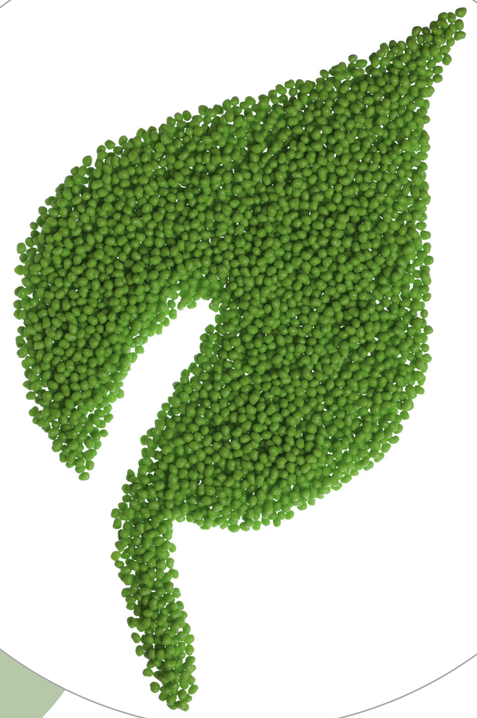
A Material Difference

Dryflex® Green

Our Soft Plastics from Plants



HEXPOL® TPE

Contents

Introduction

Dryflex Green is a family of biobased thermoplastic elastomer (TPE) compounds containing raw materials from renewable resources. We have developed numerous compounds with amounts of renewable content to over 90% (ASTM D 6866-12) and hardness from 15 Shore A to 60 Shore D.

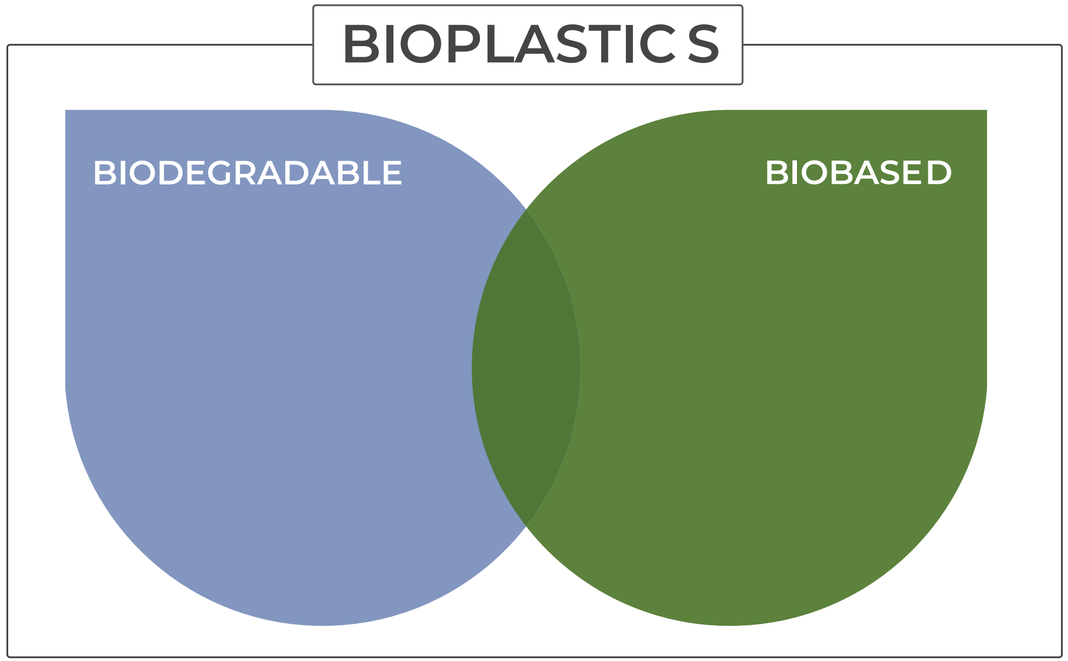
In this guide we show some typical properties for the Dryflex Green range, these are not exhaustive and by no means list all available properties and materials. Our aim is to supply a material that precisely matches application requirements and where an existing grade cannot satisfy the specific demands of your application, we have the proven expertise to customise a material that will.

Please use this guide as an introduction to our Dryflex Green range and contact us to discuss your specific requirements.

What are Bioplastics?

The term bioplastics describes an evolving and increasingly sophisticated family of materials. Bioplastics can be biobased, biodegradable or both.

