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Sunum İsmi

Levulinate technology enabling safer and more sustainable coatings

Sunum Yapan Kişi
Jan Weernink

Firma veya Kurum
GFBiochemicals

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BIOCHEMICALS






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Speaker
Jan Weernink - CCO

Levulinate technology as an enabler to increase biogenic carbon content for more sustainable and safer coatings

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Agenda


Intro
Levulinate Technology
Key Properties
Application Data

MEGATRENDS

Consumers demanding Green products

Climate change awareness is driving consumer behaviour. Manufacturers and brands are demanding sustainable solutions

Tougher Regulations

Use of existing material increasingly restricted (e.g D5-silicones in personal care)
CMR and PFAS materials under pressure

Corporates moving towards sustainable alternatives

e.g: press release Unilever: 100% replacement of petro-solvents in home care by 2030

Improved health & safety

Incumbent industrial chemicals
being banned (e.g. NMP)
Low toxicity
alternatives sought

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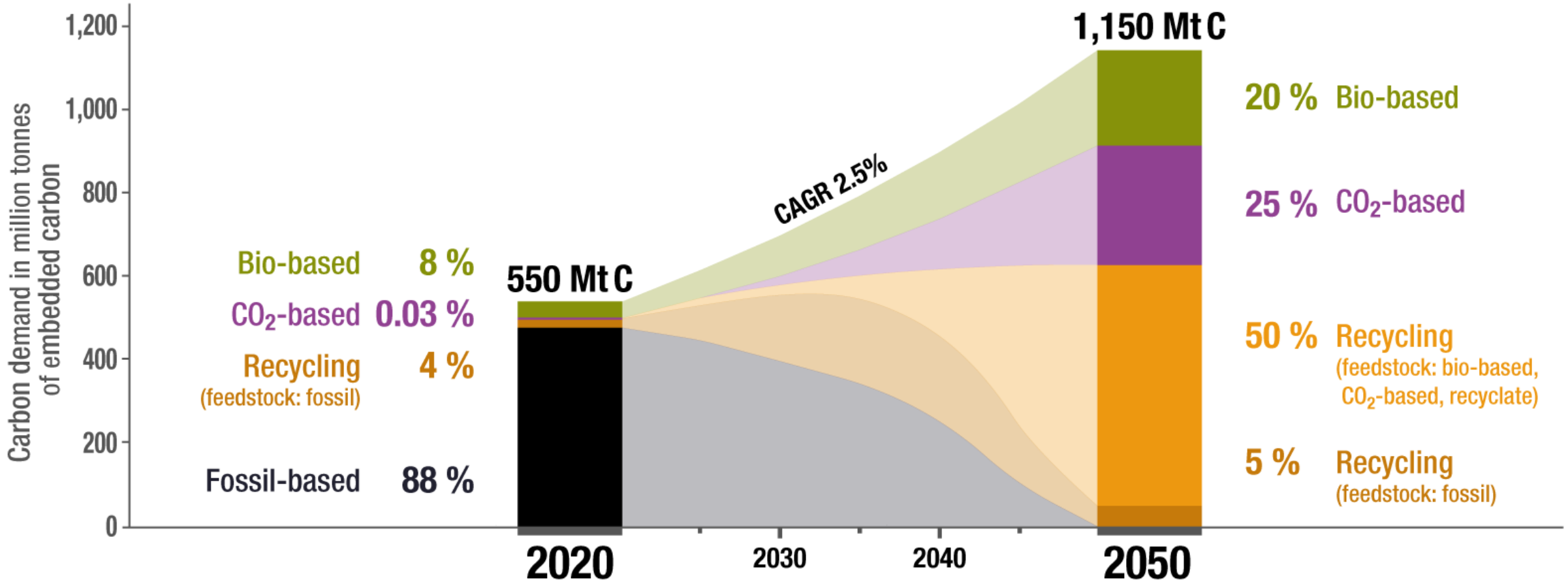
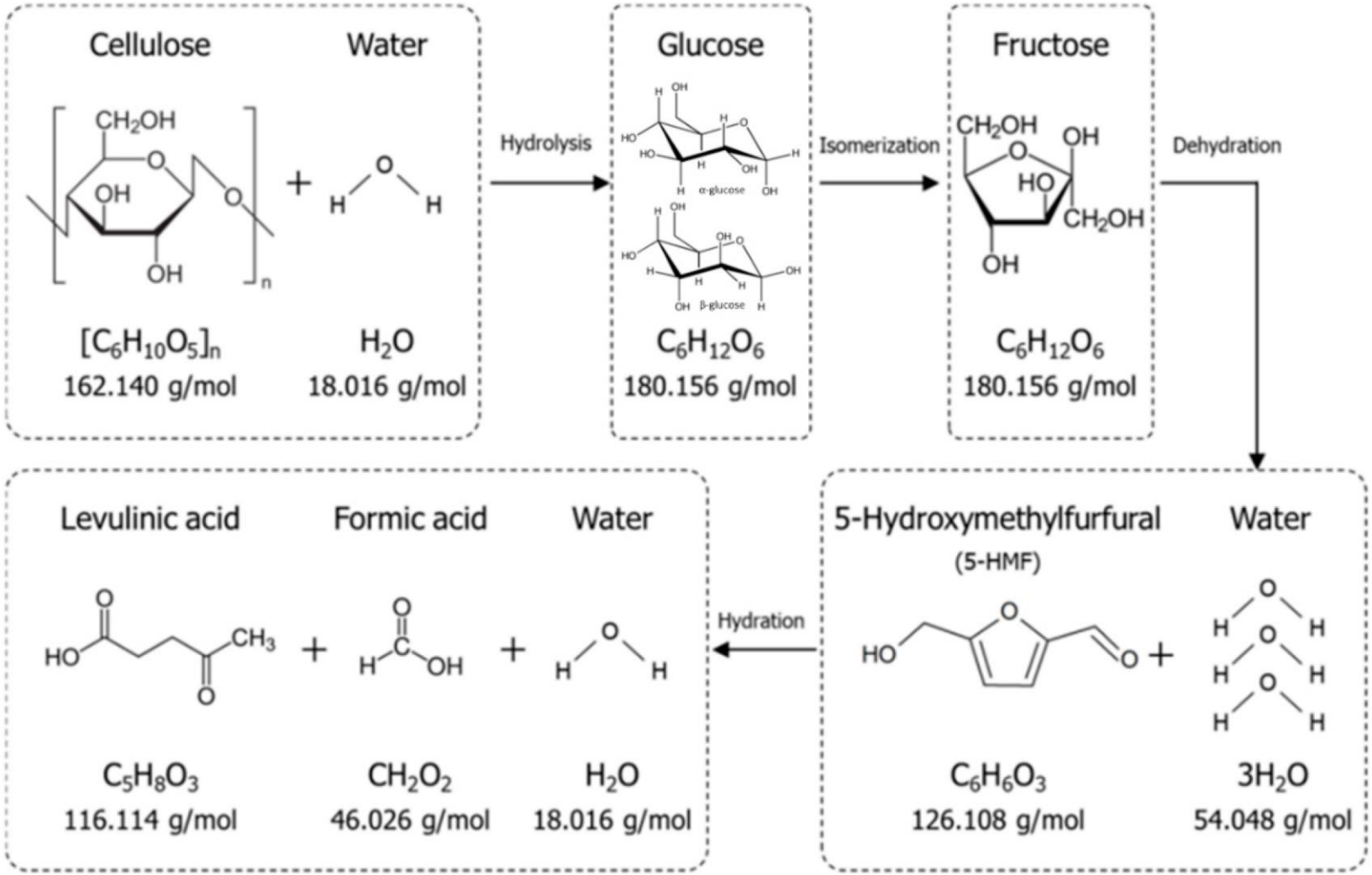
Embedded Carbon & Source

