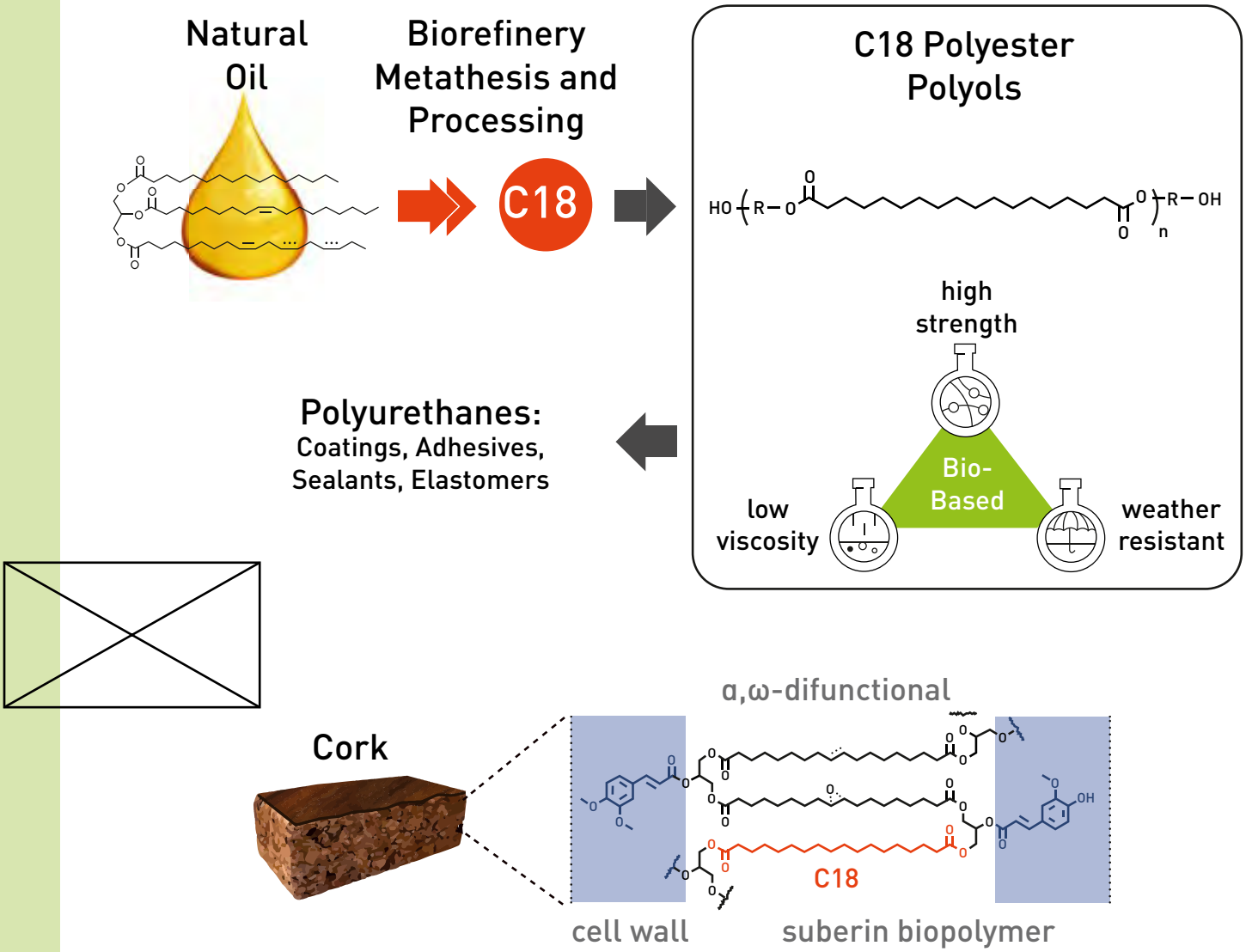
From cork to polyurethane

C18 Polyols: A new class of renewable, high-performance polyester building blocks for polyurethanes

Difunctional polyester polyols represent a fundamental set of macromonomer building blocks used in polyu-rethane coatings, adhesives, sealants and elastomer (CASE) applications. Despite their versatility, most polyes-ter-based urethanes have a susceptibility to hydrolysis, which remains an "Achilles' heel" and limits their utility in products designed to withstand exposure to harsh environments. Elevance Renewable Sciences, Inc. intends to challenge this conventional paradigm through the development of a new class of high-performance C18 polyols.

Following the commercialization of Inherent® C18 Diacid via a proprietary natural oil metathesis process, a vi-able route to C18 polyols is now enabled (Fig. 1 top). These novel hydrophobic building blocks aim to offer for-mulators differentiated performance through access to a balance of favorable properties such as moisture and chemical resistance all while maintaining low viscosities for ease in processing and providing high renewable content [1]. One needs only to recognize the unique properties of suberin, the protective natural biopolyester found in cork, to appreciate the performance possibilities offered by polymers designed from long chain α,ω-difunctional fatty acid derivatives such as C18 diacid (Fig. 1 bottom).

Figure 1. (Top) Renewable C18 polyols designed from Elevance C18 building blocks. (Bottom) A simplified model of suberin, the natural biopolyester in cork that contains a significant fraction of long chain α,ω-difunctional fatty acid building blocks such as C18 diacid.



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By:
Paul A. Bertin
Elevance Renewable Sciences Woodridge, Illinois, USA

Typical properties of developmental C18 polyols made from various diols are shown in Table 1. Depending on the choice of comonomer, polyols with a broad range of melting temperatures are accessible from semi-crystalline solids that melt between 60—85 °C to amorphous ambient liquids. To serve a variety of polyurethane CASE applications, the higher melting polyols (C18-BD, C18-PDO, C18-PG) are made at average molecular weights of 2000 g/mol and 3000 g/mol while the low melting C18-BEPD and C18-TPG exist at 2000 g/mol.

Elevance is actively commercializing these C18 polyols and ready to engage customers and potential partners with these or other samples for evaluation.

References:

[1] Beuhler, A.; Bertin, P.; Mody. K.; Tindall, D. PU Magazine 2015, 12(4), 308-311.

C18 Polyol	Diol Comonomer*	OH Value (mg KOH/kg)	Melting Range (°C)	Color (APHA)	Bio-Based Carbon (%)
C18-BD	BDO	37, 56	80-85	<200	80-100
C18-PD	PDO	37, 56	75-80	<200	100
C18-PG	PG	37, 56	60-65	<200	85
C18-BEPD	BEPD	56	15-20	<200	65
C18-TPG	TPG	56	15-20	<200	65

*BDO = 1,4-butanediol; PDO = 1,3-propanediol; PG = propylene glycol; BEPD = 2-butyl-2-ethyl-1,3-propanediol; TPG = tripropylene glycol