Bioplastic that is biobased is made partially or wholly from raw materials derived from renewable biological sources, these include products and by-products from agriculture that are rich in carbohydrates, especially saccharides such as grain, sugar beet, sugar cane, etc. The biobased content could derive from different raw materials such as polymers, fillers, plasticizers or additives.



Biobased vs Biodegradable

There can sometimes be confusion between the terms biobased and biodegradable, biodegradability and biobased content are in fact, two distinct features of bioplastics.

A common misconception is that biobased bioplastics are all biodegradable, they are not. A bioplastic that is biobased may not necessarily be biodegradable, and a biodegradable bioplastic may not be biobased.

We can therefore categorise bioplastics in three groups, each with their own set of properties and characteristics.

Biobased plastics: a plastic where at least a part of the content comes from renewable biological or agricultural materials

Biodegradable & biobased plastic : a plastic that is designed to degrade under compost conditions. Containing renewable content

Biodegradable plastics : a plastic that is designed to degrade under compost conditions. Based on fossil resources

Dryflex Green TPE compounds are biobased and recyclable

Why Use Biobased?

Sustainability : Biobased plastics help to reduce the usage and dependency on limited fossil resources.

Improved Carbon Footprint : Plants absorb carbon dioxide from the atmosphere as they grow. By using these crops to create biobased plastic products, greenhouse gases (CO_2) are removed from the atmosphere.

Life Cycle Assessment : Bioplastics contribute to an improved result from LCA.

Ethical Land Management : Crops for industrial use can be grown in poor soil which is unsuited to food crops, potentially avoiding food crop displacement.

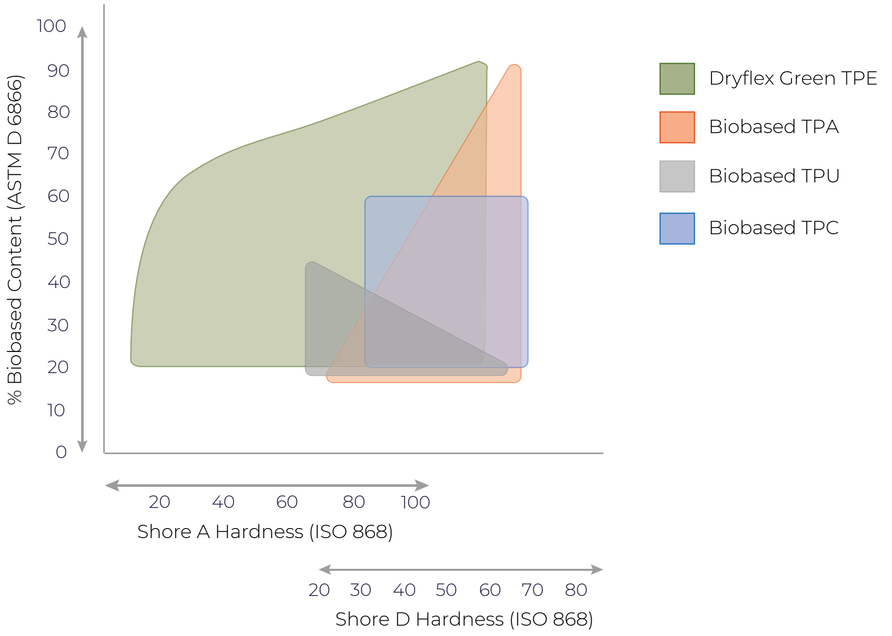
Consumer Demand : Purchasing power favours products from sustainable resources.

Creating Soft Materials with High Levels of Renewable Content

Since most biobased raw materials in the market are quite hard on their own, a major challenge has been to develop compounds with high renewable content, low hardness while at the same time maintaining mechanical properties at acceptable levels.

Figure 1 shows the Dryflex Green TPE compounds divert from the other soft thermoplastic materials on the market today by including also soft materials with high levels of renewable content and thereby covering a greater segment and opening up more design possibilities.

Figure 1 : Percentage of Bio-content vs Hardness



How do they Compare to Conventional TPEs?

- Dryflex Green TPE compounds display mechanical and physical properties close to and comparable to TPE compounds from fossil based raw materials.
- In general the Dryflex Green compounds show very good bonding behaviour to PE and PP.
- We have also developed special grades with good bonding to ABS, PC/ABS, PET etc.
- Like conventional TPE compounds, Dryflex Green TPEs can easily be coloured to give vibrant and appealing visual impact.

