nonoilen

made for cleaner environment

Giving back to nature what we take from it.
NonOilen® is full biobased.

...panara

Content

NonOilen® concept

NonOilen® is an ecological alternative that can be used in various applications as a replacement for conventional plastic materials made from crude oil and also currently used bioplastics on the market. It is a progressive, fully biodegradable material from renewable resources. The name NonOilen® was created by connecting three words – non, oil and environment. Its main message is "it is possible without oil"

Fully biobased

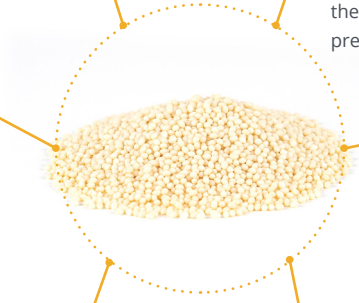
The composition of NonOilen® is based on polymers from renewable resources. The material can be described as fully bio-based, because the sole origin of the polymers used is biomass. This accounts for all current and all future NonOilen® grades.

100% made in Slovakia

NonOilen® is the result of collaboration between scientists from the Slovak Technical University in Bratislava under the leadership of Professor Pavel Alexy and PANARA. The goal of both parties is to produce bioplastics with a wide range of practical uses.

Recyclable

As one of the few ecological substitutes for plastics, NonOilen® is fully material recyclable, which will make it possible to extend its life cycle. Unlike conventional synthetic plastics, material recycling in the case of NonOilen® is a truly sustainable solution. Material recycling cannot be done endlessly - here NonOilen® has an advantage over conventional synthetic polymers as it can be composted once it cannot be recycled anymore.



Fully compostable

NonOilen® is 100% biodegradable and depending on its particular grade, it decomposes in home or industrial compost; special types of NonOilen® can also decompose in soil. It decomposes fully - without the formation of microplastics. It decomposed only in presence of microorganisms.

100% ecological

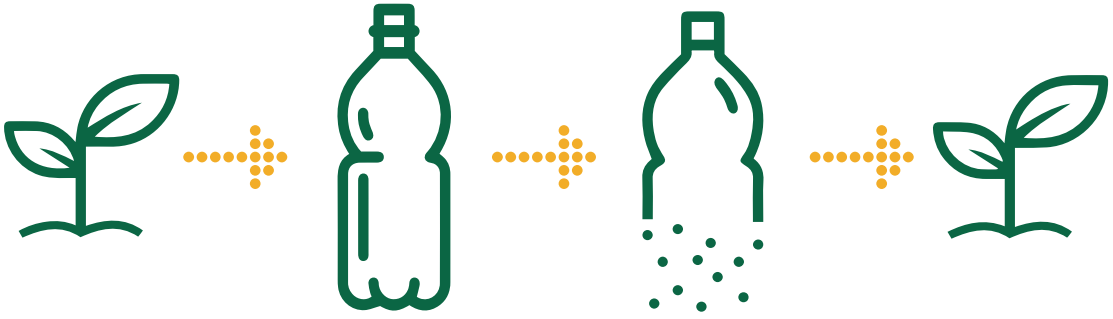
Unlike conventional synthetic polymers made from crude oil, NonOilen® is biobased and thus does not add additional carbon from underground to the biosphere. Hence NonOilen® does not add additional greenhouse gases to the atmosphere when it is decomposing. NonOilen® is consistent with the philosophy of giving back to nature what we have taken from

Modifiable properties

We prepare NonOilen® in the form of pellets. The converter does not have to adapt to the properties of the material as NonOilen® is adjusted to the application needs. Further existing processing equipment can be used. Thanks to the individual approach, NonOilen® can be used in various application areas.

NonOilen®

Introducing NonOilen®. A polymer blend that never becomes a waste, as it turns into biomass at the end of its life. It is fully biodegradable, fully compostable and made only of polymers from renewable sources.



In the production of the NonOilen®, we chose an uncompromising, full-eco approach. The basic raw materials for the production of NonOilen® come exclusively from renewable sources.

Products made from NonOilen® are fully compostable under industrial, home or soil conditions.

NonOilen® does not impair the natural activity of the compost and does not pollute it. It is a part of a naturally occurring carbon cycle. NonOilen® materials decompose in the same way as other natural materials. The decomposition is a result of biochemical activity of microorganisms in compost or soil. Unlike some bioplastics available on the market, NonOilen® actually decomposes into water, carbon dioxide and biomass in a presence of microorganisms without leaving microplastics in the environment.

With NonOilen®, we foster the idea of *„Giving back to nature what we took from it".*

Converters do not have to adapt to the properties of NonOilen®, we are able to modify NonOilen® according to their requirements. By doing so, we enable a quick and efficient introduction of a wide range of sustainable, compostable products to the market.

