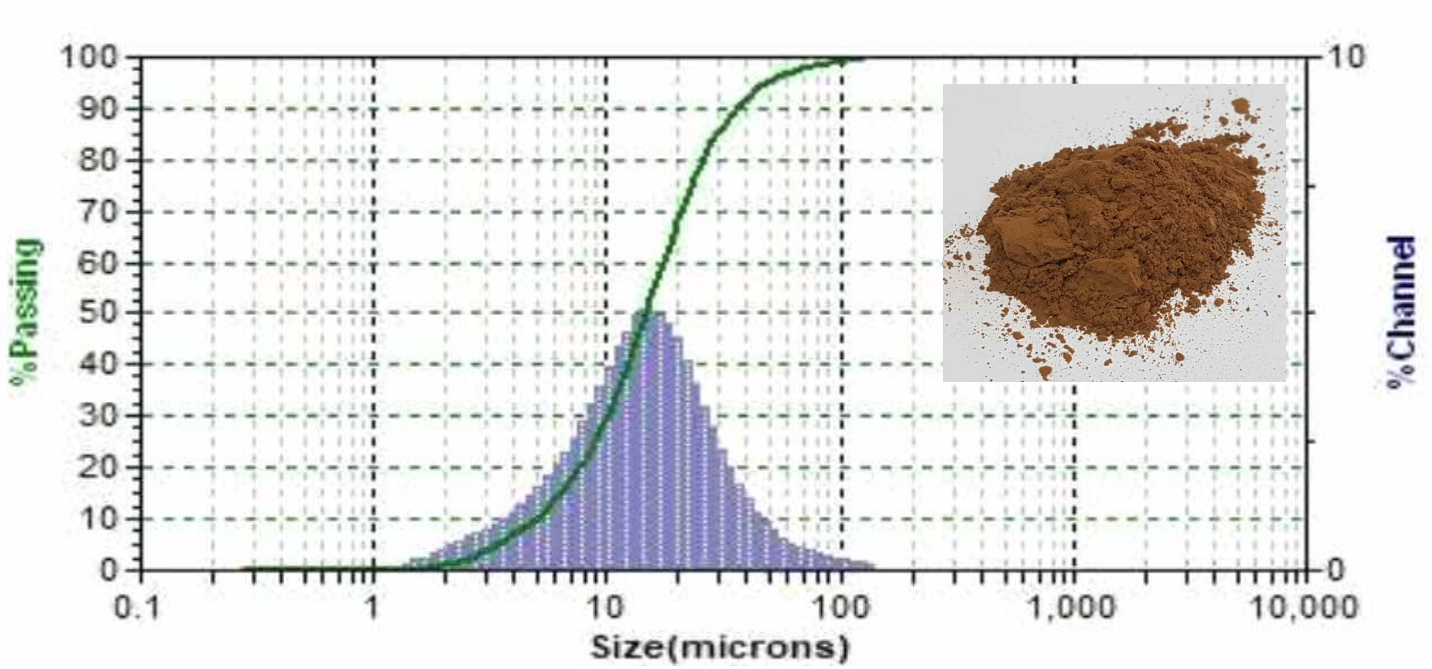
SSEIF®-L

Product specification and Technical Data Sheets

1. Product specification sheet of SSEIF®-L

Production information	Product name	SSEIF-L	
	Chemical name	Lignin/Cellulose	
	CAS No.	9005-53-2	
Physical properties		**Units**	**Values**
	Molecular weight	-	4.3×10^{12} g/mol
	Density	g/cm^3	1.2
	Particle refractive index		1.52
	Appearance		Dark Brown Powder
	Decomposition temp.	°C	>250
Specification	Sieve residue 106 um	%	<1 %
	Specific surface area	m^2/kg	727.5
	Moisture (%)		≤3 %
	pH	-	6~8
	Particle size Dv(10)	㎛	3.46
	Particle size Dv(50)	㎛	14.7
	Particle size Dv(90)	㎛	35.9

