Coatings Trends & Technologies SUMMIT

Ramadan Abouomar, PhD

PakItGreen

PakItGreen

We were working on PFAS alternative at Scops Coating Technologies

Then PakItGreen acquired Scops Coating Technologies

We developed a Technology that is not only PFAS-Free but also

Micro-plastic-Free and used biodegradable technology

Introduction

Plastics and microplastic dilemma

PFAS Enigma (very good performance, reasonable price, harmful for environment ; Forever chemicals)

Paper packaging why recyclability is important?

Our New Technology

requirements of the coating

Performance; water, MVTR, oil and grease

Introduction

Plastics in Packaging (36% of plastics are used in packaging)

Examples

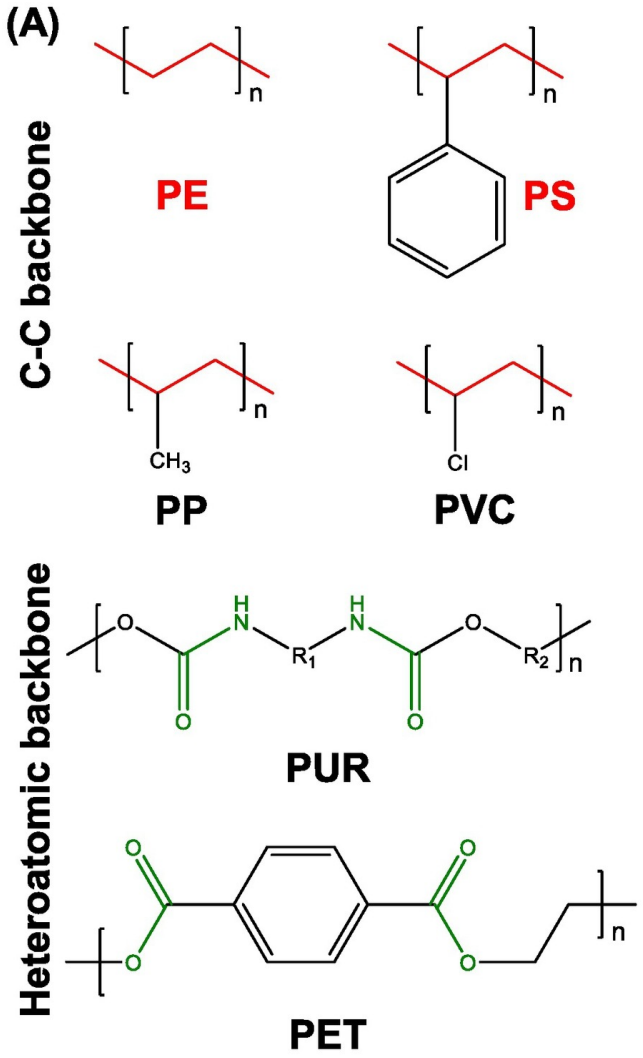
applications

paper cups

problems (<20% recycled; landfill; microplastics,.. global warming due to use of resources)

