environmental concern

- Food and consumer safety is not required.
- Barrier properties against moisture, oxygen and light is not required.
- Contamination is not a concern!
- Less emphasis on environmental concern.

Roadmap for adoption of bioplastics in food packaging

01 Bioplastics can be more expensive than traditional plastics.

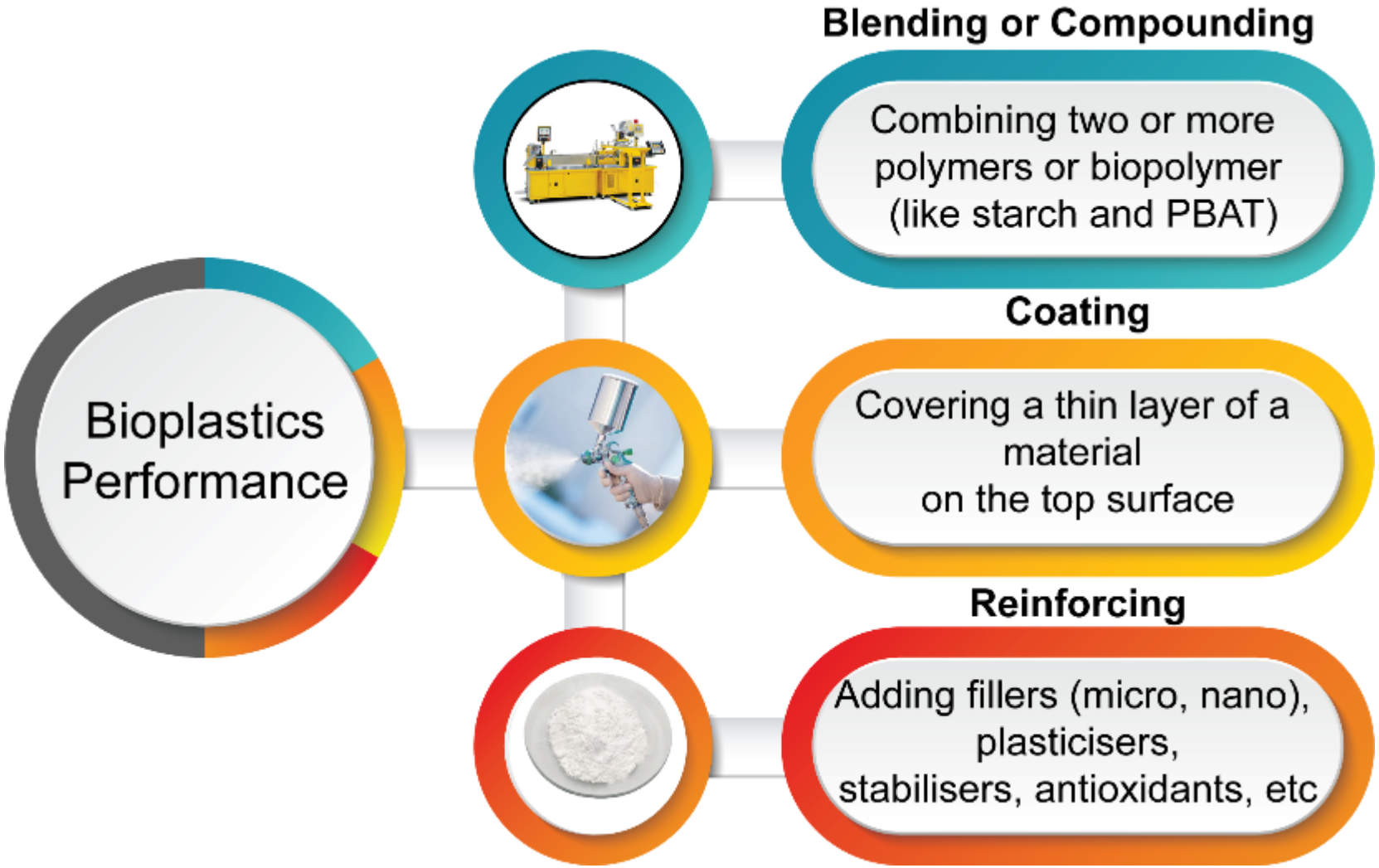
02 Bioplastics do not have the same performance of traditional plastics, such as durability and barrier properties.