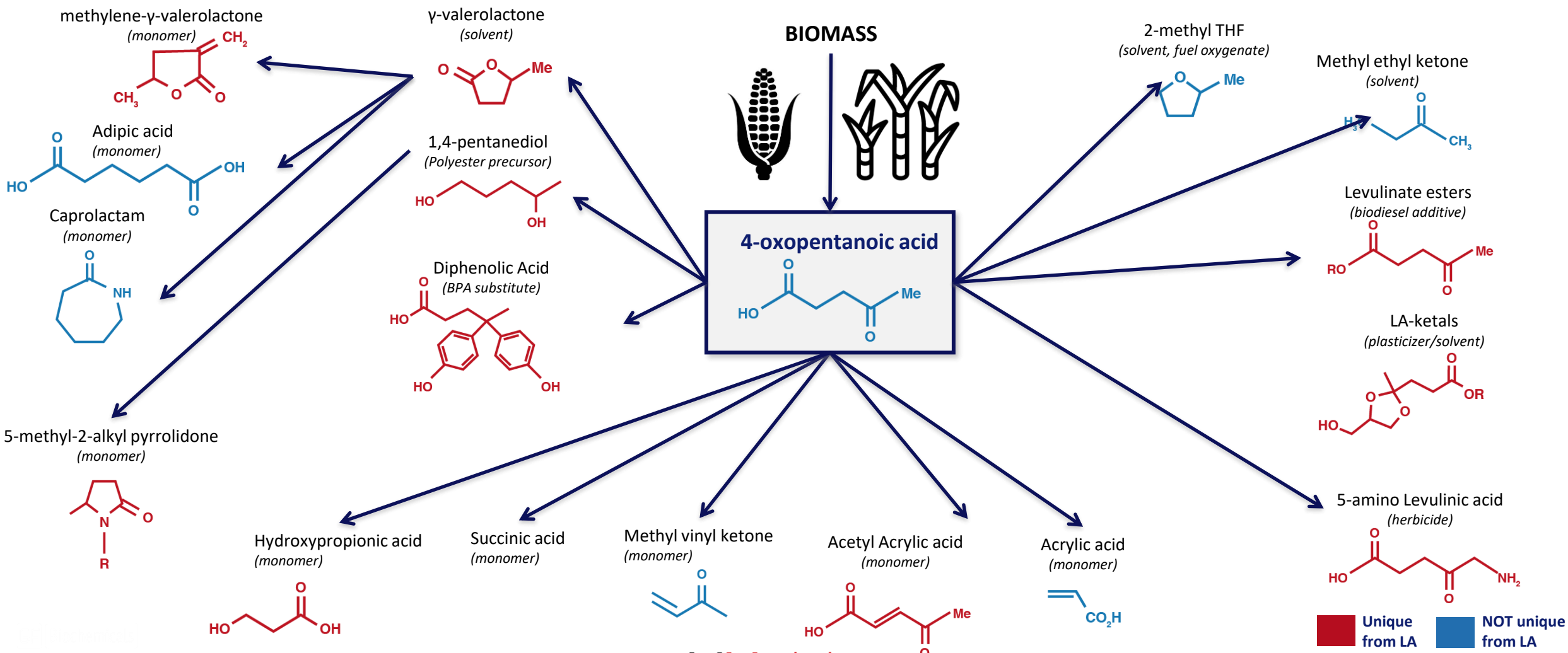


• Source: Nova Institute

4-oxopentanoic acid formation pathway



Levulinic acid platform versatility



