



BIOBASED ADDITIVES FOR POLYMERS

InCrops Project Meeting, Cambridge

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About BC

- Specialist research and knowledge transfer group developing new products and materials from natural products
- All project work is undertaken collaboratively with industrial partners



CASE STUDY 1

Thermosetting polymers – bio-resins

- A resin or resin formulation derived from a biological source
- e.g., soybean oil, collagen, casein, blood, starch, tannin



Issues with current thermoset resins

- Volatile components
- Toxic
- Non-sustainable
- Pollution prevention and control regulations



The case for bioresins

- Improved health and safety in manufacturing
- Better environmental profile of manufacturing processes
- New bio-based product lines with higher sales and margins
- Energy savings in processes replacing aqueous resins with oils
- Marketing advantage offered by formaldehyde-free resin usage in products
- Sustainable raw material supply and price stability



The processing steps



Rapeseed oil

Ozonisation
(ozone gas)

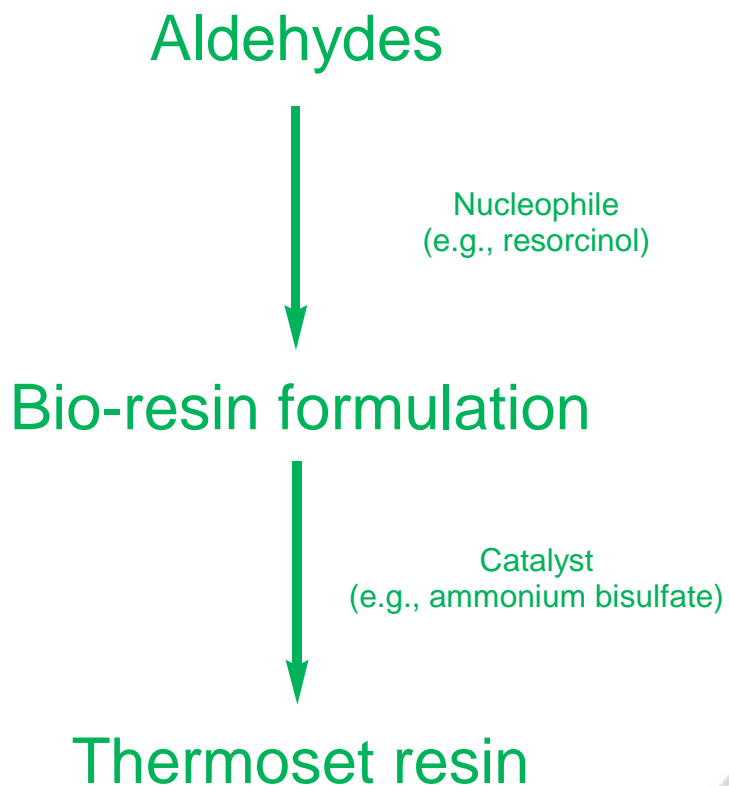
Ozonide intermediates

Reduction
(hydrogen gas)

Aldehydes

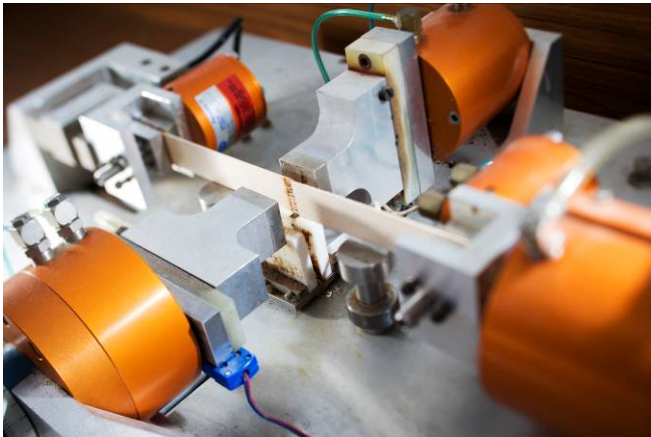


Bio-resin formulation



Results in wood-based panels

- Resin formulated with resorcinol
- IBs in range 0.5-0.6 MPa





Status of technology

- Pre-commercial
- Trialled in a number of applications
- Pilot scale to deliver multi-tonne quantities for evaluation Factory trials carried out
- Seeking partners/investors
- Contact: Cambridge BioPolymers +44 1223 832026