PakItGreen

Plastics



https://doi.org/10.1016/j.biotechadv.2022.107991

https://doi.org/10.3389/fmicb.2022.821629

Coatings Trends & Technologies SUMMIT

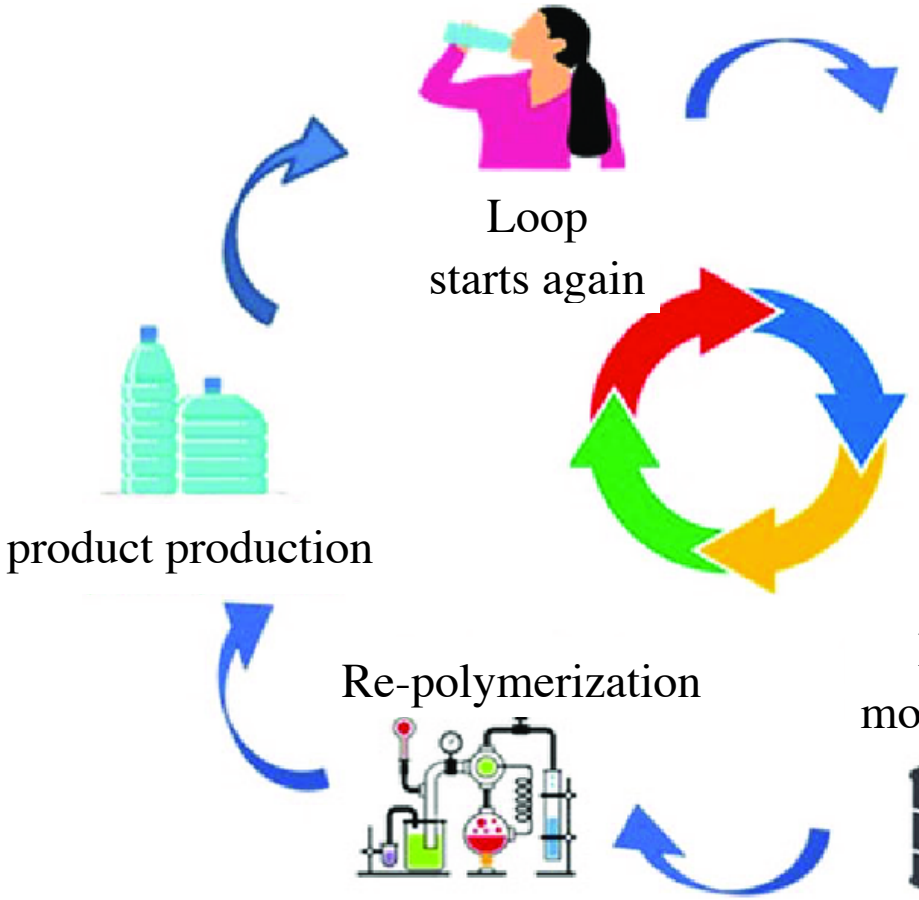
Landfill& Microplastic

Plastic pollution and micro-plastic

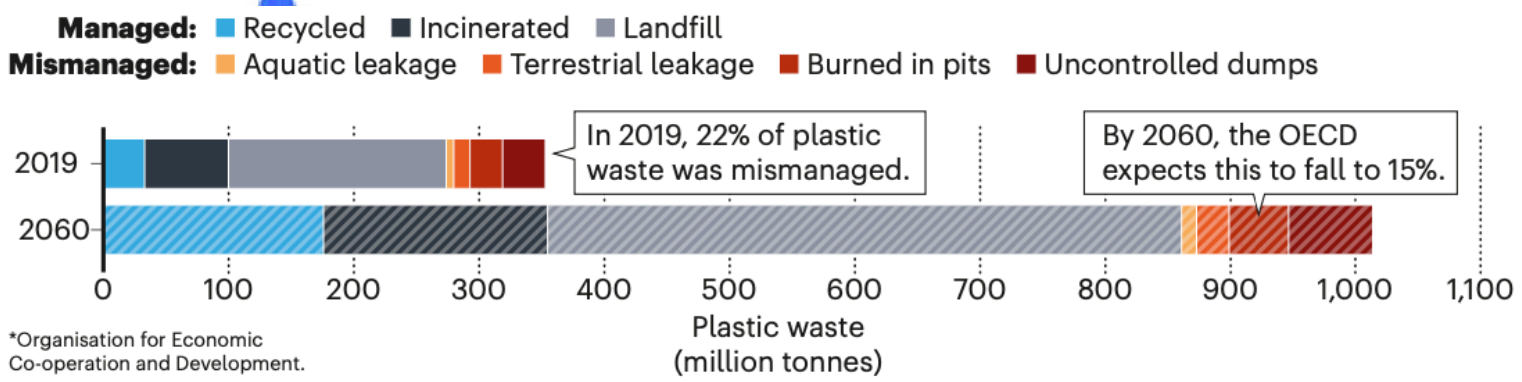
https://education.nationalgeographic.org/resource/microplastics/
https://education.nationalgeographic.org/resource/pollution/

Introduction

380 million tons of plastic are made every year. Is it truly recyclable ?!



WHERE PLASTIC WASTE GOES



18% recycled

https://grist.org/accountability/380-million-tons-of-plastic-are-made-every-year-none-of-it-is-truly-recyclable/

https://www.nature.com/articles/d41586-023-00975-5

PakItGreen

Paper cups?

https://www.jpost.com/environment-and-climate-change/article-756288

Coatings Trends & Technologies SUMMIT

PFAS

PFAS: Great performance with bigger problems

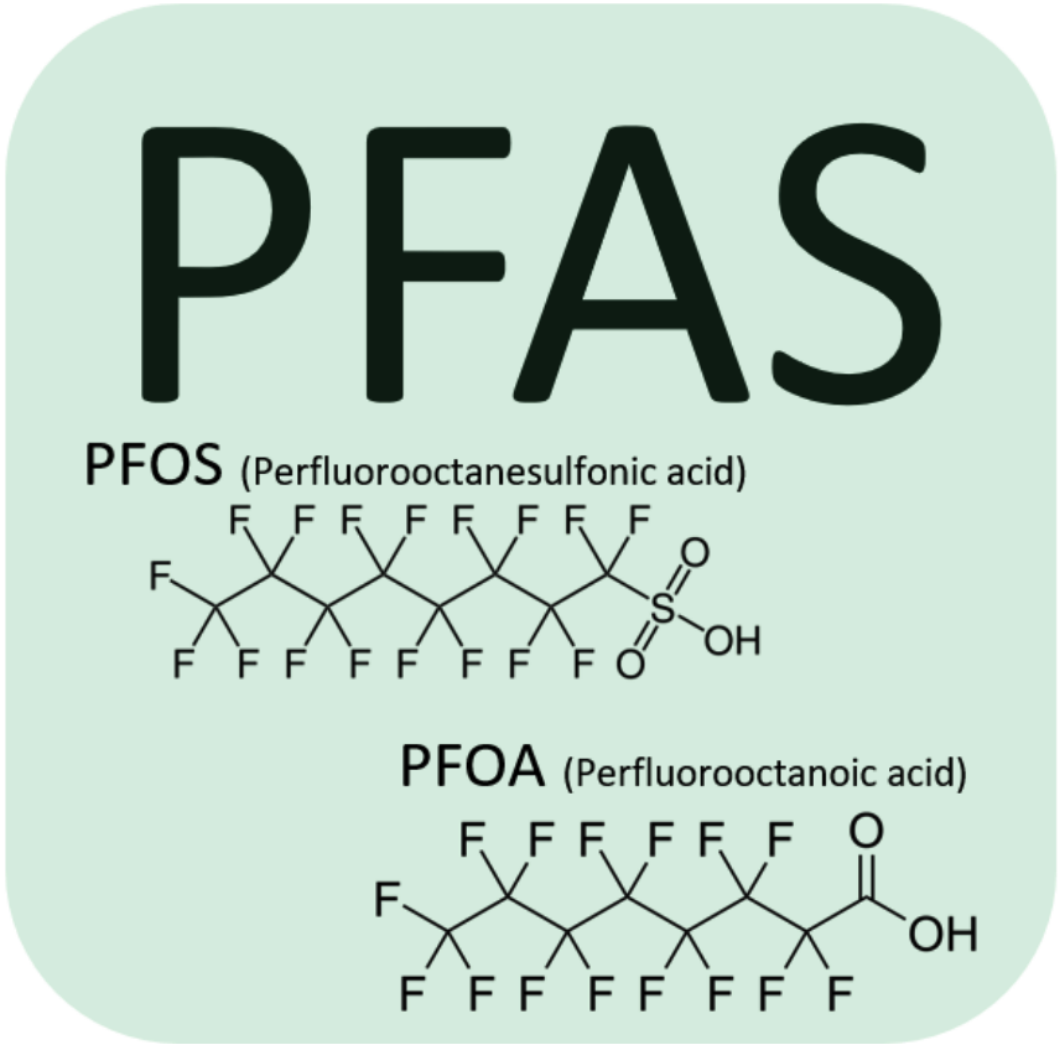
PFAS structures What are PFAS?