2. Particle size distribution



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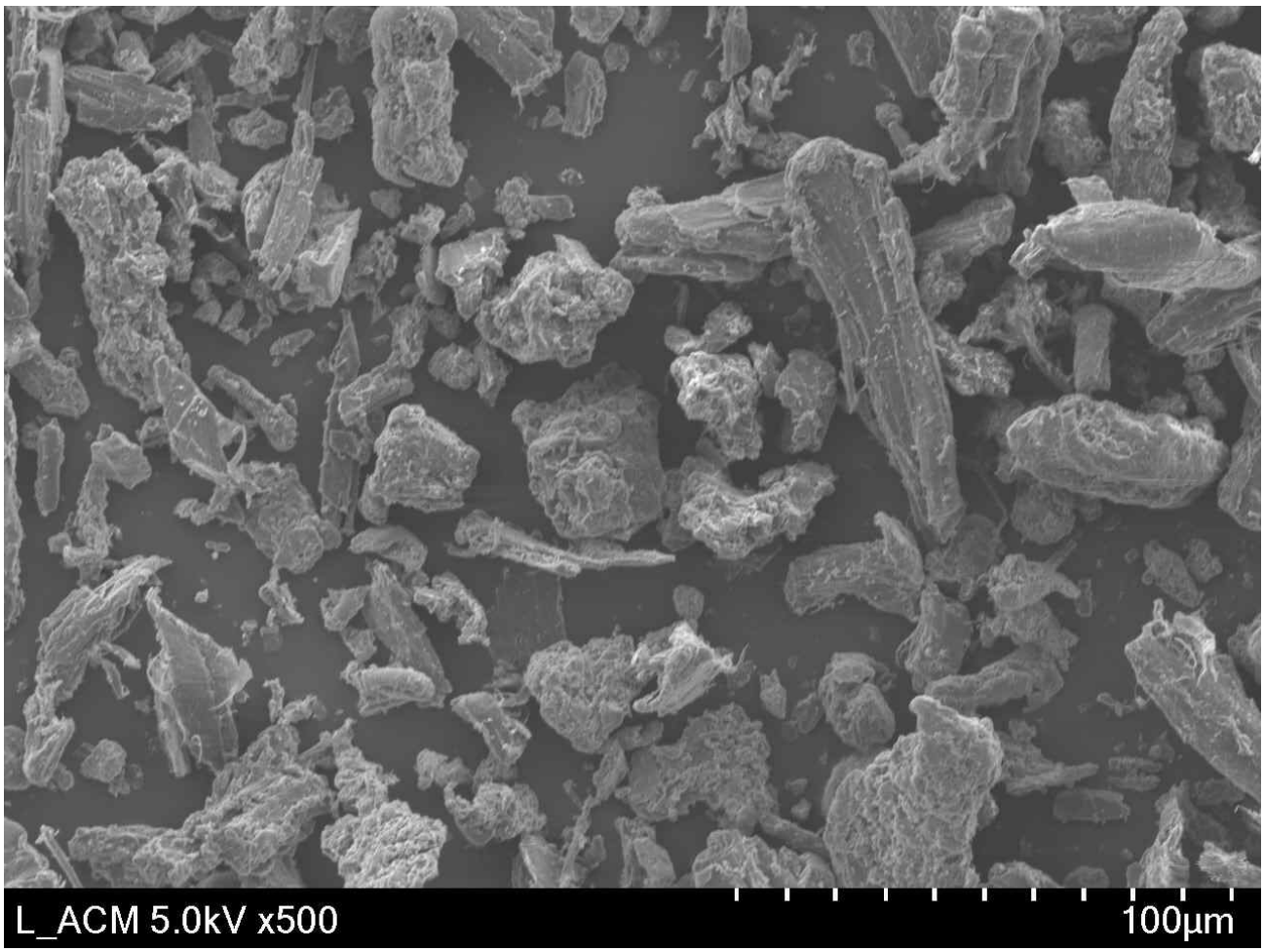
3. SEM



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4. Physical properties of polypropylene-SSEIF®-L composite (Talc 10% vs. SSEIF-L 10%)

Properties	Test Methods	Test conditions	Units	PP*+ talc 10 wt%	PP* + SSEIF-L 10 wt%
Density	ISO 1183	-	-	0.972	0.941
Tensile strength	ISO 527	50mm/min	MPa	28.7	27.8
Elongation	ISO 527	50mm/min	%	18	14
Tensile modulus	ISO 178	50mm/min	MPa	2477	2031
Flexural strength	ISO 178	10mm/min	MPa	44	42
Flexural modulus	ISO 178	10mm/min	Mpa	1703	1644
IZOD impact strength	ISO 180/1A	RT	KJ/m^2	4.4	3.7
Rockwell hardness	ISO 2039-2	R-scale	-	96	95
HDT	ISO 75-1/-2	1.82 kgf/cm^2	℃	113	116

*Lotte Chemical J-580S

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5. Physical properties polypropylene-SSEIF®-L composites.

