AACOMA

Demo project #4

Title: A Biodegradable and Biobased Intumescent Flame-retardants for polymer composites

Lead partner: AMIBM

Motivations

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Potential fire risk of polymers

Why Flame Retardants?

Fire accidents

Smoke and heat

Death and financial loss

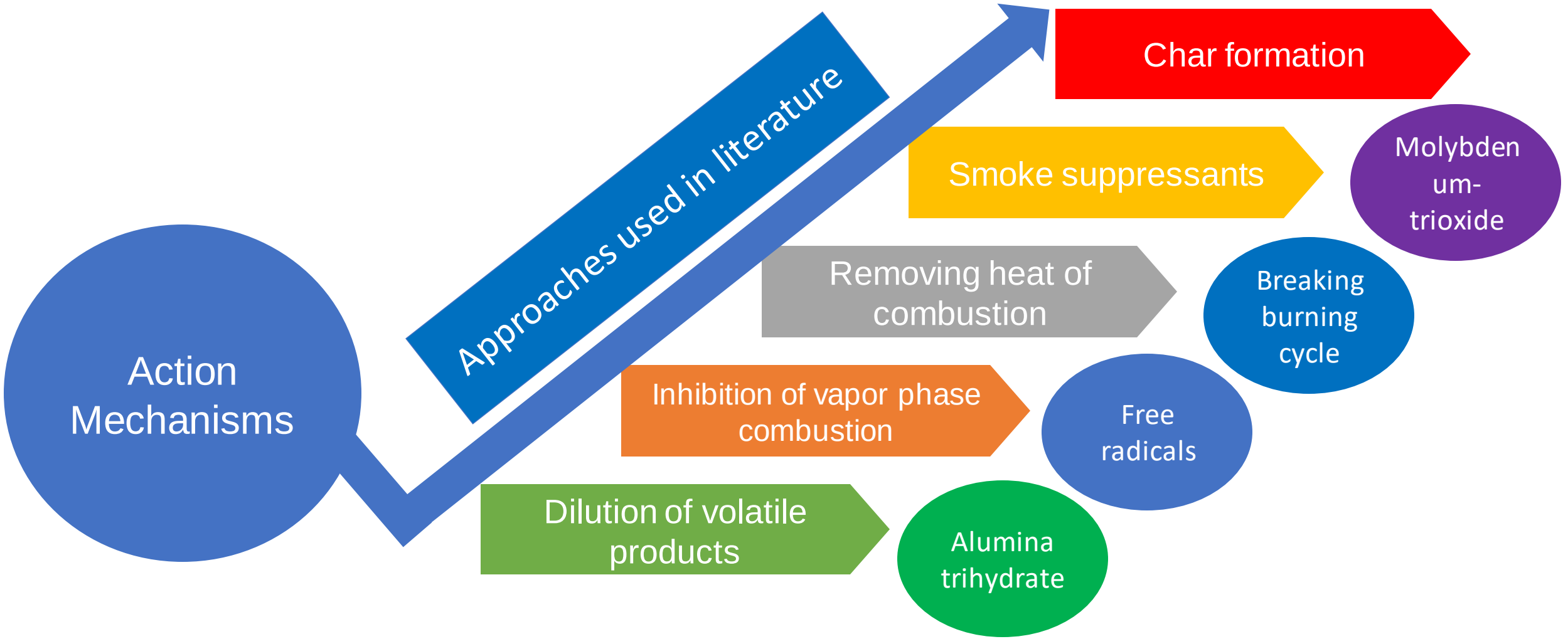
FR additives are used in polymers to improve their flame-retardancy against fire hazards

Majority of the frequently used polymers burn quite briskly

2.0 – 2.5 million fire accidents in Europe in 2018 [1]

60% of the deaths were caused by smoke inhalation [2]