Examples of DRYFLEX GREEN TPS Compounds

Over 20% bio-content

Grade	Hardness[1] ISO 868 Shore A	Density ISO 2781 g/cm3	Tensile Strength[2] ISO 37 Type 1 MPa	Stress at 100% Strain[2] ISO 37 Type 1 MPa	Stress at 300% Strain[2] ISO 37 Type 1 MPa	Elongation at Break[2] ISO 37 Type 1 %	Tear Strength[2] ISO 34-1 Method C N/mm	CS 23°C / 72h ISO 815-1 Type B %	CS 70°C / 22h ISO 815-1 Type B %	Biobased Carbon Content ASTM D6866 % of TOC	Gravimetric Fogging ISO 6452 100°C / 16h mg
Dryflex SE 60A25G1N A	60	0.90	4.4	1.6	2.1	> 650	19	19	42	25	0.39
Dryflex SE 70A28G1N A	70	0.90	4.6	2.0	2.4	> 700	21	19	47	28	0.44
Dryflex SE 80A28G1N A	80	0.90	5.2	2.6	3.1	> 650	29	22	51	28	-
Dryflex SE 60A25G2N A	60	1.09	4.2	1.5	1.8	> 750	17	21	42	25	0.44
Dryflex SE 70A26G2N A	70	1.09	4.6	1.8	2.3	> 600	16	21	46	26	-
Dryflex SE 80A27G2N A	80	1.09	5.5	2.4	3.2	> 550	23	23	51	27	-

[1] After 15 seconds

[2] Across the flow direction

Examples of DRYFLEX GREEN TPS Compounds

Over 60% bio-content

Grade	Hardness[1] ISO 868 Shore A	Density ISO 2781 g/cm3	Tensile Strength[2] ISO 37 Type 1 MPa	Stress at 100% Strain[2] ISO 37 Type 1 MPa	Stress at 300% Strain[2] ISO 37 Type 1 MPa	Elongation at Break[2] ISO 37 Type 1 %	Tear Strength[2] ISO 34-1 Method C N/mm	CS 23°C / 72h ISO 815-1 Type B %	CS 70°C / 22h ISO 815-1 Type B %	Biobased Carbon Content ASTM D6866 % of TOC	Gravimetric Fogging ISO 6452 100°C / 16h mg
Dryflex SC 60A64G1N A	60	0.89	3.1	1.9	2.6	> 400	20	23	60	64	0.53
Dryflex SC 70A63G1N A	70	0.89	3.8	2.8	3.5	> 350	27	24	66	63	-
Dryflex SC 80A65G1N A	80	0.89	4.4	3.2	3.8	> 450	33	26	68	65	0.57

[1] After 15 seconds

[2] Across the flow direction

Examples of DRYFLEX GREEN TPS Compounds

Over 80% bio-content

Grade	Hardness[1] ISO 868 Shore A	Density ISO 2781 g/cm3	Tensile Strength[2] ISO 37 Type 1 MPa	Stress at 100% Strain[2] ISO 37 Type 1 MPa	Stress at 300% Strain[2] ISO 37 Type 1 MPa	Elongation at Break[2] ISO 37 Type 1 %	Tear Strength[2] ISO 34-1 Method C N/mm	CS 23°C / 72h ISO 815-1 Type B %	CS 70°C / 22h ISO 815-1 Type B %	Biobased Carbon Content ASTM D6866 % of TOC	Gravimetric Fogging ISO 6452 100°C / 16h mg
Dryflex SC 50A82G1N A	50	0.90	4.5	1.5	3.0	> 600	19	17	38	82	0.54
Dryflex SC 60A82G1N A	60	0.90	4.9	1.9	3.3	> 750	32	26	42	82	0.68
Dryflex SC 70A83G1N A	70	0.90	5.3	2.8	4.0	> 750	35	33	52	83	0.95
Dryflex SC 80A84G1N A	80	0.90	5.6	3.5	4.6	> 800	40	40	55	84	0.96
Dryflex SC 50A82G2N A	50	0.98	4.0	1.3	2.6	> 600	24	13	43	82	0.43
Dryflex SC 80A84G2N A	80	0.98	5.0	3.3	4.4	> 600	38	35	53	84	0.91