Properties		Methods	Units	SSEIF®-L composites								
				General			High Impact			High Stiffness, HDT		High HDT
				PP-SL5-1	PP-SL5-2	PP-SL5-T5	PP-SL5-T15	PPO-SL5-T5	PPO-SL5-T10	PPO-SL5-T20	PP-SL5-T35	PP-SL5-T15
Density		ISO 1183-1	-	0.92	0.95	0.98	1.01	0.98	0.98	1.07	1.21	1.01
Filler Content	Talc	ISO 3451	%			5	15	5	10	20	35	15
	SSEIF-L		%	5	5	5	5	5	5	5	5	5
MFI		ISO 1133-1	g/10min	20	8	22	30	22	22	30	10	10
Tensile strength		ISO 527	Mpa	22	22	25	20	16	17	22	33	30
Tensile elongation		ISO 527	%	-	-	-	-	-	-	-	-	-
Flexural modulus		ISO178	Mpa	1300	1000	1900	1600	1250	1350	2000	4000	2300
Flexural Ssrength		ISO178	Mpa	35	35	40	30	22	25	30	53	40
Izod impact strength		ISO180 (23°C)	KJ/m^2	7.5	7.0	5.0	5.0	25	29	25	3.0	3.0
		ISO180 (-10°C)	KJ/m^2	3.0	-	-	2.5	-	-	-	-	-
		ISO180 (-30°C)	KJ/m^2	-	-	-	-	6.0	5.0	5	2.0	1.5
Charpy impact strength		ISO180 (23°C)	KJ/m^2	7.0	7.0	5.0	5.0	25	26	25	3.0	3.0
		ISO180 (-10°C)	KJ/m^2	3.0			2.5		-		-	
		ISO180 (-30°C)	KJ/m^2	-	-		-	6.0	4.0	5.0	2.0	1.5
HDT		ISO75	°C	85	80	100	95	85	90	100	138	120
Scratch resistance		MS210-050	△L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	<1.0

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6. Physical properties polypropylene-SSEIF®-L composites.

Properties	Units	Results										
PP (EP400M)	%	100	95	90	80	95	90	80	95	90	80	90
SSEIF-L	%	-	5	10	20	5	10	20				5
Talc	%	-	-	-	-	-	-	-	5	10	20	5
MAPP	%					3	3	5				3
Flexural strength	kgf/cm^2	423.8	448.4	465.1	489.0	455.4	478.4	554.4	451.7	473.6	505.7	493.8
Tensile strength	Kgf/cm^2	250.4	247.2	247.6	244.4	260.0	262.9	273.2	263.8	267.4	275.6	269.4
Elongation	%	215.3	35.1	34.8	21.9	39.5	29.6	20.9	96.2	67.3	45.2	34.4
Density	-	0.897	0.910	0.933	0.963	0.912	0.928	0.965	0.929	0.958	1.037	0.947
Impact strength	kgf·cm.cm	11.5	6.2	5.2	3.5	8.1	6.8	4.9	10.0	9.2	6.2	6.9
MI	g/10min	8.0	8.8	7.2	6.5	8.7	7.6	6.4	8.6	8.6	8.8	9.0
Moisture content	%	0.01	0.02	0.03	13.35	0.03	0.04	1.55	0.01	0.01	0.01	0.02

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SSEIF®- L

Application Data Sheets

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1. Physical properties of polypropylene-SSEIF®-L composites for automotive components for VW requirements.

Properties	Methods	Units	Requirements (TL-523**-E)	Results (replaced 5wt% talc with SSEIF-L)
Density	ISO 1183	g/cm^3		0.99
Filler content (Talc)	ISO3451	%	16	10.5
Melt index	ISO1133	g/10min		22.1
Tensile strength	ISO 527	MPa		17
Elongation at break	ISO 527	%		163
Flexural strength	ISO 178	MPa		25
Flexural modulus	ISO 178	MPa	>1200	1373
Izod notched impact	ISO 180/1A	KJ/m^2, (23°C)		28.5
Izod notched impact	ISO 180/1A	KJ/m^2, (-30°C)		4.7
Charpy notched impact	ISO 179/1eA	KJ/m^2, (23°C)	>25	25.7
Charpy notched impact	ISO 179/1eA	KJ/m^2, (-30°C)		4.1
Rockwell hardness	ISO 2039	-		54.4
HDT (Flatwise)	ISO 75/B	°C		93
Melting point	ISO 11357	°C		164.5

- Ingredients of the compound resin

Chemical Name	Common Name	CAS Number	Contents
Lignocellulose	SSEIF-L	**9005-53-2**	5 wt%
Poly(ethylene-co-propylene)	Polypropylene copolymer	9010-79-1	57 wt%
Poly(ethylene-co-1-octene)	Polyolefin elastomer	26221-73-8	23 wt%
	Talc	14807-96-6	10 wt%
	Additives		5 wt%

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2. Physical properties of polypropylene-SSEIF®-L Composites for automotive components for Ford requirements.