What are the applications? why? performance!

What are the problems?

PakItGreen

What is PFAS?

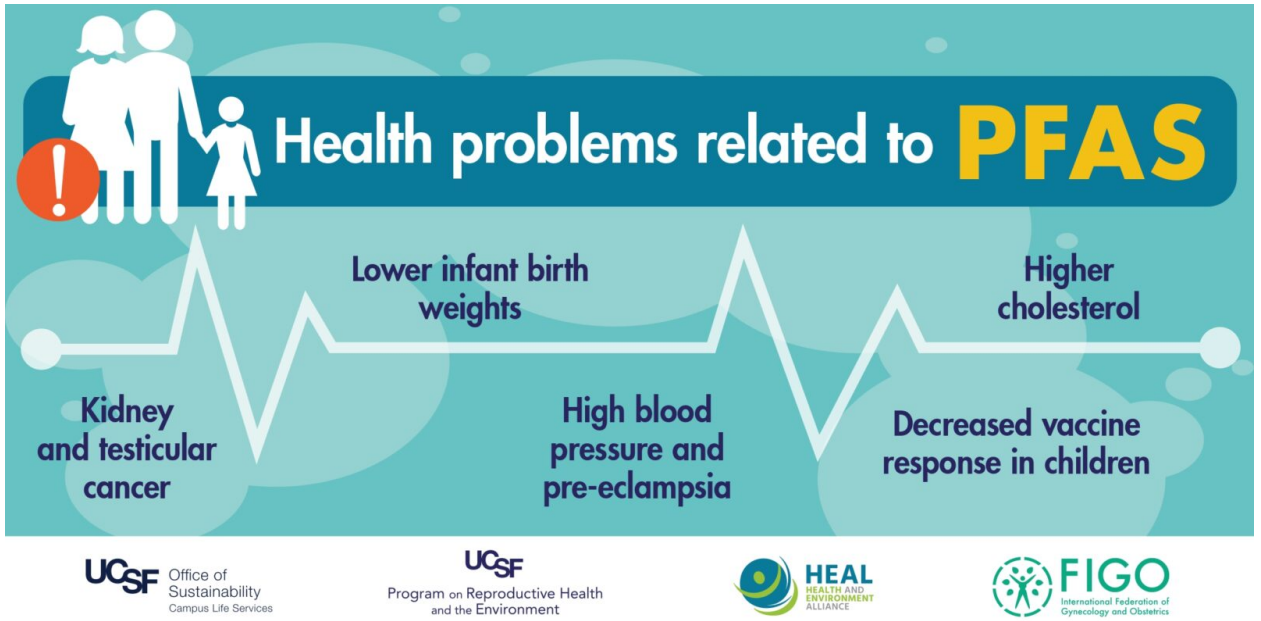


https://www.portco.com/portco-packaging/the-path-of-pfas
https://news.sundanceusa.com/news/what-you-need-to-know-about-pfas-in-packaging

Coatings Trends & Technologies SUMMIT

PakItGreen

PFAS and Health



https://www.env-health.org/how-pfas-chemicals-affect-women-pregnancy-and-human-development-health-actors-call-for-urgent-action-to-phase-them-out/

PFAS future uncertain

PFAS leads the future of fluorinated coatings to doubt

POLLUTION

Michigan declares state of emergency in town with high PFOS, PFOA levels in drinking water

Source of perfluorocarbon pollution as yet unknown, state says

by *Cheryl Hogue*

AUGUST 1, 2018 | APPEARED IN VOLUME 96, ISSUE 32

Volume 95 Issue 41 | p. 11 | News of The Week
Issue Date: October 16, 2017 | Web Date: October 10, 2017

DowDuPont, Chemours named in GenX lawsuit

Replacement for troublesome fluoropolymer processing aid is the target of a class-action suit

By *Marc S. Reisch*

EAST METRO

3M settles groundwater lawsuit for $850 million

The money will be used to clean up drinking water and groundwater contamination in east metro communities.