[1] After 15 seconds
[2] Across the flow direction

Examples of DRYFLEX GREEN TPO Compounds

Grade	Hardness[1] ISO 868 Shore A	Density ISO 2781 g/cm3	Tensile Strength ISO 37 Type 1 MPa	Stress at 100% Strain ISO 37 Type 1 MPa	Elongation at Break ISO 37 Type 1 %	Tear Strength ISO 34-1 Method C N/mm	Biobased Carbon Content ASTM D6866 % of TOC
Dryflex EP 60A33G1N U	60	0.87	4.5	2.4	> 500	27	33
Dryflex EP 70A34G1N U	70	0.87	5.2	2.6	> 600	28	34
Dryflex EP 80A36G1N U	80	0.87	6.4	4.3	> 400	42	36

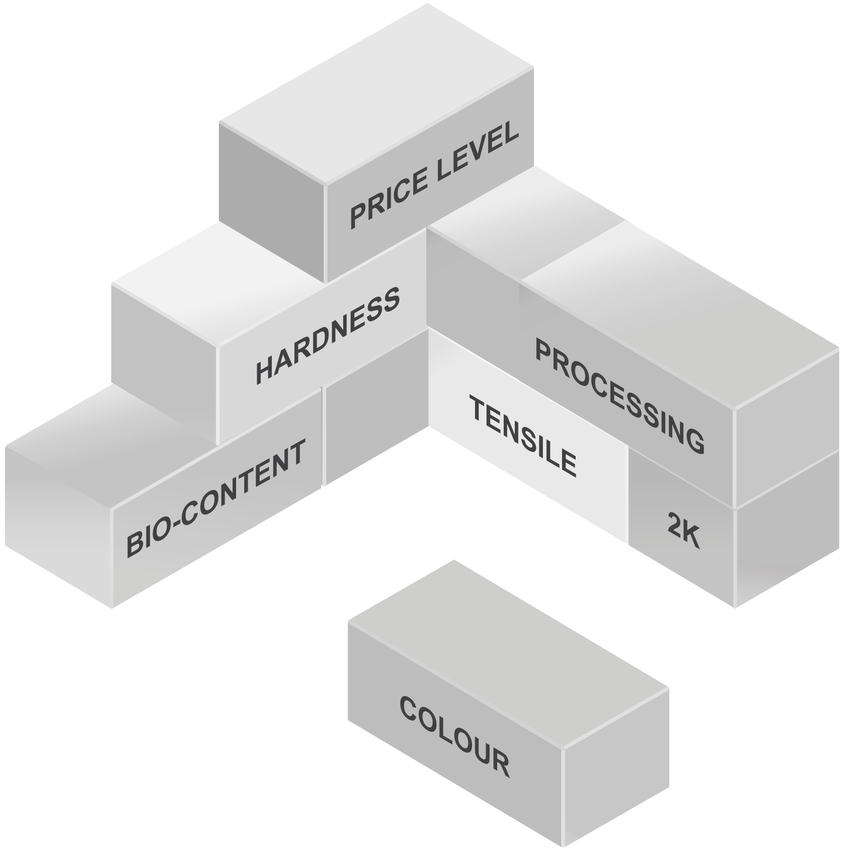
[1] After 15 seconds
[2] Across the flow direction

Customised Building Blocks

As requirements can vary greatly for each application, we see a need for highly customised formulations.

Alongside our standard ranges, we have qualified a number of raw materials which will allow us to work with a modular system to build a compound that is tailored to customer specifications.

Depending on requirements regarding bio-content and hardness, food contact grades are available.

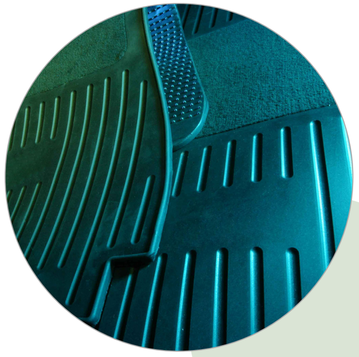


Customisation Options

- Percentage and type of renewable content (to over 90% ASTM D 6866-12)
- Hardness (15 Shore A to 60 Shore D)
- Durable and long-lasting
- Drop-in solution
- No predrying
- Adhesion to polymers, such as PE, PP, ABS, PC/ABS, PET etc
- Easy to colour
- Filled or unfilled compounds
- Mechanical behaviour such as flexibility and tensile properties
- Price Level
- Surface finish and haptics
- UV and heat stability
- Grades available with raw materials that are compliant with food contact regulations
- Automotive grades with low odour and emission
- Fully recyclable

Typical Applications

Dryflex Green TPE compounds can be used in many applications that currently use conventional TPEs, such as soft-touch grips and handles, sealing and closures, automotive, consumer goods, sports equipment, toys and infant care.



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