Properties	Methods	Units	Requirements (TPP40AE62, LyondellBasell)	Results (replaced 5wt% talc with SSEIF-L)
Density	ISO 1183	g/cm^3	1.28	1.19
Filler content (Talc)	ISO3451	%	40	35
Melt index	ISO1133	g/10min	7.5	10.3
Tensile strength	ISO 527	MPa	30.5	34
Elongation at break	ISO 527	%		
Flexural strength	ISO 178	MPa		
Flexural modulus	ISO 178	MPa	3400	3850
Izod notched impact	ISO 180/1A	KJ/m^2, (23°C)	2.8	3.8
Izod notched impact	ISO 180/1A	KJ/m^2, (-30°C)	1.6	2
Charpy notched impact	ISO 179/1eA	KJ/m^2, (23°C)		
Charpy notched impact	ISO 179/1eA	KJ/m^2, (-30°C)		
Rockwell hardness	ISO 2039	-		
HDT (Flatwise-1.8Mpa)	ISO 75/A	°C	89	92
HDT (Flatwise-10.45Mpa)	ISO 75/B		135	139
Melting point	ISO 11357	°C		

- Ingredients of the compound resin

Chemical Name	Common Name	CAS Number	Contents
Lignocellulose	SSEIF-L	**9005-53-2**	5 wt%
Poly(ethylene-co-propylene)	Polypropylene copolymer	9010-79-1	54.5 wt%
Poly(ethylene-co-1-octene)	Polyolefin elastomer	26221-73-8	-
	Talc	14807-96-6	35 wt%
	Additives		5.5 wt%

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3.1. Physical properties of EPDM-SSEIF®-L composite

Properties		Results	Comment
SSEIF-L content (%)		9.2	
Mooney (125 ℃)	Mv	39.6	
	T5	20:01	
MDR (170 ℃*10min)	T_{max}	8.5	
	T_{min}	1.5	
	tc10	2:12	
	tc90	5:06	
170 ℃ @ 10 min press cured			
Test		**Results**	
Physical property	Hs (Shore-A)	53	
	Tensile strength (kg/㎠)	143	
	Elongation (%)	735	
	Density (g/㎤)	1.044	
Compression set (70 ℃* 22hrs*25%)		24	170℃*20min Press Cured
Resilience (%)		56	

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3.2. Physical properties of EPDM-SSEIF®-L composite

Properties			T1	T2	T3
EPDM	phr		100(50wt%)	100(50wt%)	100(50wt%)
CaCO3			10		10
SSEIF-L				10	10
Rheology (170×12′)	Tmax MH		19.65	19.75	19.80
	Tmin ML		2.33	2.38	2.43
	Ts2		02'45"	02'48"	02'47"
	Tc10		02'41"	02'44"	02'43"
	Tc90		06'12"	06'27"	06'36"
무늬점도(FMB)	121℃	ML(1+4)	17.59	17.58	20.14
Mooney 타임(FMB)	121℃	T5	17'41"	18'39"	18'12"
		T35	26'50"	27'18"	27'52"
Conditions		SHEET	170℃×20'	170℃×20'	170℃×20'
		C . S	170℃×40'	170℃×40'	170℃×40'
Physical properties	Hs	50±5	**50**	**53**	**53**
	IRHD	-	49.0	51.3	51.0
	Ts (kgf/㎠)	T.B.D	67.2	64.0	61.0
	Eb (%)	T.B.D	420.1	398.0	430.2
	M100 (kgf/㎠)	-	12.1	16.2	14.5
	M300 (kgf/㎠)	-	42.2	46.5	41.2
비 중			1.051	1.040	1.061
Thermal properties	Experimental conditions		70℃ × 70h	70℃ × 70h	70℃ × 70h
	HS	+ 7 MAX			+4
	Ts	-25 MAX			+21.0
	Eb	-25 MAX			-1.0
Compression set	Conditions		70℃ × 22h	70℃ × 22h	70℃ × 22h
	Impact resilience	25 MAX	11.0	9.7	9.6
Ozon test	Conditions		50PPHM × 40℃ × 8(72)h × 20%	50PPHM × 40℃ × 8(72)h × 20%	50PPHM × 40℃ × 8(72)h × 20%
	NO CRACK		NO CRACK	NO CRACK	NO CRACK
Cold test	Conditions		-40℃ × 3'(24h)	-40℃ × 3'(24h)	-40℃ × 3'(24h)
	NO CRACK		NO CRACK	NO CRACK	NO CRACK