By Josephine Marcotty Star Tribune | FEBRUARY 20, 2018 — 10:35PM

Packaging Alternatives

How to solve the packaging problems?

1- Technology to improve recycling

2- Create new kinds of plastic

Why recyclability is important?

PakItGreen

Impact of recycling

1 Ton Recycled paper saves

17 trees

381 gallons oil

7000 gallons Water

3 Yard Landfill

4000 Watts of Energy

https://www.moldedfiber.com/

https://www.weilaipak.com/?campaign=Sales-Search-1&device=c&keyword=molded%20fiber%20packaging%20manufacturer&matchtype=e&gad_source=1&gclid=Cj0KCQjwzva1BhD3ARIsAJ0uPnYvQVYLpXrTfLsD6KEE7a8ceVEqwKKBWbL_czFcKbxDGOFU-Vly1_waAu-mEALw_wcB

Novel Technology

Our Water and OGR portfolio has many interesting products including:

1- Water and OGR paper coating (biodegradable coating)

2- OGR for molded Pulp; it is fluorine-free additive

3- Composites with fibrous materials for food applications (Yogurt cups)

PakItGreen

Biodegradable coating

Our Water and OGR Paper coating with the features:

1- Biodegradable (100%)

2- Compostable

3- Environmentally Friendly

4- Kit rating (12) ASTM F119-8 @60-65 ^{o}C (> 20 hrs), Oil test >5 hrs

5- Cobb value of <2 after 30 min

6- Heat-sealing for some formulas

7- Good MVTR (work in progress)

PakItGreen

Substrates

Our technology is suitable for many fiber-based substrates including but not limited to:

1- Kraft papers

2- Cardboard

3- Cellulose fibers

4- Pizza boxes

Rational Design

Variety of starting materials to account for:

1- film formation

2- Water resistance

3- MVTR

4- OGR

5- Mechanical properties Hardness; toughness

6- Price ?!

