

Eco-bio Sanitary Pads: Reducing Period Poverty and Advancing Environmental Sustainability

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What is Our Priority?

The entire nature of the sanitary napkins has changed due to the plastic revolution

- **Health of Women/Girls!!**
- **Protection of Environment!**



Source: <https://gcgh.grandchallenges.org/challenge/innovations-materials-science-transformative-menstrual-health-and-hygiene-product-round>

Disposable Pads: A Double-edged sword

Period affluency: UK

Women use single use pads :
10,631,000 = 63%

Tampon: 6,124,000 = 37%

Total 2,104,938,000 single use pads/ per
years

They do not degrade for hundreds of years

~21,049 tonnes of menstrual
managements products into UK landfills.

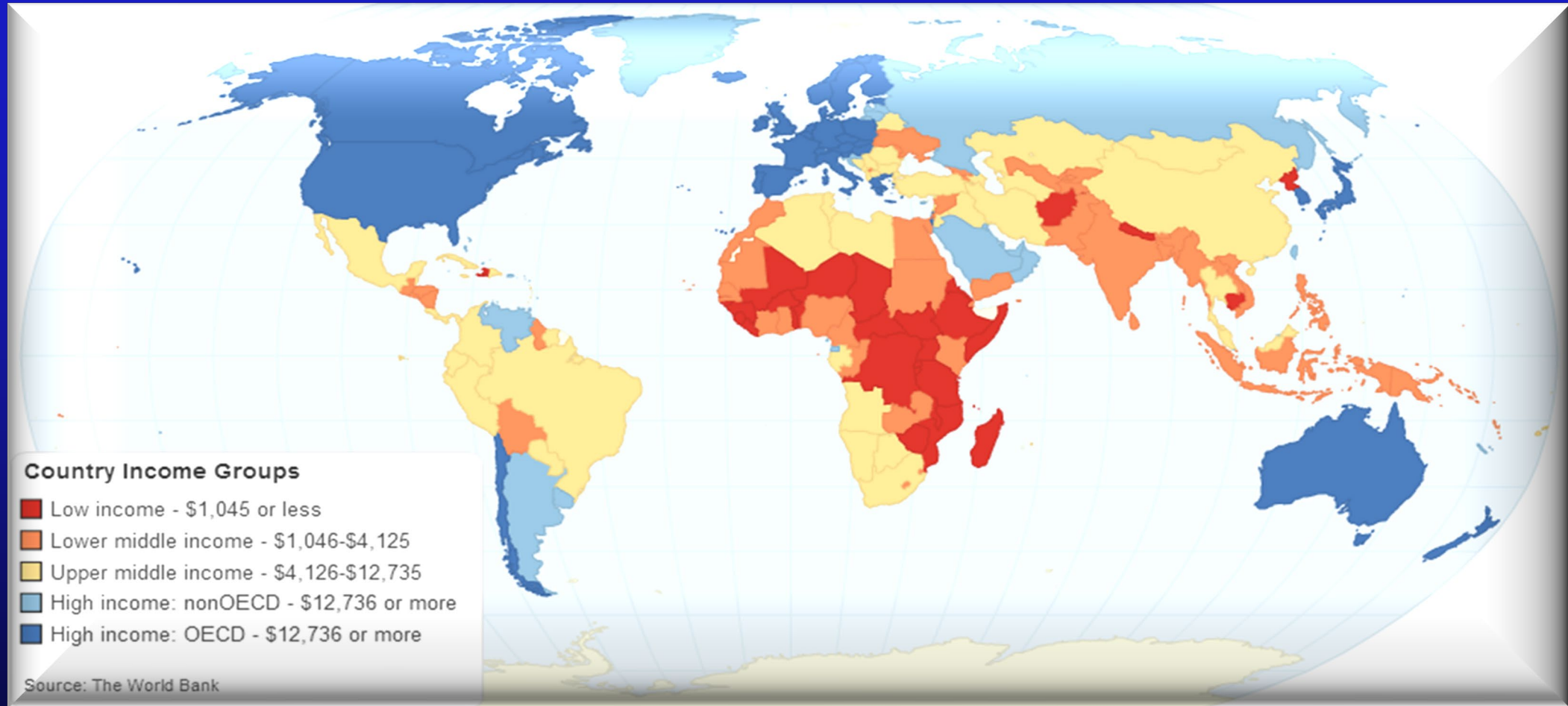
X 195 countries X 3 products (1).