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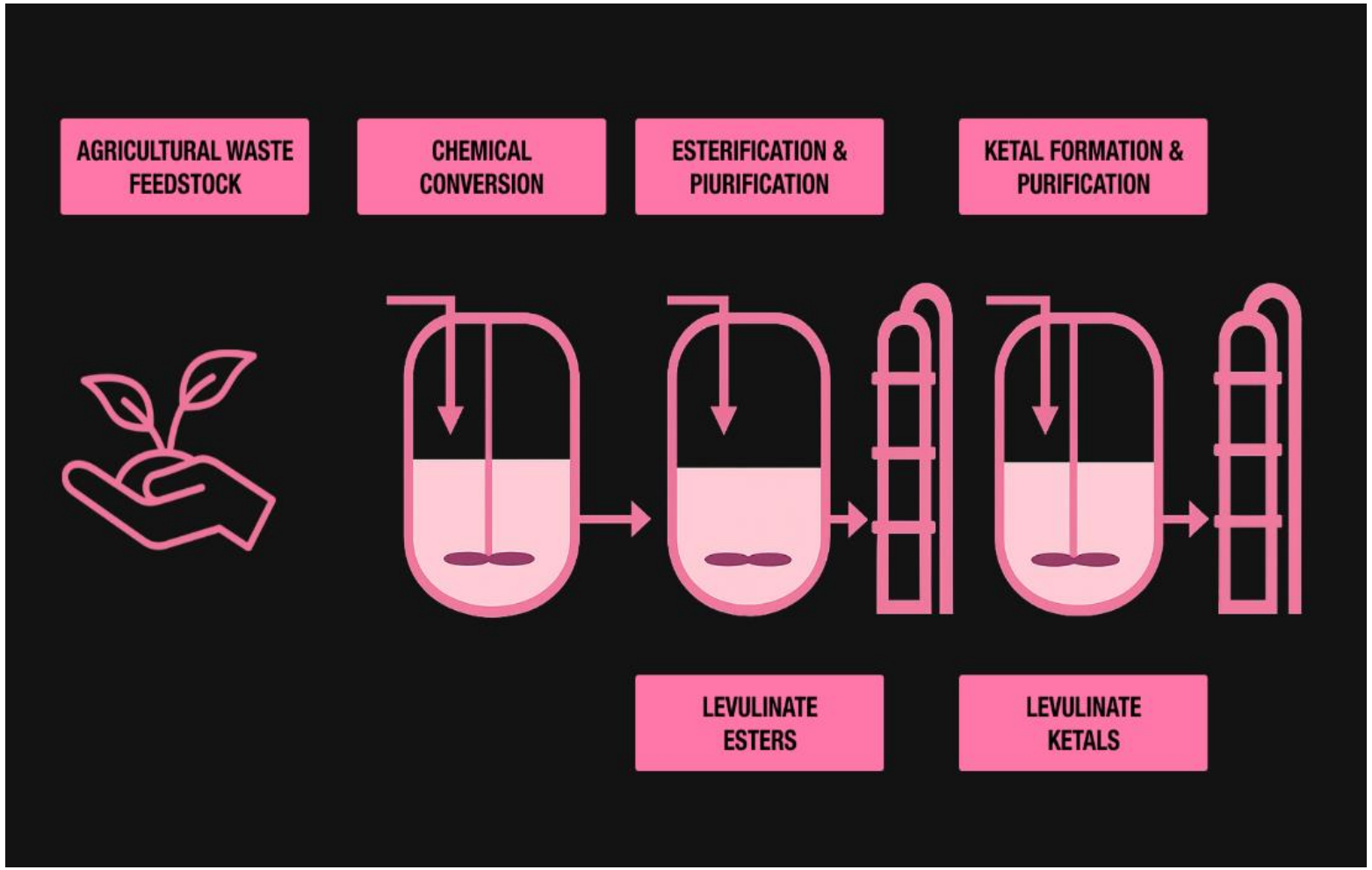
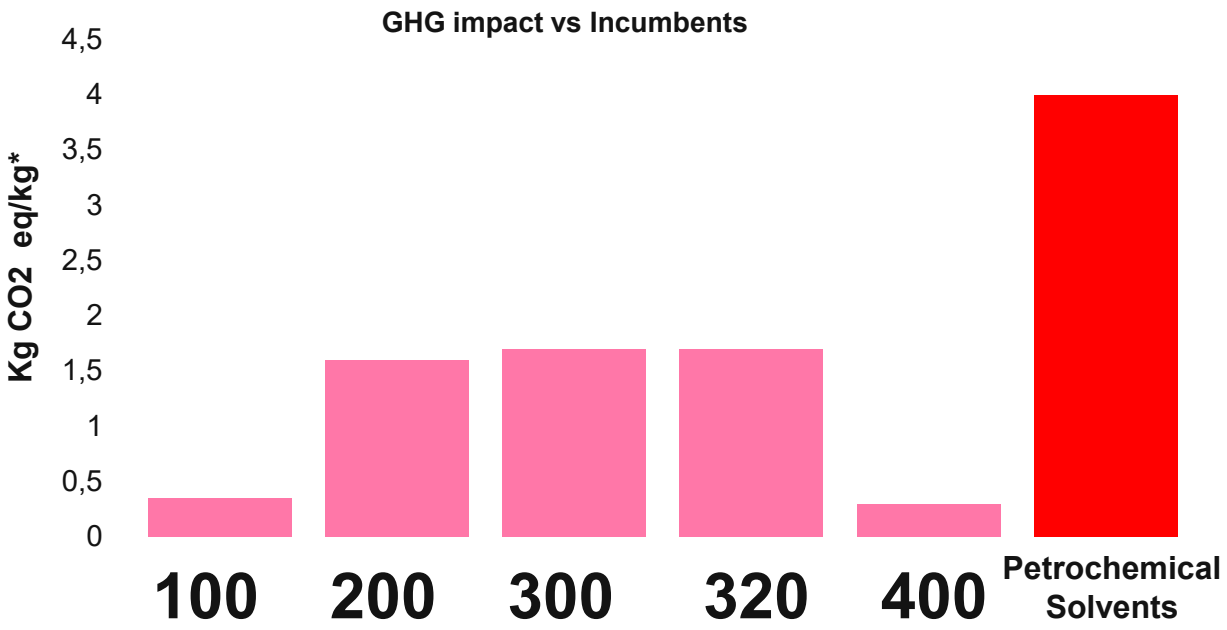
Levulinic acid platform - process