7- Biodegradability

Barrier Performance

MW and MWD

Morphology

Crosslinking

Tg

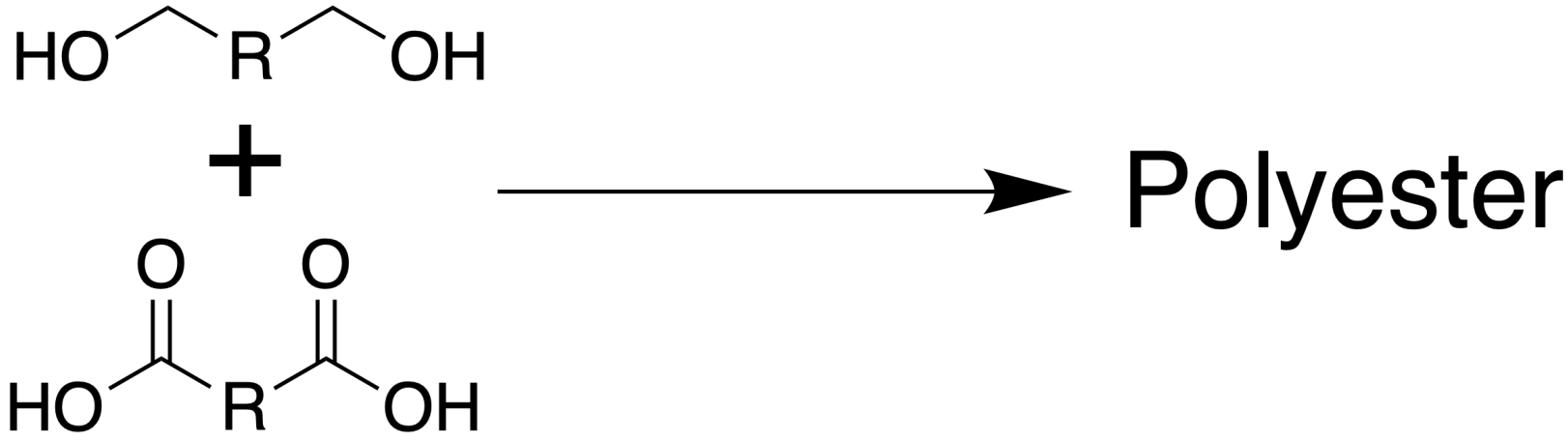
Solubility parameter

Polarity

Additives/Fillers

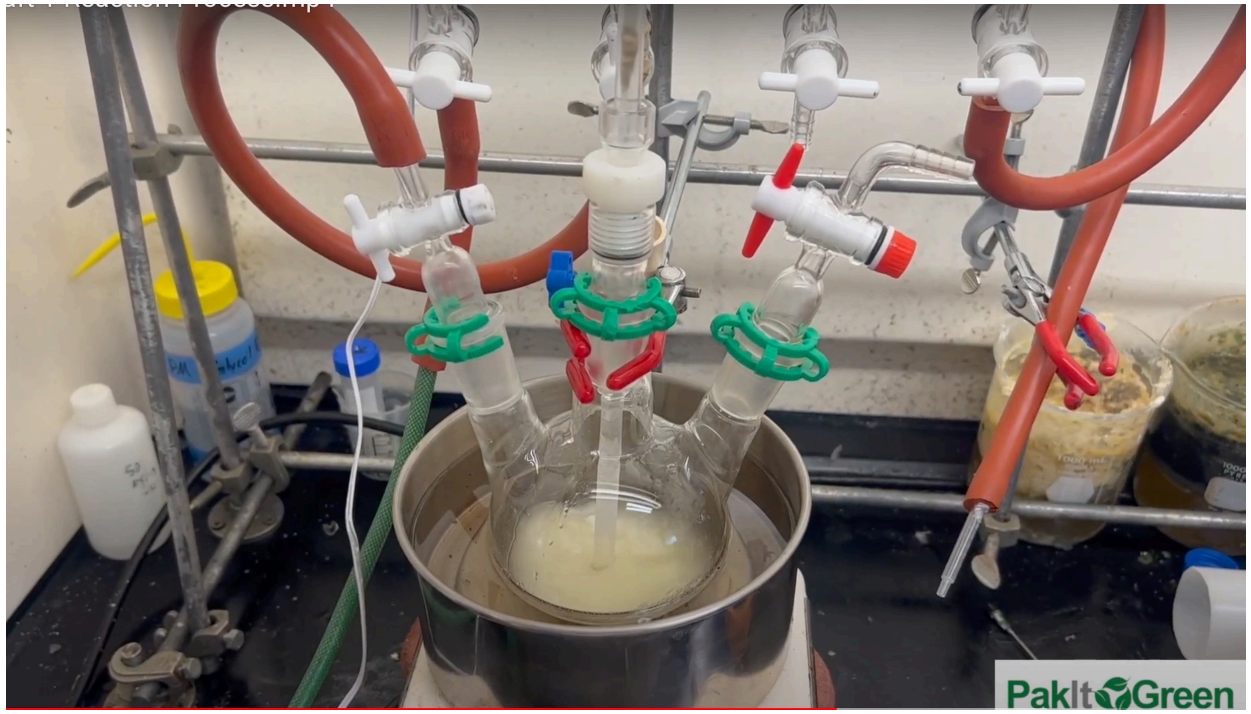
Experimental

- **Biodegradable coating is based on Polyester chemistry with modified structure to improve the OGR/Water performance and to enhance the biodegradability of the coating**