State of the art



Intumescent flame-retardants

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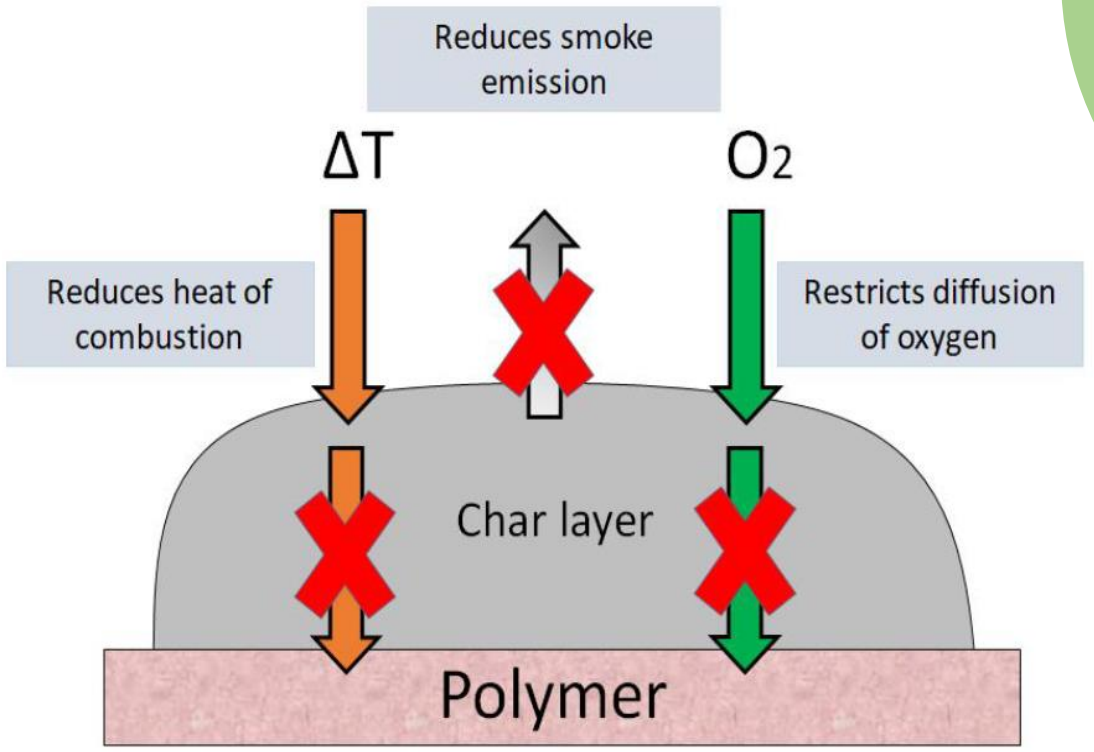
Acid source $Mg(OH)_2$

Carbon source (PER)

Blowing agent (Melamine)



Technical Problems of PER as carbon source

- PER has higher water solubility
- Sensitive to hydrolysis
- Lower decomposition temperature
- PER not biodegradable

Environmental and health problems

- $Mg(OH)_2$ not biodegradable
- PER not biodegradable
- Melamine not biodegradable

What we want to achieve?

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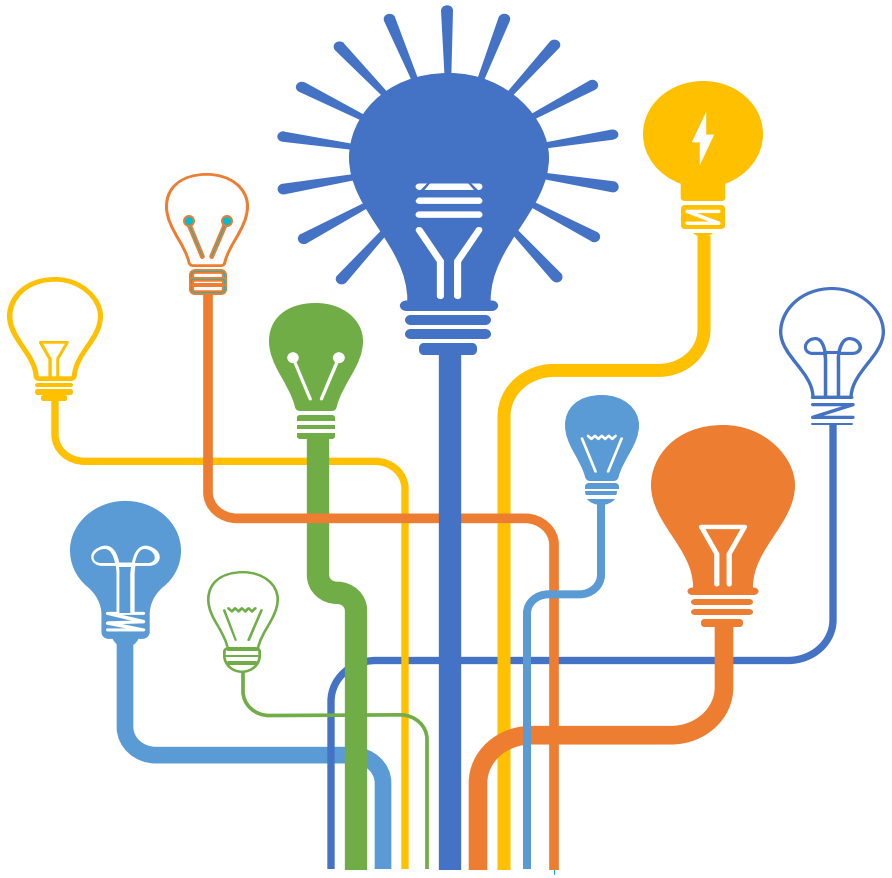
To have biodegradable IFR's what is needed?