Feminine care, (2). Baby care and. (3).

Adult incontinence products

Period Poverty

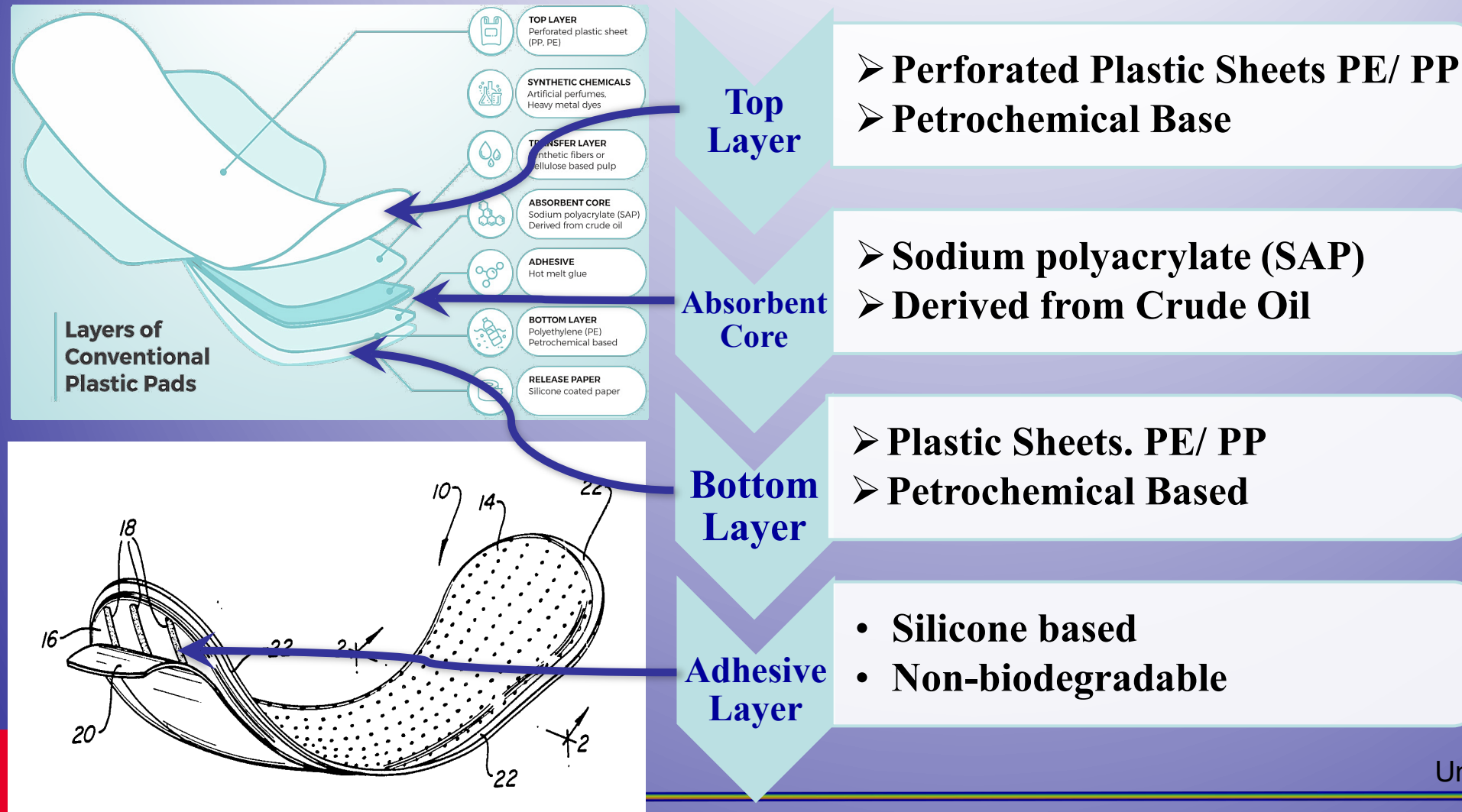
Period Poverty: Menstruation –A Taboo! A Health Problem!