CASE STUDY 2

Alternative plasticisers for PVC

Goal was to manufacture a new plasticiser for use in the plastics industry based on a naturally derived fatty acid

These materials were expected to behave as commercially available materials but without the associated toxicity and health risks



Crambe – Abyssinian mustard



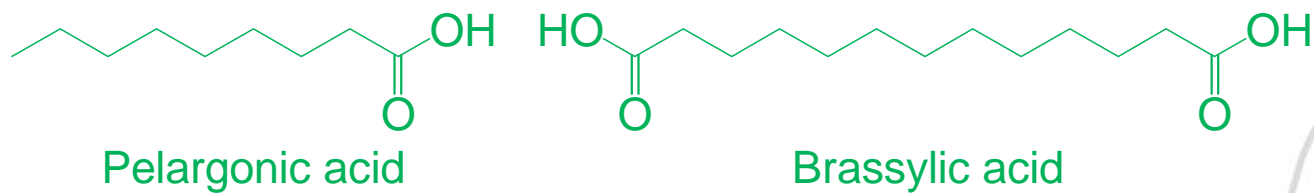
Fatty acid		% of total
Palmitic	(C16:0)	1.8
Stearic	(C18:0)	0.7
Oleic	(C18:1)	17.2
Linoleic	(C18:2)	8.7
Linolenic	(C18:3)	5.2
Eicosanoic	(C20:1)	3.4
Erucic	(C22:1)	56.2
Brassicidic	(C22:1)	0.7
Tetracosanoic	(C24:0)	0.7
Nervonic	(C24:1)	1.6
Others		2.5



