



biosuccinium[®]
sustainable succinic acid

enabling sustainable materials

POLYESTER POLYOL
DATA SHEET

enabling sustainable
materials



INTRODUCTION

Biosuccinium™ sustainable succinic acid is a 100% bio-based succinic acid that enables the production of polyester polyols and polyurethane products with lower environmental footprints. Biosuccinium™ offers an alternative to traditional chemicals such as fossil-based succinic acid or adipic acid which are conventional raw materials.

This document shows the properties of polyester polyols based on biobased succinic acid with a wide variety of applications. The data has been generated by Reverdia based on actual (lab scale) production of these polyester polyols and is intended to showcase that (1) polyester polyols based on biobased succinic acid can be manufactured and (2) lead to properties that are in the same range as conventional polyester polyols.

In those polyols where mixed diols or mixed diacids are used to synthesis co-polyesters, the mix ratios are expressed in %molar.

The renewable content is expressed as percentage renewable carbon content. In the formulations below, Biosuccinium™, 1,3-propanediol and sebacic acid are of renewable origin. Ethylene glycol, di-ethylene glycol, and 1,4 butanediol are of fossil origin.

Table 1: Formulation and properties of succinic acid and adipic acid based polyester polyols

Di-acid	Diol (molar ratio)	Renewable content [%w]	Functionality	Mn [g/mol]	Viscosity [mPa.s]	Acid / OH value [mg KOH/g]	Tm [°C]	Remarks
Adipic acid	BDO	0%	2	1943	800 (70°C)	0.75 57.0	58	
Biosuccinium™	BDO	50%	2	1918	Solid (75°C) 400 (125°C)	0.11 58.5	108	not soluble in THF
Biosuccinium™	BDO	50%	2	1623	Solid (75°C) 274 (125°C)	2.30 -	105	not soluble in THF; synthesis incomplete
Biosuccinium™	BDO	50%	2	1009	Solid (75°C)	1.01 110.2	102	not soluble in THF
Adipic acid	BDO+EG (50:50)	0%	2	2004	579 (75°C)	1.30 54.7	~17	
Biosuccinium™	BDO+EG (50:50)	57%	2	2004	1306 (75°C)	1.10 54.9	~55	

Table 2: Formulation and properties of 1,4 BDO vs 1,3 PDO based polyester polyols

Di-acid	Diol	Renewable content [%w]	Functionality	Mn [g/mol]	Viscosity [mPa.s]	Acid / OH value [mg KOH/g]	Tm [°C]	Remarks
Adipic acid	BDO	0%	2	1943	800 (70°C) 136 (125°C)	0.75 57.0	58	
Biosuccinium™	BDO	50%	2	1918	Solid (75°C) 400 (125°C)	0.11 58.5	108	not soluble in THF
Biosuccinium™	PDO	100%	2	1955	2680 (70°C)	1.39 57.4	48	100% renewable

Table 3: Formulation and properties of mixed diol co-polyester polyols

Di-acid	Diol (molar ratio)	Renewable content [%w]	Functionality	Mn [g/mol]	Viscosity [mPa.s]	Acid / OH value [mg KOH/g]	Tm [°C]	Remarks
Adipic acid	BDO	0%	2	1943	800 (70°C)	0.75 57.0	58	
Biosuccinium™	BDO	50%	2	1918	Solid (75°C) 400 (125°C)	0.11 58.5	108	not soluble in THF
Biosuccinium™	BDO+EG (50:50)	57%	2	2048	3650 (70°C)	1.19 53.6	56	
Biosuccinium™	BDO+HDO (50:50)	44%	2	1995	2150 (70°C)	0.55 55.7	50	
Biosuccinium™	BDO+PDO (50:50)	53%	2	1985	2000 (70°C)	1.13 55.4	56	partly soluble in THF

Table 4: Formulation and properties of succinic acid and adipic acid based co-polyester polyols

Di-acid (molar ratio)	Diol	Renewable content [%w]	Functionality	Mn [g/mol]	Viscosity [mPa.s]	Acid / OH value [mg KOH/g]	Tm [°C]	Remarks
Adipic acid	BDO	0%	2	1943	800 (70°C)	0.75 57.0	58	
Biosuccinium™+ Adipic acid (20:80)	BDO	8%	2	1948	850 (70°C)	0.51 57.1	34	
Biosuccinium™+ Adipic acid (40:60)	BDO	17%	2	1901	1150 (70°C)	1.31 57.7	22	
Biosuccinium™+ Adipic acid (60:40)	BDO	27%	2	2078	1400 (70°C)	0.4 53.6	66	
Biosuccinium™+ Adipic acid (80:20)	BDO	38%	2	2057	Solid (70°C)	0.54 54.0	82	
Biosuccinium™	BDO	50%	2	1918	Solid (70°C) 400 (125°C)	0.11 58.5	108	not soluble in THF

Table 5: Formulation and properties of succinic acid and sebacic acid based co-polyester polyols

Di-acid (molar ratio)	Diol	Renewable content [%w]	Functionality	Mn [g/mol]	Viscosity [mPa.s]	Acid / OH value [mg KOH/g]	Tm [°C]	Remarks
Adipic acid	BDO	0%	2	1943	800 (70°C)	0.75 57.0	58	
Sebacic acid	BDO	71%	2	1967	1100 (70°C)	0.85 56.2	63	
Biosuccinium™+ Sebacic acid (50:50)	BDO	64%	2	1937	550 (70°C)	0.81 57.1	42	
Biosuccinium™+ Sebacic acid (67:33)	BDO	60%	2	1953	6500 (70°C)	0.65 56.8	83	
Biosuccinium™	BDO	50%	2	1918	Solid (75°C) 400 (125°C)	0.11 58.5	108	not soluble in THF

Table 6: Formulation and properties of EG/DEG co-polyester polyols for microcellular PU

Di-acid	Diol (molar ratio)	Renewable content [%w]	Functionality	Mn [g/mol]	Viscosity [mPa.s]	Acid / OH value [mg KOH/g]	Tm [°C]	Remarks
Adipic acid	EG+DEG (60:40)	0%	2	1945	502 (75°C)	1.1 56.6		microcellular PU
Biosuccinium™	EG+DEG (60:40)	59%	2	2059	1405 (75°C)	0.5 54		microcellular PU
Biosuccinium™+ Sebacic acid (85:15)	EG+DEG (60:40)	64%	2	1958	1292 (75°C)	0.3 57		microcellular PU

Table 7: Formulation and properties of polyols for foam, coatings or adhesives

Di-acid	Diol	Renewable content [%w]	Functionality	Mn [g/mol]	Viscosity [mPa.s]	Acid / OH value [mg KOH/g]	Tm [°C]	Remarks
Biosuccinium™	conventional	t.b.d	2 - 4	300-500	4350 (25°C)	0.5 347		Rigid Foam
Biosuccinium™	conventional	t.b.d	2 - 4	300-500	3300 (25°C)	0.5 238		Rigid Foam
Biosuccinium™	conventional	t.b.d	3 - 4	2000	4480 (60°C)	1.12 61.5		Coatings / Adhesives/ Flex Foam
Biosuccinium™	HDO	40%	2	2000	1000 (70°C)	0.93 57.2	57	Coatings / Adhesives

Source: Reverdia information

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