There are ~1.32 billion girls and women aged 15-64 living in Lower-middle- and Low-income countries.

Feminine care Product : Menstrual Products and Sustainability

Sanitary Pads is a multi-layered Engineered Product



Worldwide
45 BILLION
Menstrual products are used every year
1 Sanitary Pad = 4 Plastic Bags

Examining the design of commercial sanitary pads

Super Absorbent Polymer: Specification: 80 X



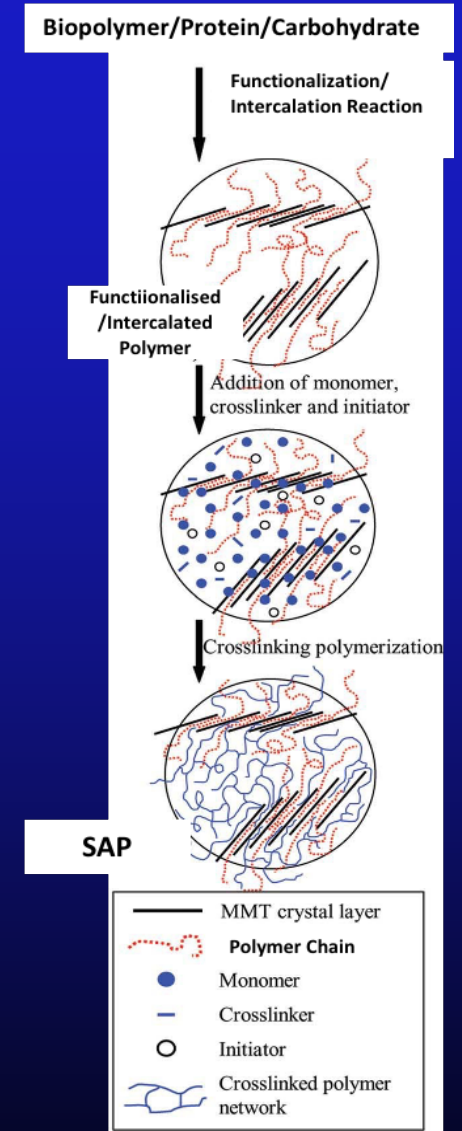