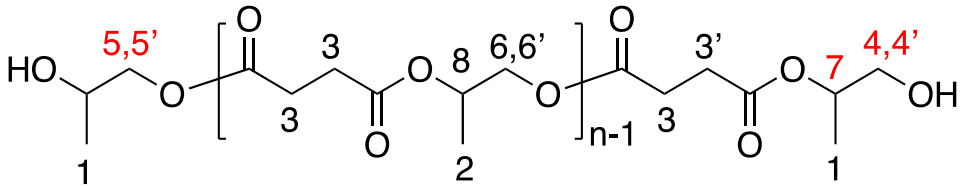
Polymerization& emulsion

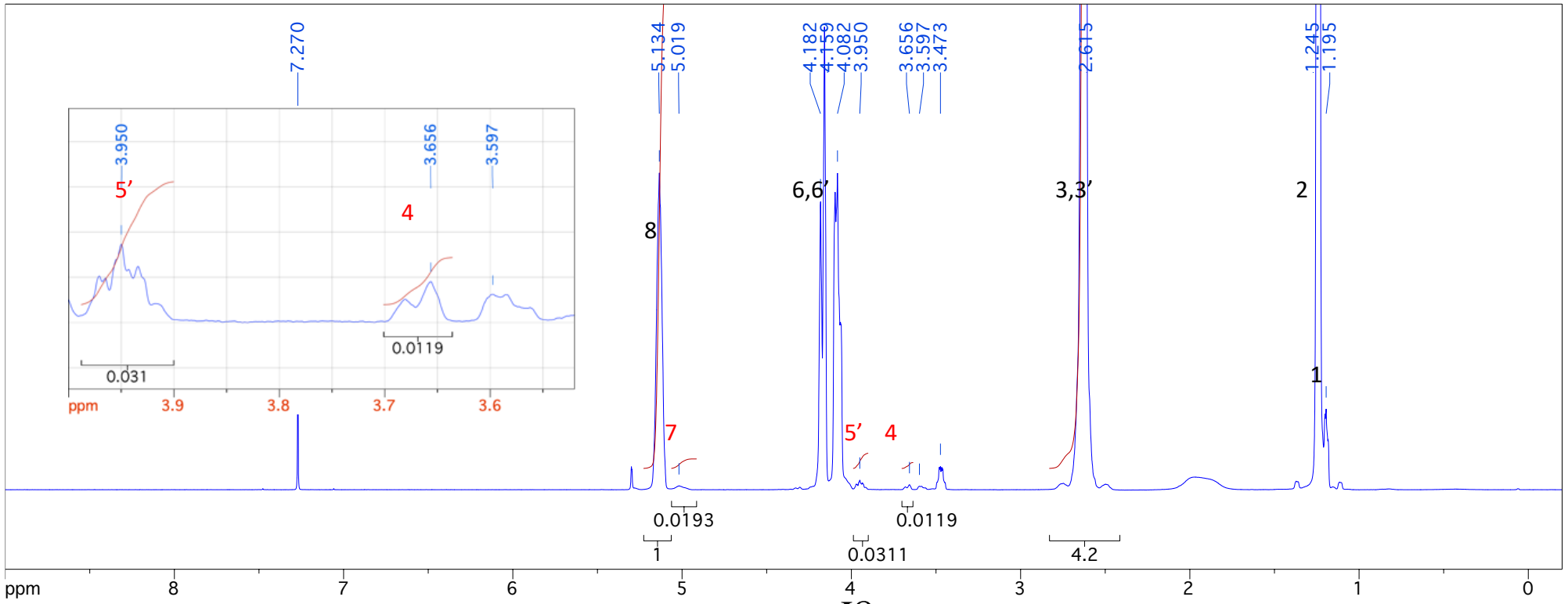
1- Polymerization



2- Emulsification

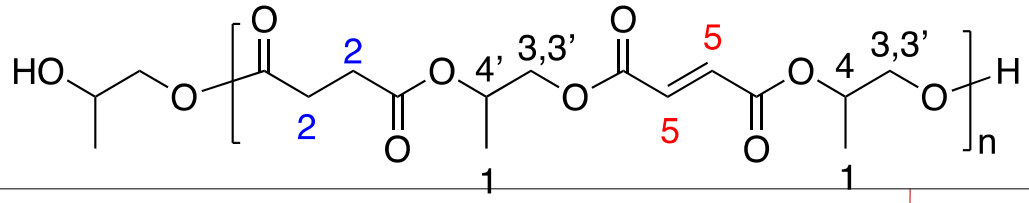
Chemical characterization

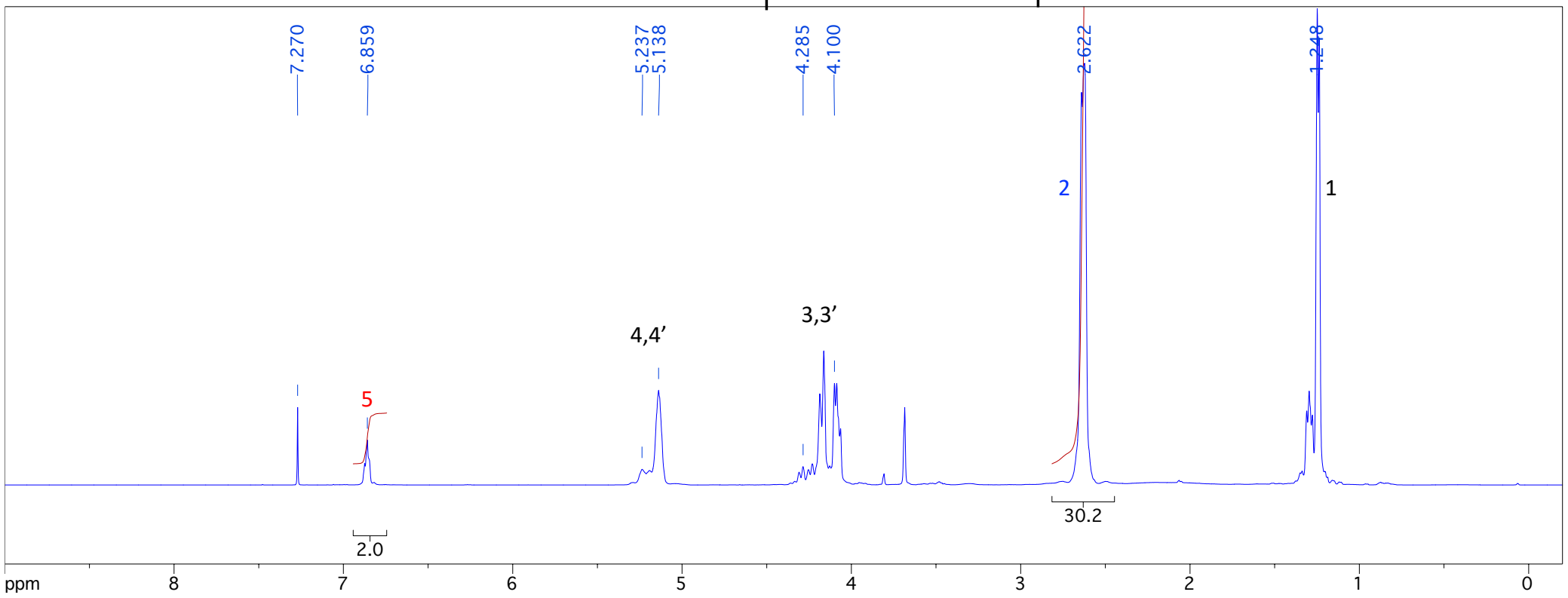