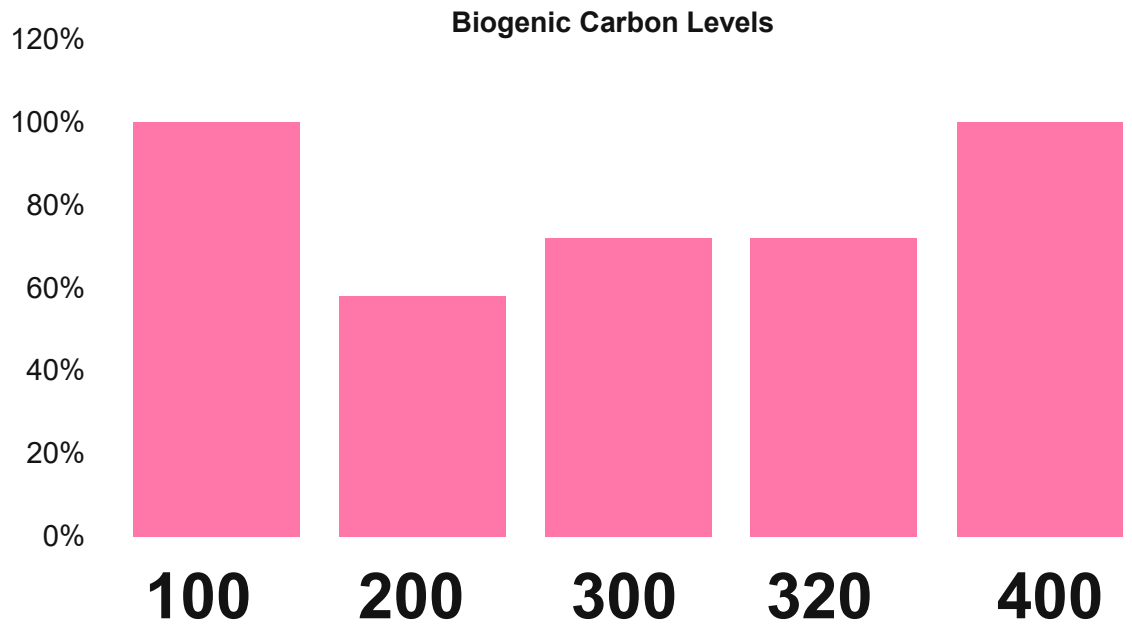


Physical Characteristics Levulinates

	Ethyl Levulinate	Butyl Levulinate	Levulinate Propanediol Ketal
Boiling Point (°C)	205.8	237.8	225.2
Melting Point (°C)	< −60	< −60	< −60
Density (20°C)	1.012	0.974	1.03
Vapour Pressure (kPa 20°C)	0.0117	0.0031	0.0065
Water solubility (g/L 20°C)	170	13	31
HSP (25 °C)			
Dispersion (δd)	14.6	15.7	15.2
Polar (δp)	10.5	9.7	4.7
Hydrogen bonding (δh)	7.0	5.8	6.8

Typical properties – CO2 footprint





Compelling carbon footprint compared to petrochemical solvents:

1. **Propylene Glycol – 12 times the CO2 emissions of Ethyl Levulinate**
2. **Tetrahydrofuran – 16.5 times the CO2 emissions of Butyl levulinate**

Biogenic Carbon of Ethyl Levulinate and Levulinate Prodanediol Ketal can be increased to 100% through incorporation of biobased butanol and 1,2 propanediol

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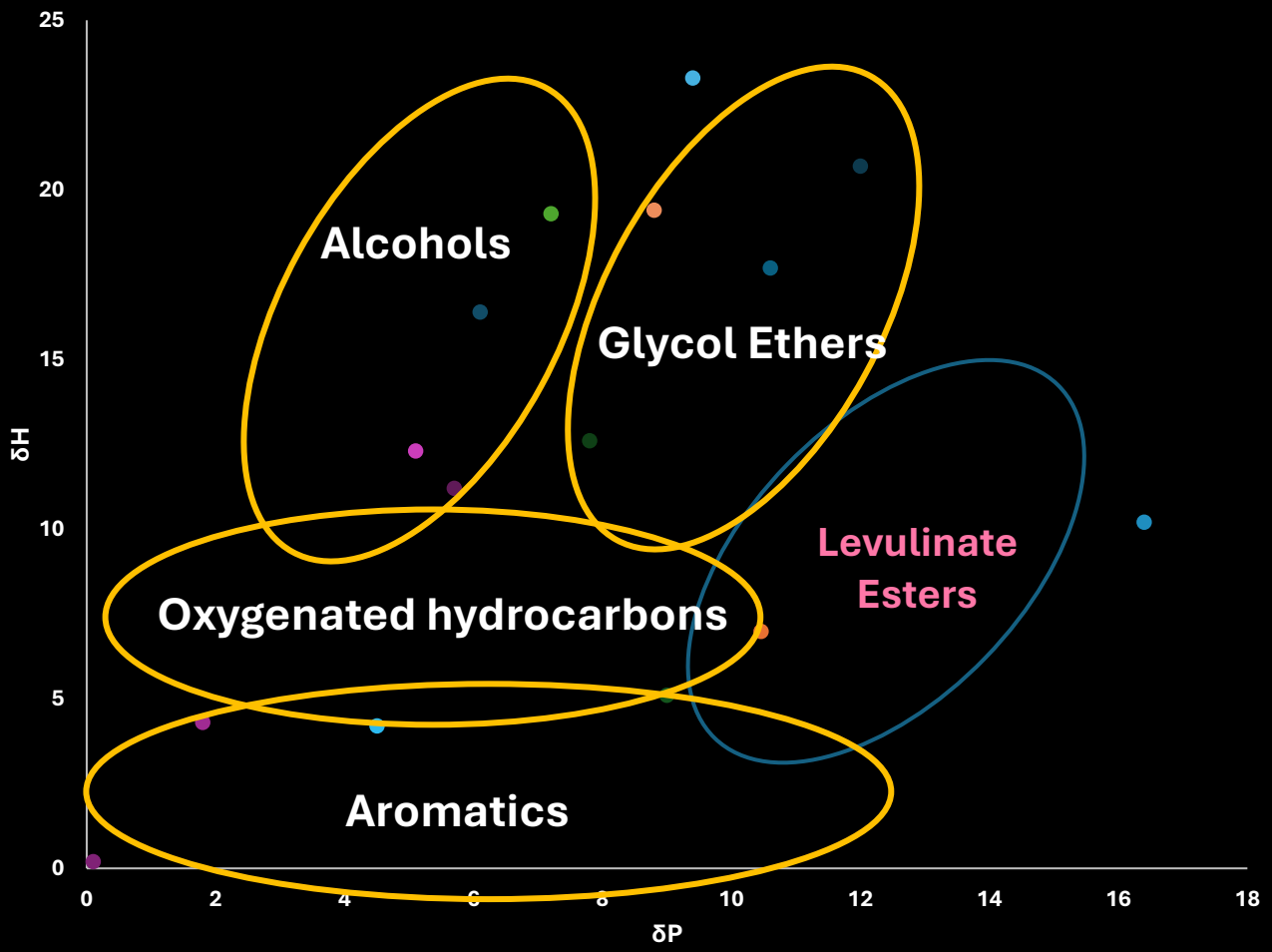
HSE Profile