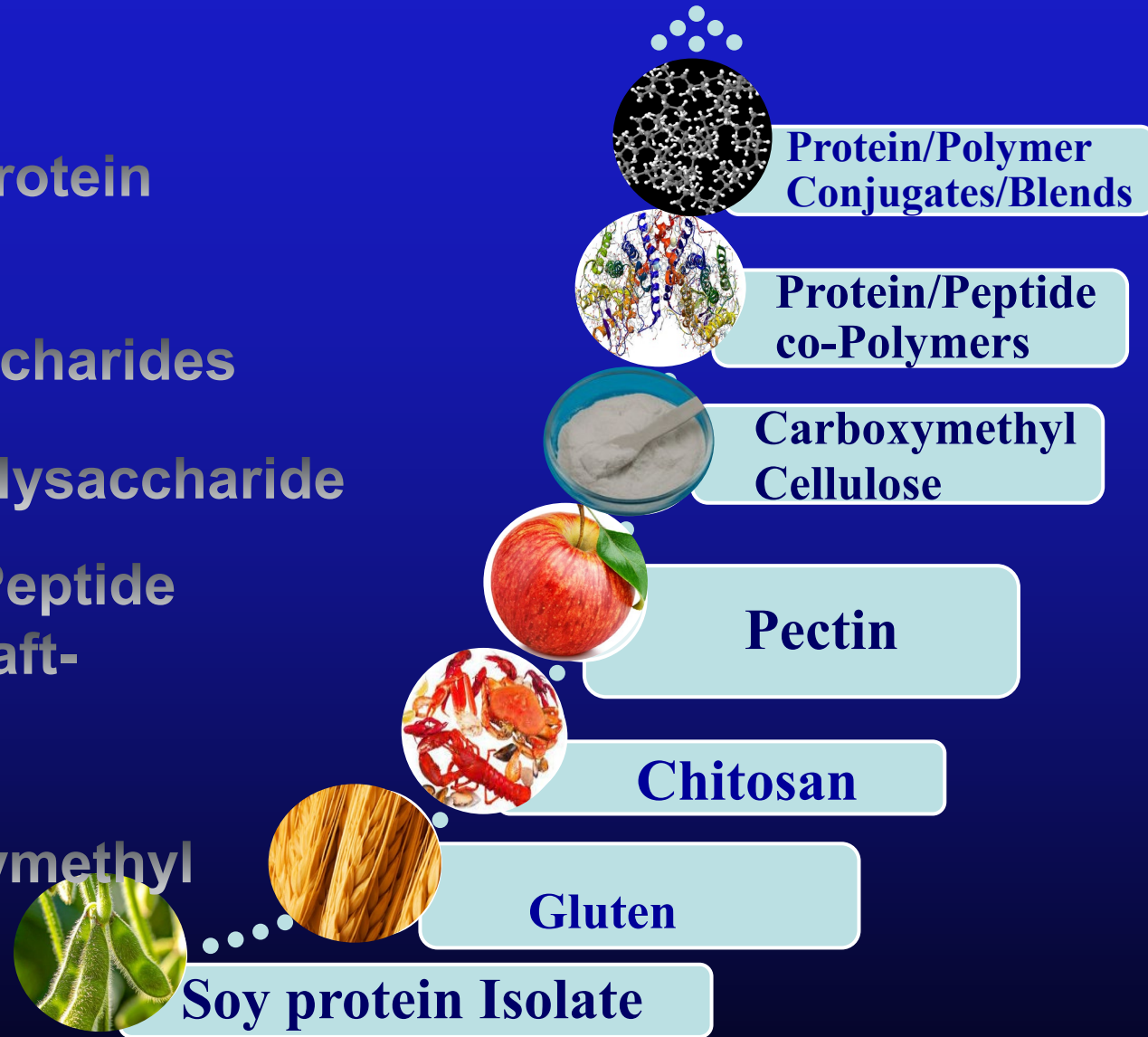
Name	Evamay Regular	Evamay Super	Libra Sport Regular	Libra Sport Super	Stayfree Light	Stayfree All night	Carefree Barely There	Carefree Original	Usport Super
Rating	2/4	3/4	2/4	3/4	1/4	4/4	1/3	3/3	-
Weight (Full pad)	~8.5 g	~10 g	~6.1 g	~7.1 g	~3.5 g	~9.7 g	~0.8 g	~1.7 g	~7.6 g
Weight (Core)	~5.3 g	~6.7 g	~3.1 g	~3.7 g	-	~6.3 g	-	~1.2 g	~ 2.7 g
Absorption	68x	76x	59x	62x	-	54x	-	33x	66x