$$Mn\ (\mathrm{NMR}) = 158 * \frac{I8}{(I4 + I5 + I7)/3} + 158 + 76$$

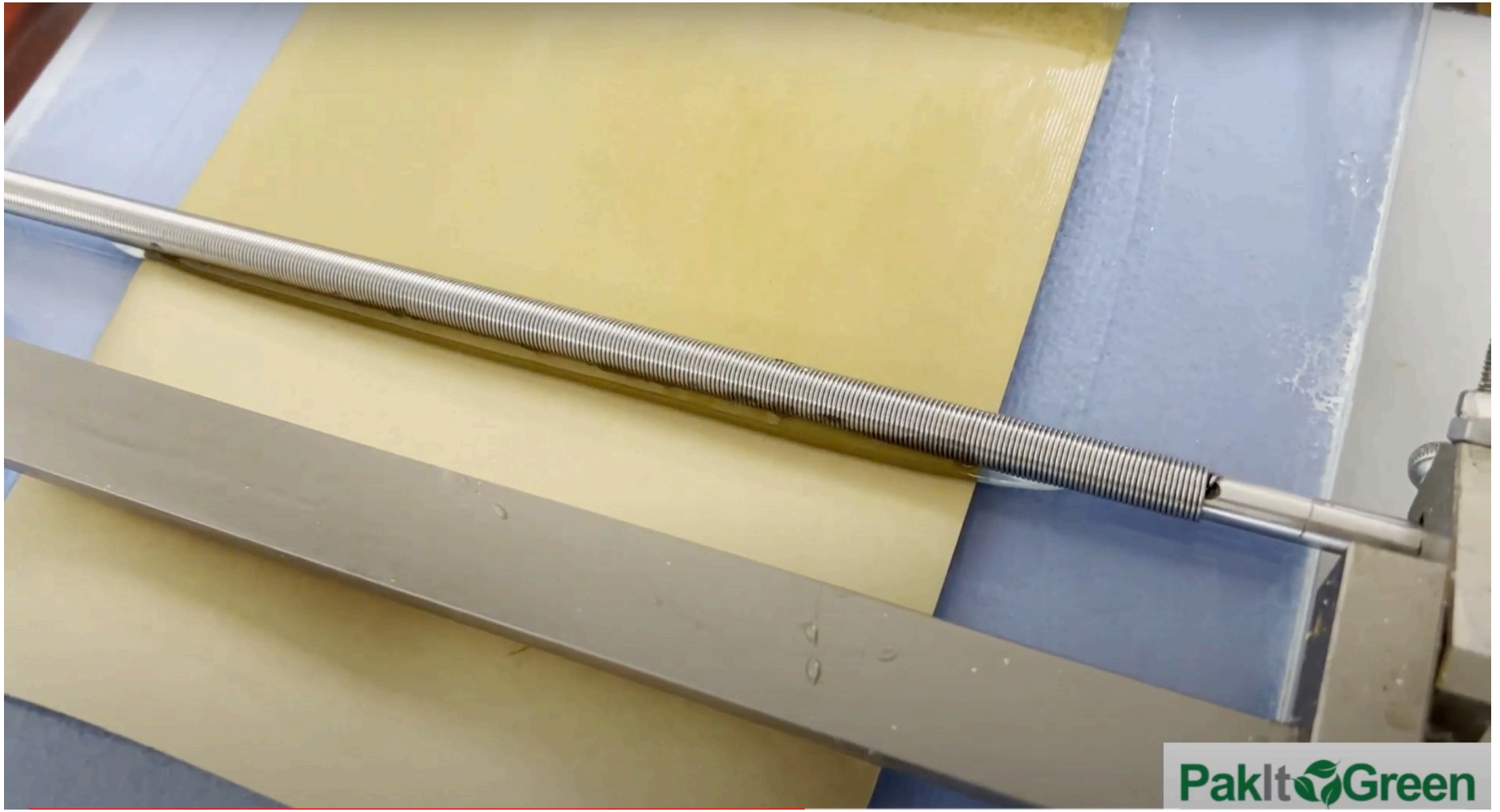
Chemical composition





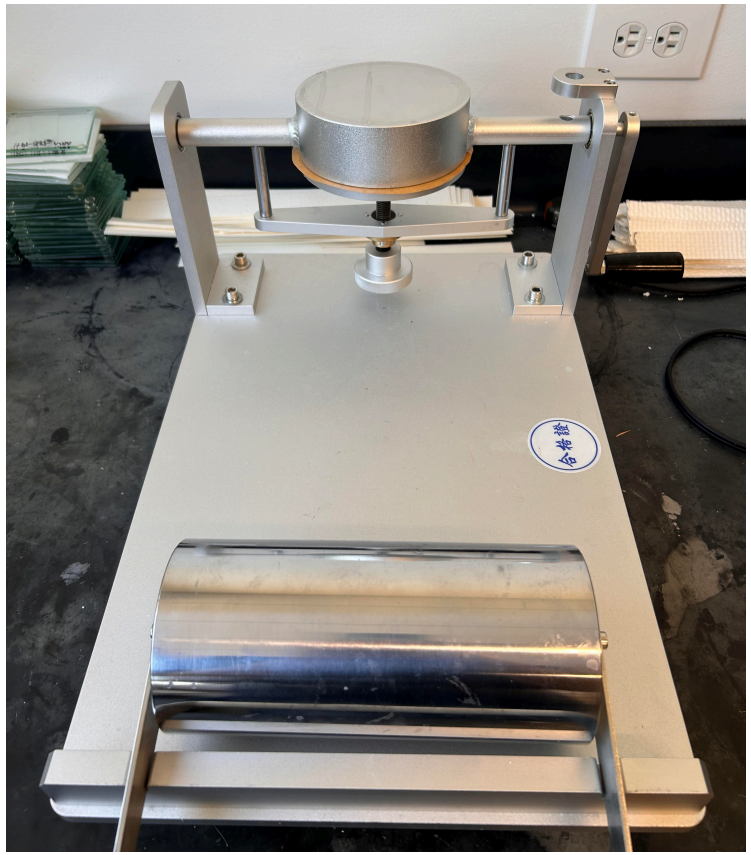
$$\text{Mole \% fumarate} = \frac{I5/2}{(\frac{I2}{4}) + (\frac{I5}{2})} * 100$$