NON-FLAMMABLE	No ATEX requirements; easier handling and storage; lower insurance costs
NO VAPOUR TOXICITY	No exposure risk to production staff; no exposure risk for end user
NO AQUATIC TOXICITY	No ‘dead fish’ labelling; greatly reduced environmental impact in case of spill
NOT DANGEROUS FOR TRANSPORT	Lower transportation costs
BIODEGRADABLE	Compliant with regulations; not persistent in the environment

Ethyl Levulinate	Skin and eye irritant	Butyl Levulinate	Skin and eye irritant 	Levulinate Propanediol Ketal	No labelling

Typical properties – HSP

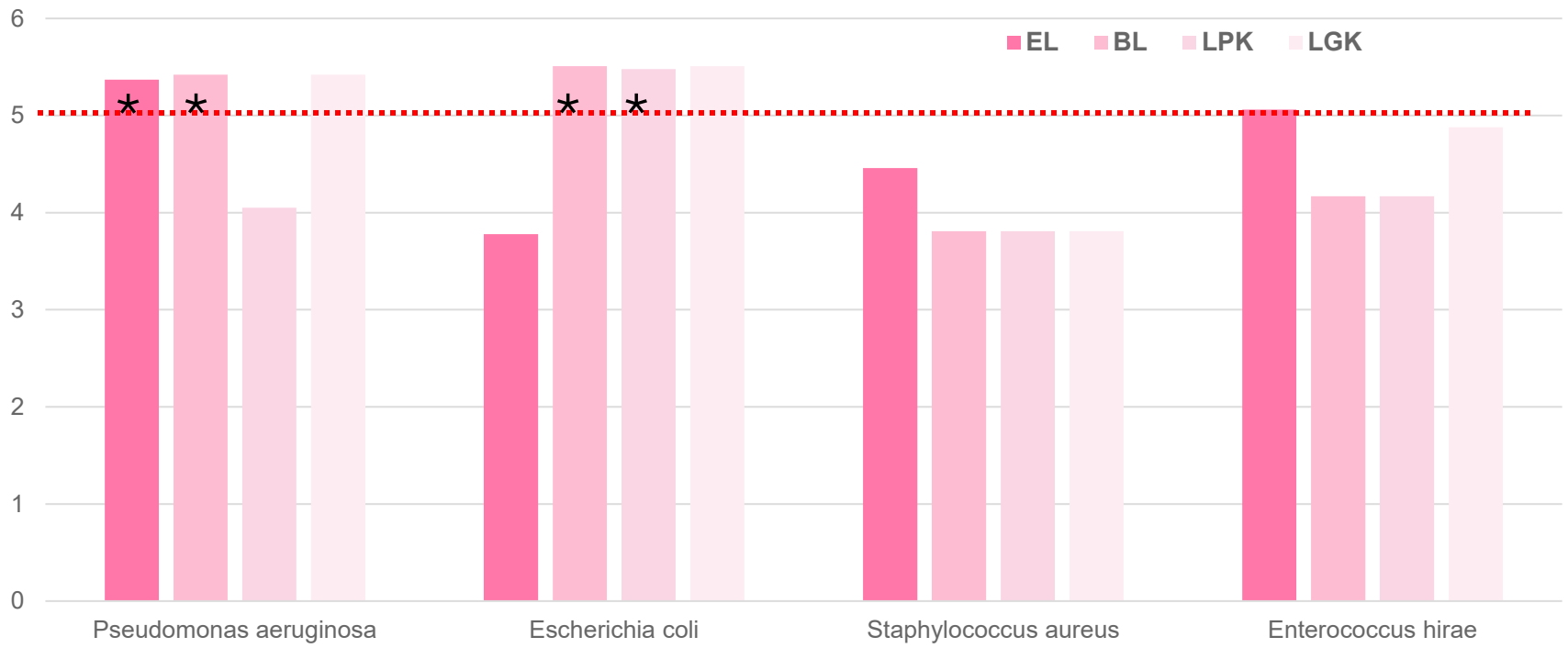
Basic Solvency comparison



General Properties

- Chemical structures facilitates multifunctional properties and bio-degradability
- Powerful bio-solvents
- High boiling point & vapour pressure
- Double C=O bonds imparts anti-microbial properties
- Excellent eco-tox profile
- Low carbon footprint

Typical Properties – Anti-microbial



EN1276:2019

Log Reduction - Bactericidal Activity (Neat, 5min Contact Time)

* End point not validated

Use case of levulinates in coatings

- **Carrier solvent**

Ethyl Levulinate

Butyl Levulinate

Equipment cleaning

Ethyl Levulinate

Levulinate Propanediol Ketal

Paint Stripping

Butyl Levulinate

Levulinate Propanediol Ketal

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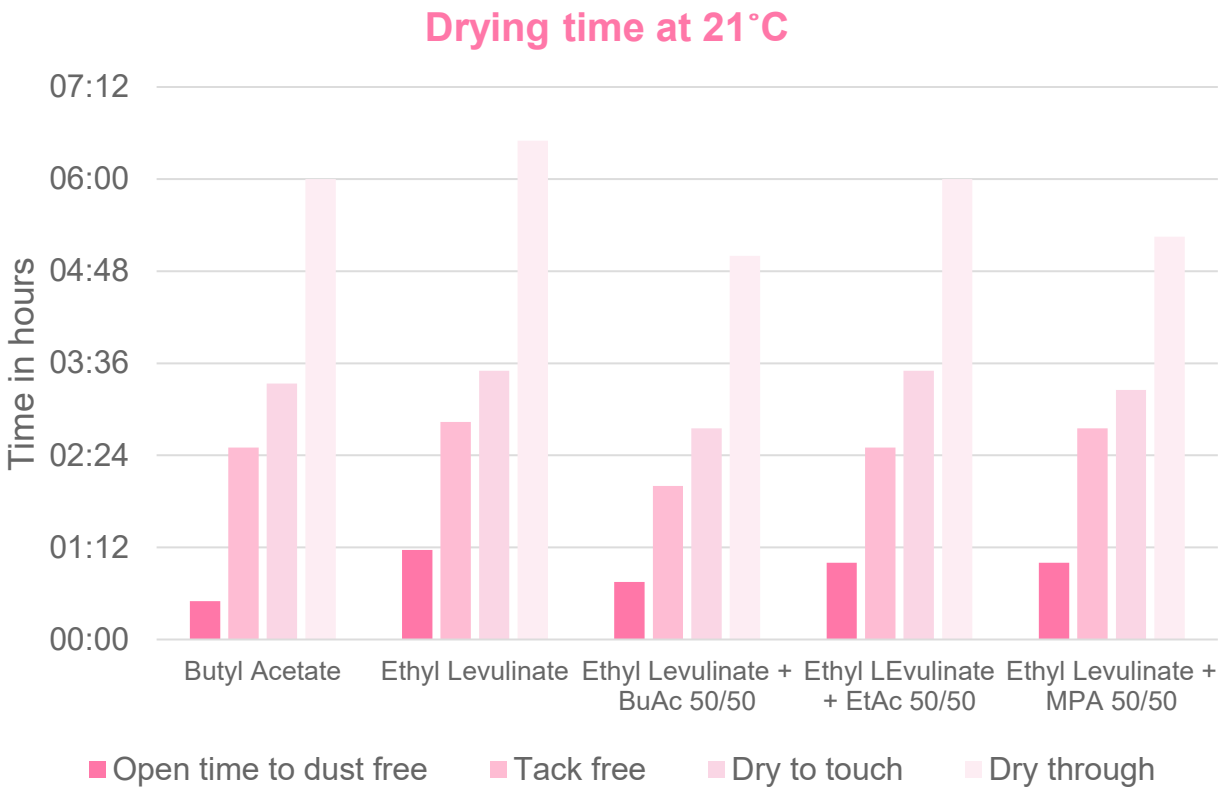
Formulations tested