03 Bioplastics are challenging to dispose of if proper infrastructure is lacking.

04 Bioplastics must comply with strict food safety regulations.

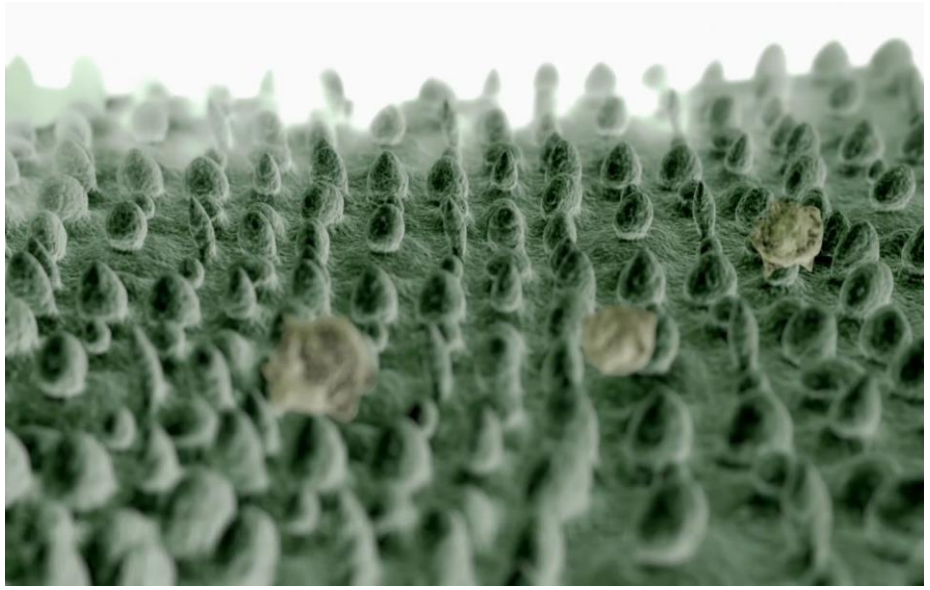
05 Consumers should be educated about the benefits and proper disposal of bioplastic food packaging.

How to improve the performance of bioplastic?



Natural Non-wetting: Lotus leaves

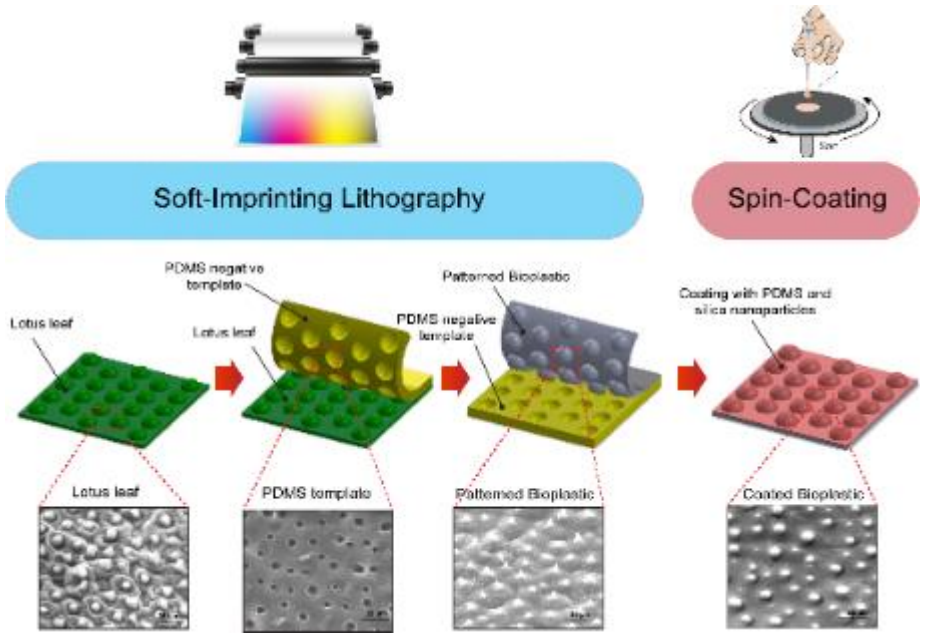
- Lotus leaves are well-known for their most water-repellent surfaces on earth and are almost impossible to get wet or dirty
- Any water that lands on the leaf remains as droplets, simply rolling off with the help of gravity or wind. The droplets sweep up dirt as they slide down, keeping the leaf clean
- Lotus leaves have a microtextured surface which reduces the available contact area for water and dirt particles