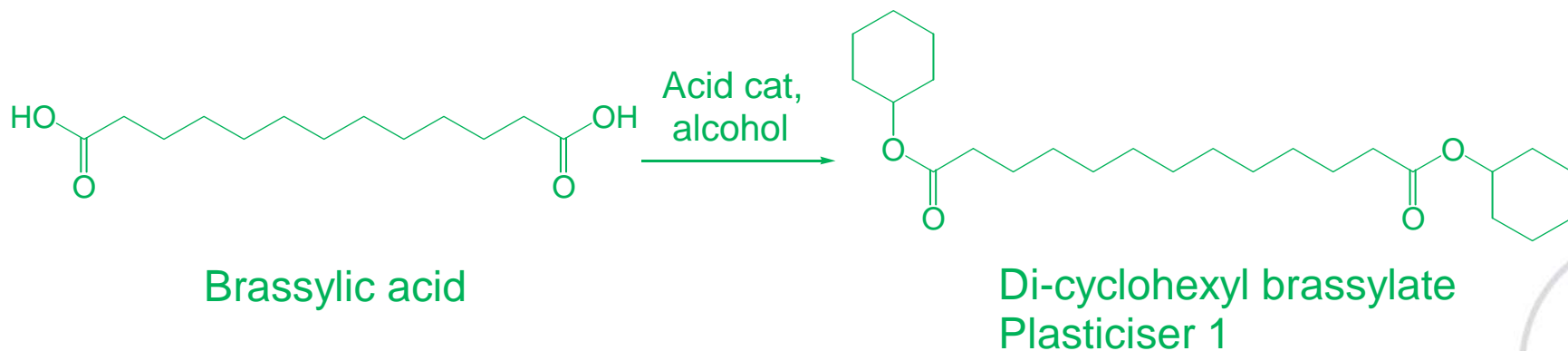
Chemical Structures



O_3 , Cat., H_2O



Plasticiser synthesis



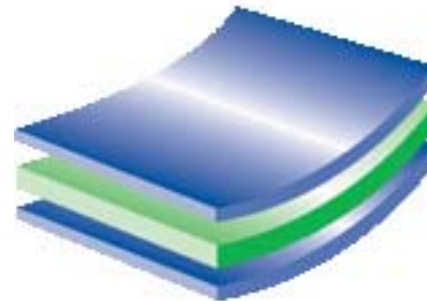
Performance testing

Parameter	DOP	Dicyclohexyl brassylate
Specific gravity	1.24	1.23
Tensile strength	21.66	20.5
Elongation	300	340
Shore A hardness	79	78
Heat stability (200 C)	15	15
British standard softness	38	39



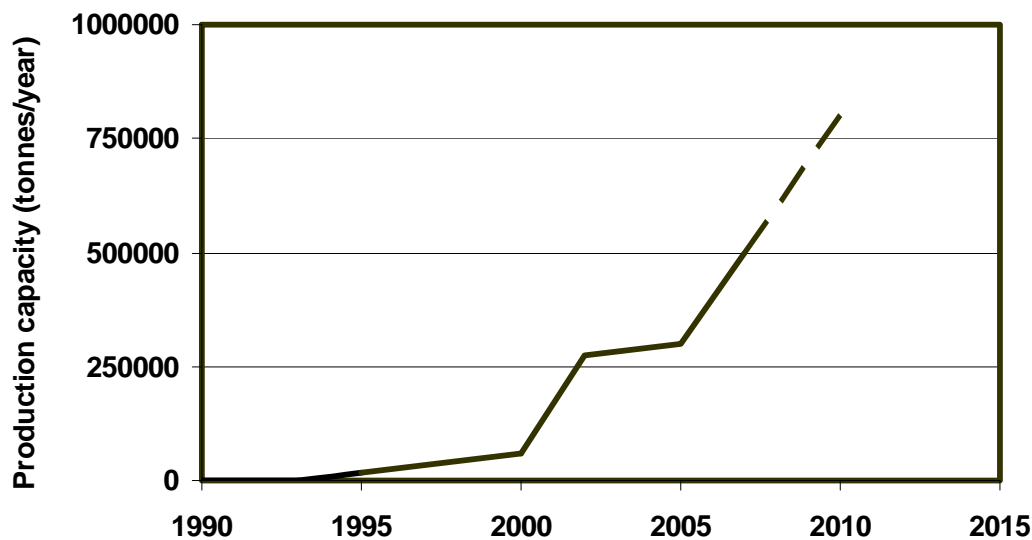
CASE STUDY 3

Biobased Packaging Films & Trays



Market situation for bioplastics

Global production capacity*:



**Bioplastics 07/08
processing parameters and technical characteristics*



Biobased films & trays

- Sandwich structures for light-weighting
- Use of locally produced & prepared fibres
- Modified atmosphere packaging
- Increased shelf life



Why lightweight packaging?

- Means reduced material use
- Means reduced cost of materials
- Means reduced cost of transport
- Means reduced energy demand
- Means reduced waste
- Means reduced landfill requirement
- 6R



Lightweight packaging materials

- Main purposes of packaging:
 - protect the product from its surroundings
 - maintain the quality of the product for its entire shelf life.
- Lightweight packaging products impart the same performance functionality as 'normal' packages



Fulfilment

- Develop novel lamination and reinforcement processes
- Develop innovative foaming techniques
- Develop a new lightweight high performance packaging tray for food sector made from bio based materials
- Must be:
 - Low cost starting materials
 - Fast production processes



Conclusions

- Bio based polymers have been introduced as substitutes for petroleum based thermoplastic for packaging.
- Novel bio based polymers can be stiffer or with higher elongation than conventional plastics.
- Possible to reduce the weight of food packaging by developing ultra-thin materials or by using foamed sandwich structure materials.
- There is the possibility to extend these developing technologies in other areas, for example, thermal insulation, construction panels
- The goal for using bio based materials in packaging is to lead to big reductions in waste, reduced dependence on non-renewable resources.



Capability