Have biodegradable acid and carbon sources with carboxyl and hydroxyl functional groups

Have minimum water solubility to enable thermal processing

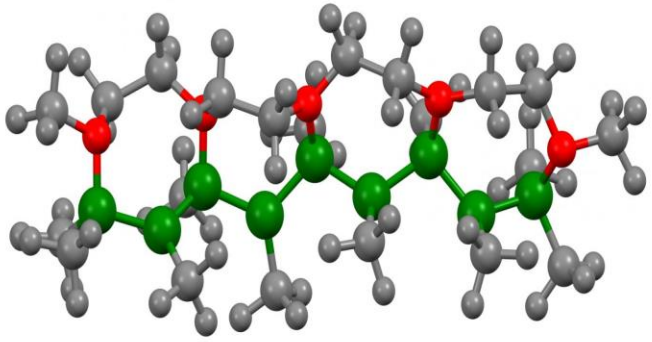


Have biomolecules that can be melt-processed further for engineering application

Do not release toxic compounds like dioxins and fulfill REACH regulations

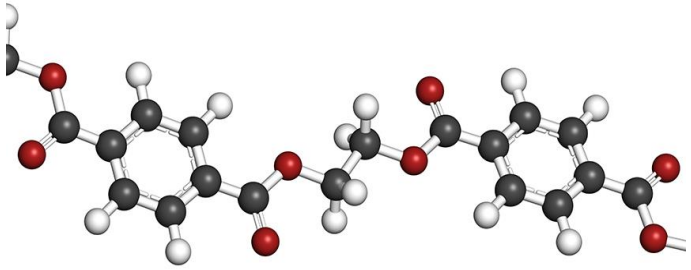
Materials selected for biodegradable flame-retardants

- Very low solubility in water
- Do not require blowing agent
- Higher thermal stability
- Biodegradable



- Melt-processing is possible
- Biodegradable
- Higher thermal stability
- Possess necessary functional groups for charring effect

- Better FR properties than PET
- Available in different grades
- Melt-processing is possible
- Biodegradable



- Biodegradable
- Possesses necessary functional groups for charring effect
- Melt-processing is possible

Benchmark properties in the composites

- To obtain Limiting oxygen index equal to or above 28%
- To achieve V-0 rating in UL-94 vertical burning test
- To attain peak heat release rate below 400 kW/m^2
- To accomplish effective heat of combustion below 15 kJ/g

- To achieve total smoke production below 300 m^2/m^2
- To obtain rating E in ignitability test
- To optimize additives composition
- To upscale production to industrial scale

Partners involved and Timeline

Partner	Task	Role of partner
AMIBM	Materials procurement	Facilitating in finding the suppliers for the right material and cost performance benchmarking
AMIBM	Compounding	Producing PLA/APP/Lignin compounds
SIRRIS	Comp. molding	Compression molding and samples for Burning behavior
CENTEXBEL	Burning behavior tests	LOI, time to ignition
Industrial partner	Upscaling 3D printing	???

Task title	Responsible Partner	Duration
Compounding PLA/Lignin	AMIBM	04-2021
Compression molding	SIRRIS	06-2021
Burning behavior tests	CENTEXBEL	08-2021
Application	???	04-2022

Thank you!

DEMO #4 project Leader

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