*Sodium polyacrylate (SAP)

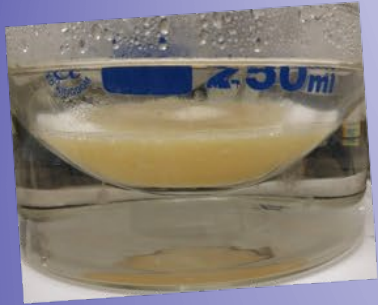
* Derived from Crude Oil

Our Research Focus: Bio-based Super Absorbent Polymer

- Plant Proteins
- Modified Plant Protein
- Polysaccharide
- Modified Polysaccharides
- Pectin : Heteropolysaccharide
- Protein-Polymer/Peptide
- Bioconjugates/Graft-Copolymer/
- Cellulose/Carboxymethyl Cellulose



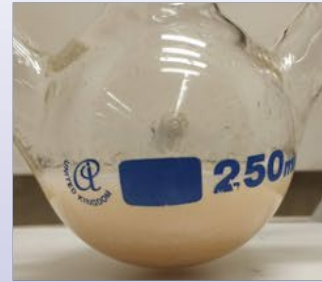
Synthesis: Bio-based Absorbent Polymer



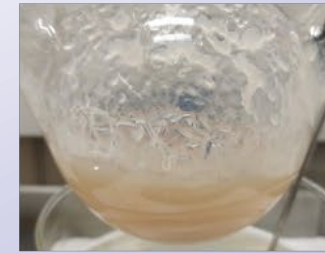
Plant Protein



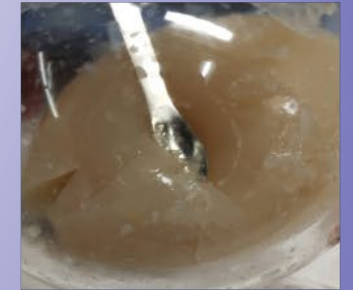
Adjust pH



Functionalization



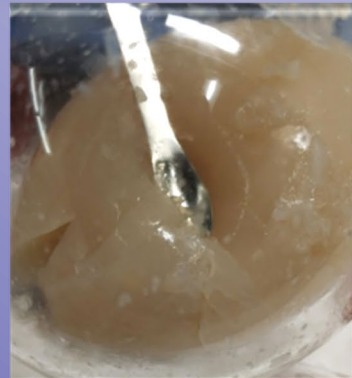
Chain Extension



Crosslinking



GEL-1



GEL-2



GEL-3

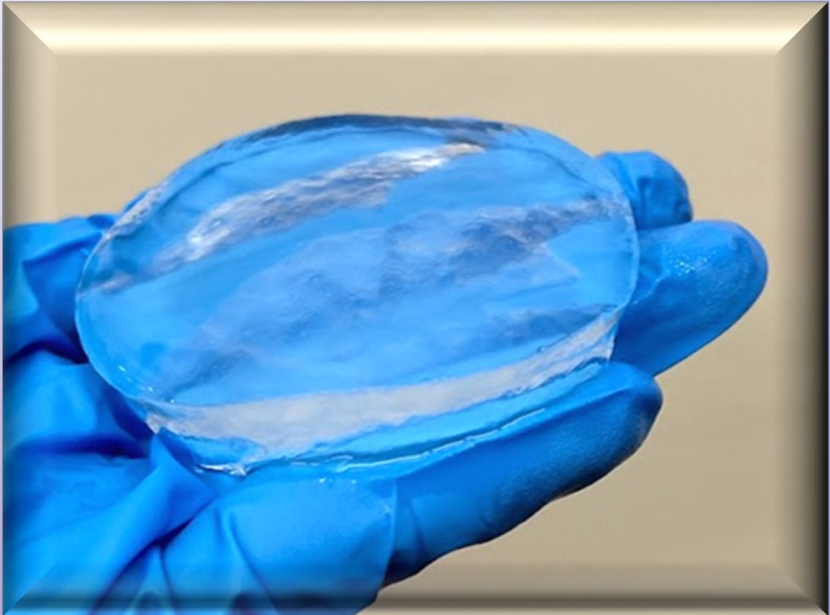
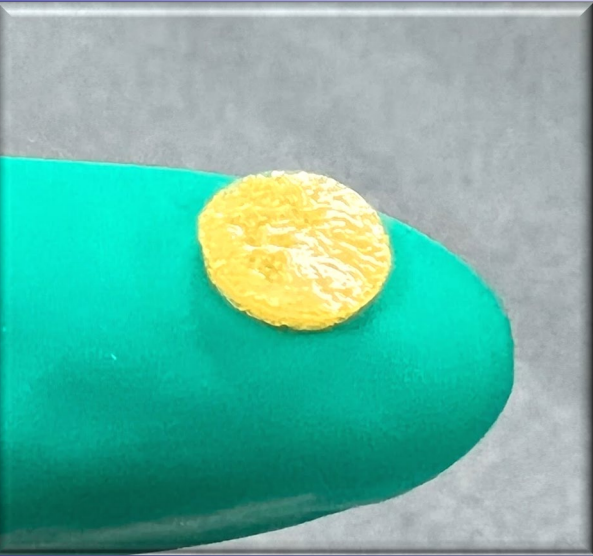