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4. Physical properties of UPR-SSEIF®-L composite

Properties	Units	Fillers					
		$CaCO_3$	Biorefinery Lignin*		SSEIF-L		
Filler content	Phr	180	20	40	30	40	50
UPR		100	100	100	100	100	100
Initial viscosity	Ps, 40℃	180	45.6	125.6	64	146	680
Toning		Possible	Impossible	Impossible	Impossible	Impossible	Impossible
GT (140′C sec)		80			Not measurable	Not measurable	Not measurable
Smoothness		Good		Bad		Good	
Warpage		Bad		Good		Bad	
Density		1.85		1.5		1.5	
Flexural strength	Mpa (ASTM D790)	180		75		170	
Flexural modulus	Gpa	10		3.5		6.5	
Tensile strength	Mpa (ASTM D638)	80		40		70	

*Competitor's functional biofiller

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5. Physical properties of NBR-SSEIF®-L, B composite

Properties	Units	Fillers			
		-	Kraft Lignin	SSEIF-BA	SSEIF-L
NBR (phr)	phr	100	100	100	100
Kraft lignin (phr)		-	10	-	-
SSEIF-BD		-	-	10	-
SSEIF-L		-	-	-	10
Zinc oxide		5	5	5	5
Stearate		1	1	1	1
PEG4000		3	3	3	3
Sulfur		1.5	1.5	1.5	1.5
2-Mercaptobenzothiazole		0.7	0.7	0.7	0.7
2-Mercaptobenzothiazole disufide		1.0	1.0	1.0	1.0
Mixing condition		30℃→80℃	-	30℃→80℃	30℃→80℃
Roll condition		30℃/3min	30℃/10min	30℃/3min	30℃/3min
Molding condition		155℃/T90	155℃/T90	155℃/T90	155℃/T90
Physical properties					
Density	g/cm^3	1.03	1.073	1.074	1.059
Hardness	A type	45	44	48	48
Tensile strength	kgf/cm^2	33.4	20.3	47.4	47.7
Elongation	%	480	495	822	839
Tear strength	kgf/cm	19.1	13.3	17.8	18.7
Impact resilience	%	25	24	23	23
DIN abrasion	mm^3	111	481	105	85
Friction force	(μ), dry/wet	0.55/0.31	0.52/0.30	0.50/0.28	0.50/0.27

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6. Physical properties of EVA-SSEIF®-L, B composite

Properties	Units	Fillers					
		-	Kraft lignin	SSEIF-BA		SSEIF-L	
EVA (phr)	phr	100	100	100	100	100	100
Kraft lignin (phr)			10				
SSEIF-BD				10	10		
SSEIF-L						10	10
Zinc oxide		2	2	2	2	2	2
Stearate		1	1	1	1	1	1
TiO_2		5	5	5	5	5	5
Dicumyl peroxide (DCP)		1	1	1	1	1	1
azodicarbonamide (JTR)		4	4	4	6	4	6.5
Mixing condition		30℃→80℃					
Roll condition		80℃/3min	80℃/10min				
Molding condition		170℃/10min(10T mold)					
Physical properties							
Density	g/cm^3	0.170	0.144	-	0.172	-	0.173
Hardness	C type	48	35	72	47	68	47
Tensile strength	kgf/cm^2	18.3	10.3	-	20.5	-	19.8
Elongation	%	157	175	-	285	-	272
Tear strength	kgf/cm	9.9	7.6	-	12.1	-	11.3
Impact resilience	%	58	56	54	57	54	57
DIN abrasion	mm^3	394	832	-	385	-	392
Ammonia	ASTM D1426-15	Detected	Detected	N.D*	N.D	N.D	N.D
ER	%	170	182	130	170	140	170

*ND: not detected

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