Paper coating



Control GSM

Water test methods

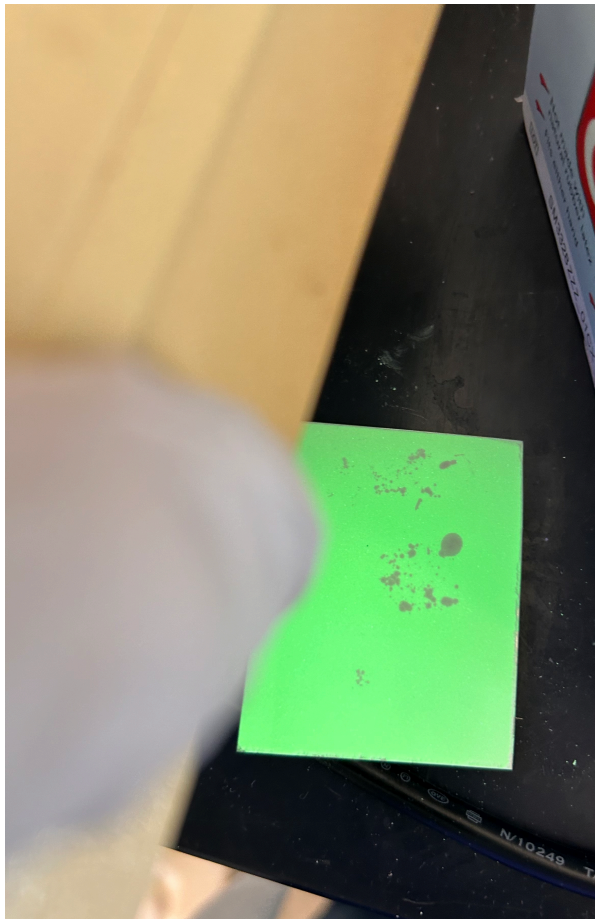


Cobb Method: used to measure water (liquid) permeability

ASTM E96 MVTR: used to measure water vapor transmission rate

Oil test methods

Two samples in the Oven
Left sample: ASTM F119-8
Right sample: Oil-boat test



We use UV light to test for oil penetration

PakItGreen

Performance

Composition	GSM	Cobb Value	Kit Rating	Oil test	ASTM F-119-8	Remarks
HD1-7a	42	2	12	100 min	-	
HD1-7b	39	6	12	140 min	-	
DW1-9a	40	<2	12	264 min	>24 h	Additive
DW1-9c	51	<2	12	133 min	>24 h	Additive
DW1-22a	18	<2	12	263 min	>24 h	Additive
DW1-22b	18	<2	12	127 min	>24 h	Additive

PakItGreen

Water resistance

Composition	GSM	Cobb Value	Water boat
HD1-7a	42	2	> 4 days
HD1-7b	39	6	> 4 days
DW1-9a	40	<2	> 4 days
DW1-9c	51	<2	> 4 days
DW1-22a	18	<2	> 4 days
DW1-22b	18	<2	> 4 days

PakItGreen

MVTR

DW 1-40-1	
WVT (g/m2*day)	99.3
GSM	23.51
Additive	To Be Disclosed

DW 1-40-8	
WVT (g/m2*day)	82.60
GSM	22.55
Additive	To Be Disclosed

DW 1-40-16	
WVT (g/m2*day)	139.44
GSM	27.52
Additive	To Be Disclosed

DW 1-40-12	
WVT (g/m2*day)	175.82
GSM	23.49
Additive	To Be Disclosed

PakItGreen

OGR

Composition	GSM	Kit Rating	Oil test	ASTM F-119-8	Remarks
HD1-7a	42	12	100 min	-	
HD1-7b	39	12	140 min	-	
DW1-9a	40	12	264 min	>24 h	Bio-Additive
DW1-9c	51	12	133 min	>24 h	Bio-Additive
DW1-22a	18	12	263 min	>24 h	Bio-Additive
DW1-22b	18	12	127 min	>24 h	Bio-Additive

PakItGreen

Summary

- Any Emerging technology must be PFAS-Free and create no Microplastics
- Technology use biodegradable materials to formulate water, oil and grease barrier coating
- Technology is suitable with any Cellulose-based substrates
- Oil resistance of more than 4 days at room temperature, more than 24 hours at 60 oC was fabricated
- Water resistance of more than 4 days at room temperature, and cobb of less than 2
- MVTR of 2 digits is achievable with promising to go to lower MVTR (<20 g/m2.day)

PakItGreen

Thank you

Coatings Trends & Technologies SUMMIT