Trade name Component A (g)	Solvent Function	Butyl Acetate	Ethyl Levulinate	Ethyl Levulinate + BuAc50	Ethyl Levulinate + EtAc50	Ethyl Levulinate + PMA50
JONCRYL® 507 (80% in Butyl Acetate)	Acrylic resin	468	468	468	468	468
BASONOL® HPE 1170 B (69% in Butyl Acetate)	Hyperbranched polyester polyol	201	201	201	201	201
DBTL (10% in Butyl Acetate)	Catalyst	10	10	10	10	10
2,4-Pentanedione	Complexing agent	13	13	13	13	13
n-Butyl Acetate	Solvent	308	-	154	-	-
RE:CHEMISTRY SOLVE100	**Solvent**	**-**	**308**	**154**	**154**	**154**
Ethyl Acetate	Solvent	-	-	-	154	-
Methyl Propyl Acetate	Solvent	-	-	-	-	154
Subtotal		1000	1000	1000	1000	1000
Component B (g)						
BASONAT® HI 2000	Polyisocyanate	295	295	295	295	295

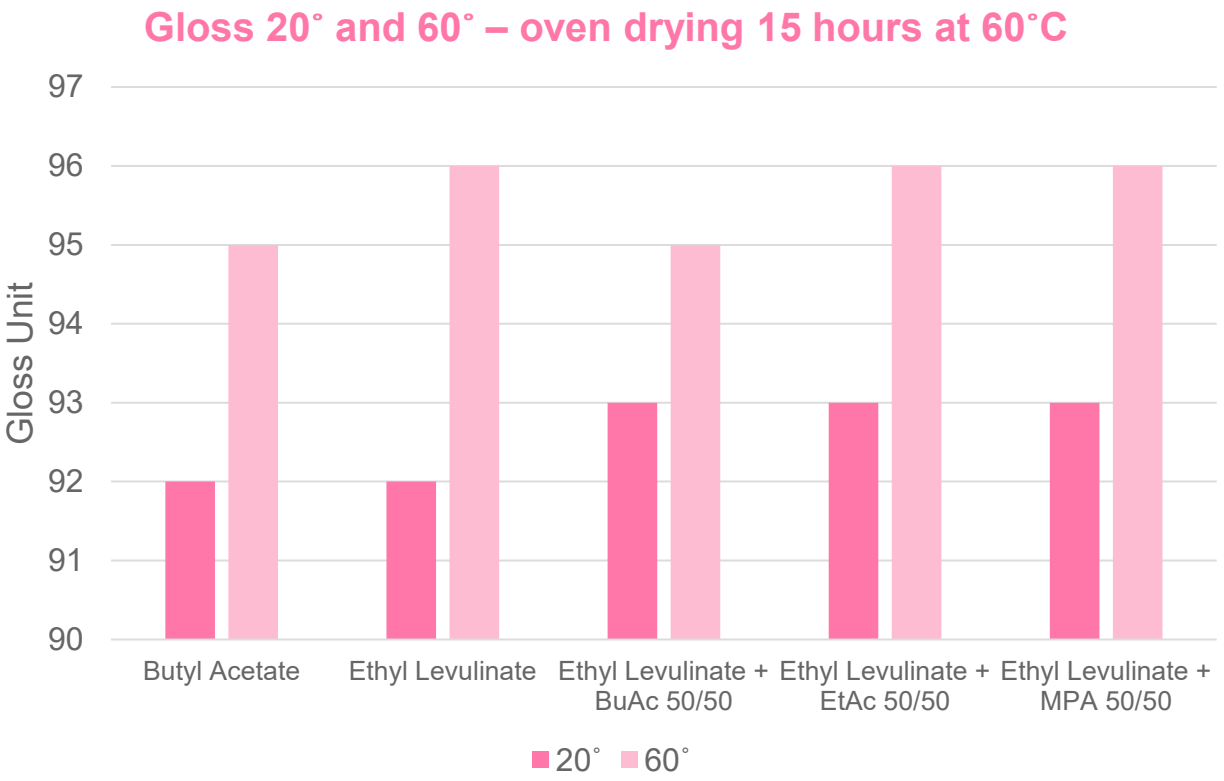
Drying time



Ethyl Levulinate impact:

- Slight impact early open time
- Full drying was similar to the reference

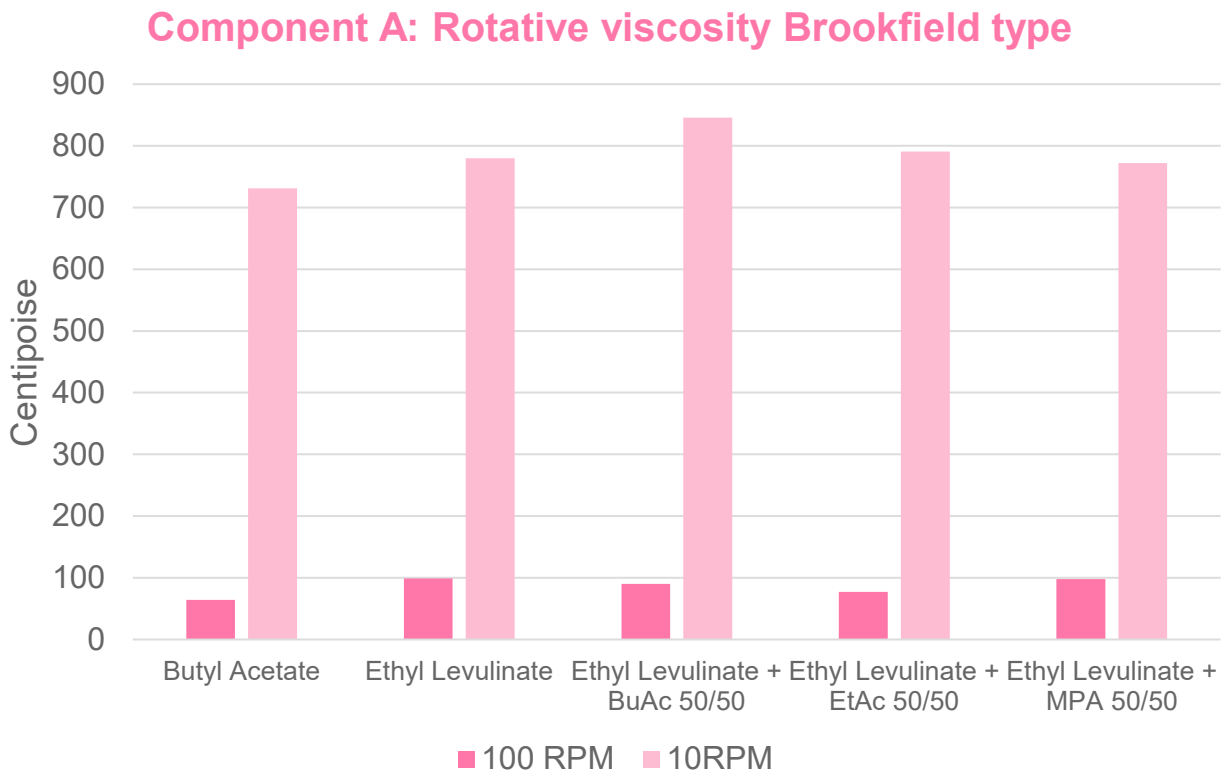
Gloss



Ethyl Levulinate impact:

- Gloss values were very similar for all formulations

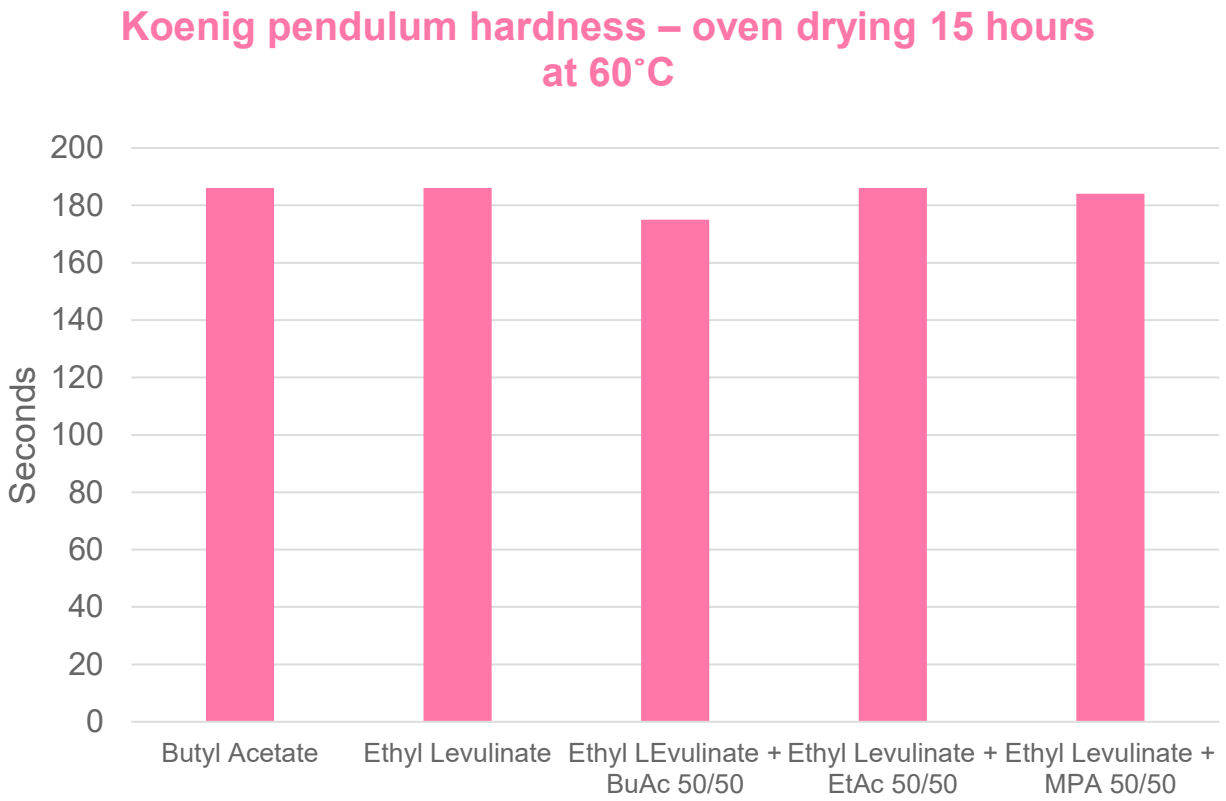
Viscosity rotative spindle – (Component A)



Ethyl Levulinate impact:

- Viscosity at 10 RPM was maintained around 800cps

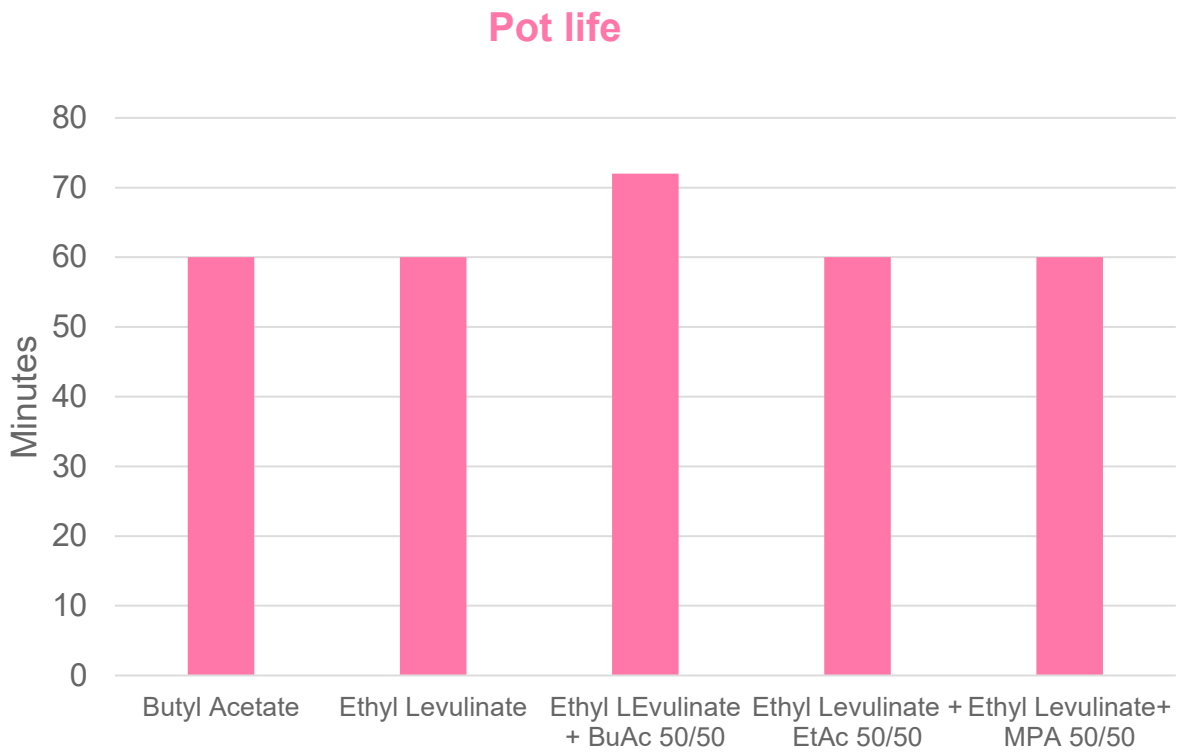
Hardness



Ethyl Levulinate impact:

- Hardness is maintained for all formulations

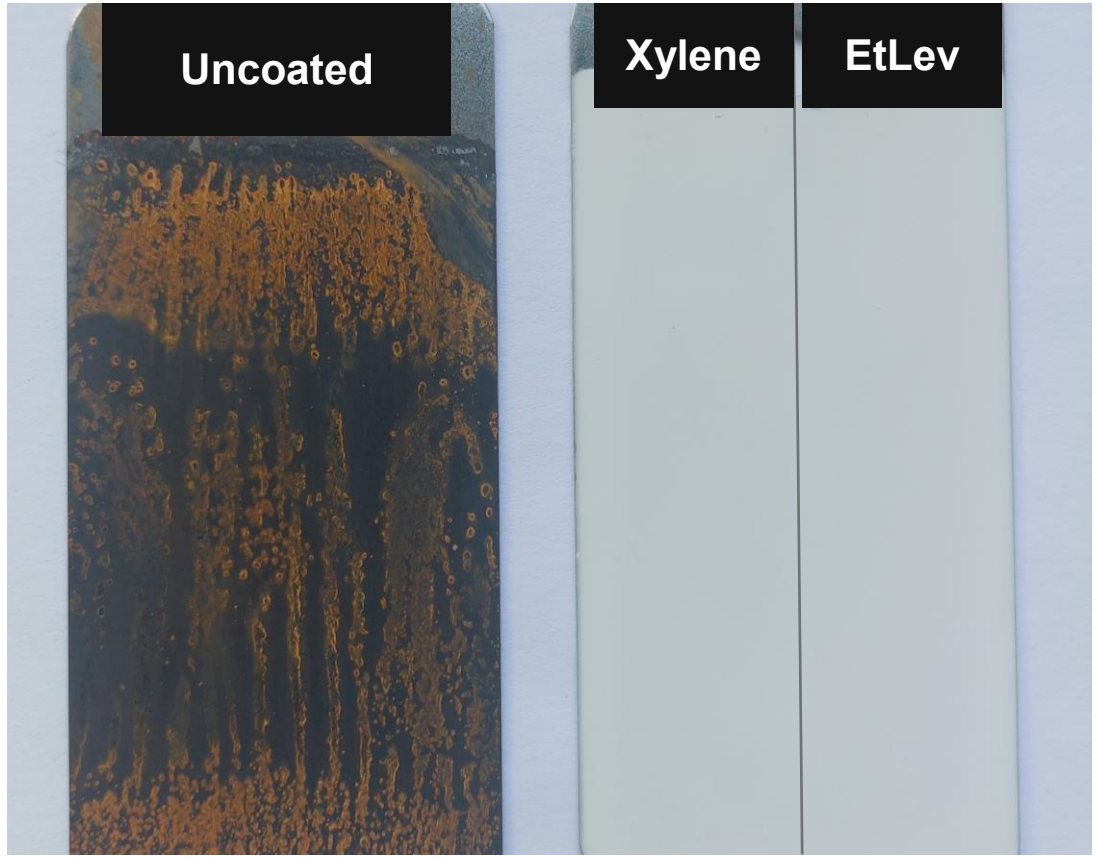
Pot life test



Ethyl Levulinate impact:

Pot life was similar for all formulations

Corrosion test



Ethyl Levulinate impact:

1 week immersion test showed no difference in corrosion results

Levulinates offer a Unique Biobased Value Proposition

Applications

Industrial Coatings

Surface cleaners

Adhesive, ink and sealant removers

Paint stripping

Functions

Carrier solvent

Cleaning solvent

Paint Stripper

Replace

Glycol ethers

DMSO

Dibasic Esters

D-Limonene

Isopropylidene Glycerol

Dimethyl 2-Methylglutarate

NMP

Lactate Esters

Benzyl Alcohol

Methylal