GEL-4



GEL-5

Water Absorption: Soy Protein Based SAPs for Eco-bio Sanitary Pads



Water uptake

226.471

247.438

268.412

287.176

Water uptake

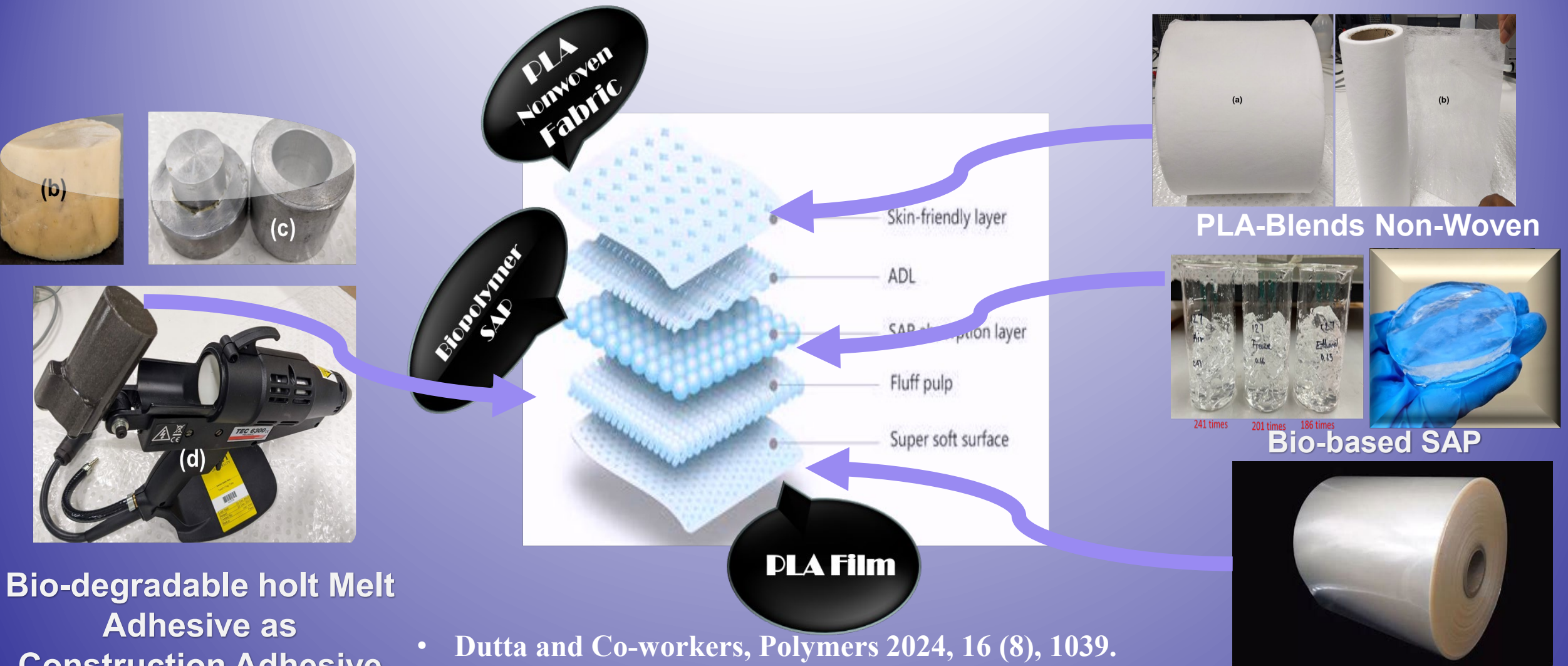
255.444

291.900

339.250

367.053

Eco-Bio Sanitary Pads: Materials Structure



Bio-degradable hot Melt Adhesive as Construction Adhesive

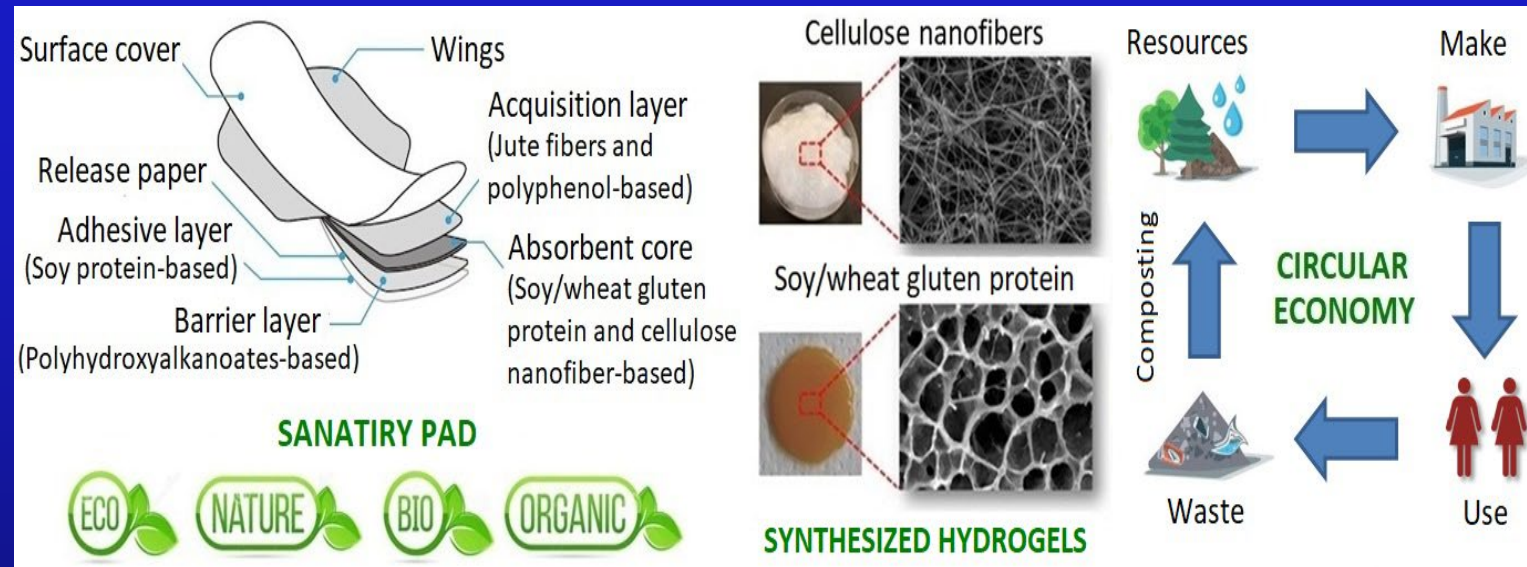
- Dutta and Co-workers, *Polymers* 2024, 16 (8), 1039.
- Dutta and Co-workers, *Polymer Engineering & Science*,

2024
Ending Plastic Waste Symposium 2024

Source: *Procedia Manufacturing* 35 (2019) 589–594



Fabrication : Eco-bio Sanitary Pads



- ❖ **Bio- Based**
- ❖ **Non-Toxic**
- ❖ **Water-as the Solvent**
- ❖ **Biodegradable /Compostable**

Collaborator: Essity Australasia

WHEN? HOW? WHERE? WHO? WHAT? WHERE? WHAT? When? WHEN? WHERE? WHAT? WHERE? HOW? WHEN? What? Where? When? WHERE? What? What? HOW? WHEN? What? When? Why? WHEN? When? WHERE? WHERE? When? Why? HOW? WHAT? When? What? WHEN? Why? WHERE? When? HOW? HOW? What? When? Why? WHEN? Why? WHERE? When? HOW?

ANY QUESTIONS?