Ghasemlou, M., Daver, F., Ivanova, E. P., Adhikari*, B. (2019). Bioinspired Sustainable and Durable Superhydrophobic Materials: from Nature to Market. Journal of Materials Chemistry A. 7, 16643-16670.
Ghasemlou*, M., Oladzadabbasabadi, N., Ivanova, E. P., & Adhikari, B. & Barrow* C. J. (2024). Engineered Sustainable Omniphobic Coatings to Control Liquid Spreading on Food-contact Materials. ACS Applied Materials & Interfaces. 16(13) 15657–15686

Ghasemlou*, M., Le, P. H., Daver, F., Murdoch, B. J., Ivanova, E. P., & Adhikari*, B. (2021). Robust and Eco-friendly Superhydrophobic Starch Nanohybrid Materials with Engineered Lotus Leaf Mimetic Multiscale Hierarchical Structures. *ACS Applied Materials & Interfaces*. 13, 36558–36573

Nature-inspired Coated Bioplastics



SCAN ME!

We devised a hybrid method with two steps:

- 1) Imprinting with a lotus pattern
- 2) Coating with a thin layer of PDMS, a silicon-based organic polymer and silica nanoparticles.

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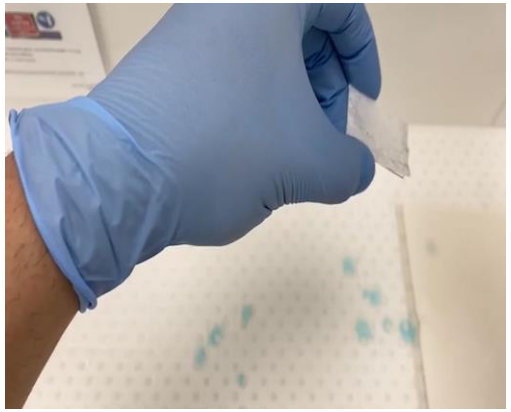
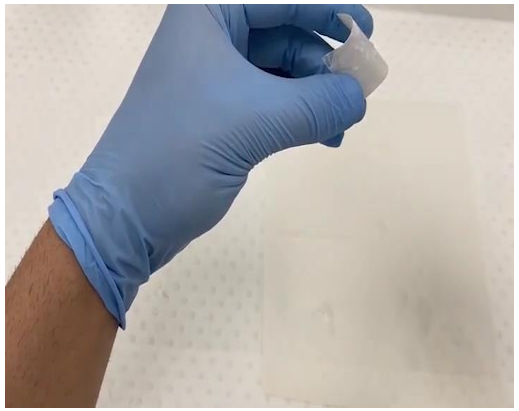
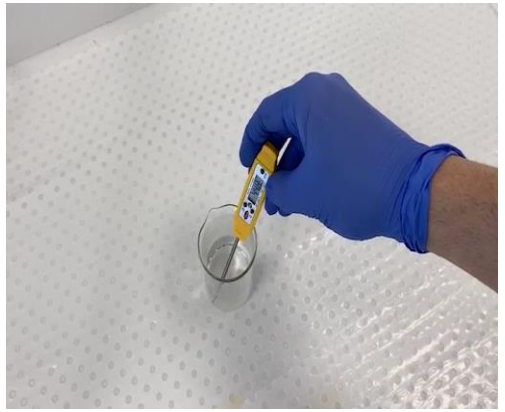
Durability



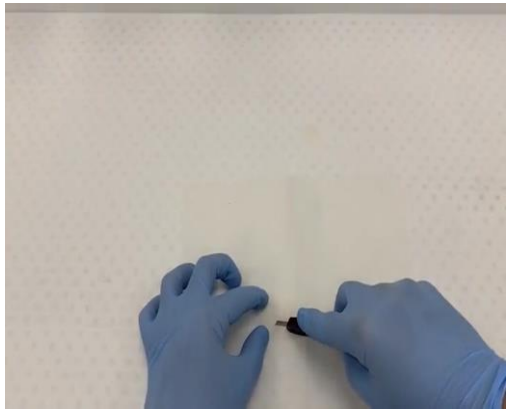
Video of water-impact test



Video of test of folded sample



Video of hot-water repellency test



Video of knife-scratch test

Coating was durable and could withstand harsh conditions!

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My team members at RMIT and Deakin

Prof. Benu Adhikari

Prof. Elena Ivanova

Prof. Colin Barrow

Assoc. Prof. Fred Pfeffer

Assoc. Prof. Fugen Daver

Nazila Oladzad

Prof. Minoo Naebe

Dr. Shima Jafarzadeh


Thank
You!