NonOilen® cycle

NonOilen® products are fully compostable at the end of their life cycle. This unique material is biodegradable and after its decomposition there are no microplastics left and no environmental burden.

As one of the few ecological substitutes for plastics, NonOilen® is fully material recyclable, which will make it possible to extend its life cycle. Unlike conventional synthetic plastics, material recycling in the case of NonOilen® is a truly sustainable solution. Material recycling cannot be done endlessly - here NonOilen® has an advantage over conventional synthetic polymers as it can be composted once it cannot be recycled anymore, thereby closing the life cycle of NonOilen® where it began - in the soil. It is a fully sustainable ecological solution in the field of new ecological materials.

Comparison of NonOilen® material properties with the most commonly used bioplastics on the market

	BioPE, BioPP, BioPET	Starch	PBAT	PLA	PHA	NonOilen®
Renewable source of raw material	✓	✓		✓	✓	✓
Biodegradation in industrial compost		✓	✓	✓	✓	✓
Biodegradation in home compost		✓			✓	✓
Heat resistance up to 100 °C	✓				✓	✓
Material recycling	✓		✓	✓		✓
Adaptable flexibility	✓		✓			✓

NonOilen® is material which meets all the criteria of modern ecological plastics without making any compromises. NonOilen® materials are based on polymers from renewable resources and are fully biodegradable in compost. Biodegradation is achieved in completely, leaving no microparticles. It stands out among other competitors thanks to its good mechanical properties even without the addition of synthetic polymers.

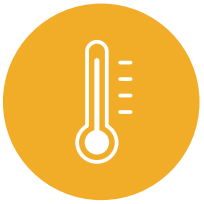
NonOilen® application

NonOilen® is suitable for production of a wide range of products with various properties. Based on the type of application, the products can be reusable, safe for food contact, and can be washed in a dishwasher repeatedly. We supply NonOilen® in the form of pellets that are processable by conventional technologies designated for thermoplastic polymers processing.

The right solution for all environmental challenges. Good processing properties and highly variable physical and mechanical properties turn NonOilen® into a widely applicable polymer material everywhere, where ecology and protection of the environment is important. It is an best possible replacement for plastics with a short life span for various consumer segments ranging from conventional packaging such as sacks, bags, blisters, secondary industrial and consumer packaging, food industry packaging and various consumer industry products to sophisticated materials for medicine and tissue engineering. By combining our special processing technology and our know how we can achieve:

From rigid to flexible (adjustable)

High oxygen and water vapor barrier



Withstand more than 100 °C

Biocompatible

NonOilen® is suitable for standard plastics processing technologies, such as

- injection moulding
- production of films
- thermoforming
- 3D printing
- blowing of hollow products
- technical fabrics (especially for agriculture applications)
- extrusion
- melt spinning
- melt pressing
- non-woven fabric
- laminating
- production of boards

NonOilen® Diversity in a

		INJECTION MOULDING				INJECTION BLOW MOULDING		EXTERUSION BLOW MOULDING	FILM BLOW
		NonOilen® IM 3056-2	NonOilen® IM 3066-1	NonOilen® IM 3361-7	NonOilen® IM 3066-9	NonOilen® IBM 3066-1	NonOilen® IBM 3361-7	NonOilen® EBM 3361-8	NonOilen® FB 3046-5
Mechanical properties	Flexibility	•	••	•	•••	••	•	••	•••
	Strength	•••	••	••	•	••	••	•	•
	Impact resistance	••	•••	•••	•••	•••	•••	•••	-
Barrier properties	Water barrier	••	•	-	-	•	-	-	•
	Oxygen barrier	••	••	•••	-	••	•••	-	•••
Thermal properties	Shape stability	•••	••	•••	•	••	•••	•	-
Biodegradability	Industrial compost	OK	OK	OK	OK	OK	OK	OK	OK
	Home compost		a	a	a	a	a	a	
	Soil condition		a	a	a	a	a	a	
Application		bowl, cups, toys, lids, dose ...				bottles for cosmetics, medicine bottles ...		bottles for cosmetics, medicine bottles ...	bags, agro mul sachets

o weak • low •• medium ••• high **N/A** not available - not relevant **a** under certification process

pplication

ING	EXTRUSION AND THERMOFORMING			3D PRINTING	PLA
onOilen® B 3361-6	NonOilen® TF 3360-1	NonOilen® TF 3066-8	NonOilen® EX 3361-9	NonOilen® 3D 3056-2	
• • •	•	•	• • •	•	○
•	• • •	• • •	•	• • •	• • •
-	• •	• • •	• • •	• •	-
-	• •	-	-	-	○
-	• • •	-	-	-	○
-	• • •	• • •	• •	• • •	-
OK	OK	OK	OK	OK	OK
a			a		
a			a		
ch, small ...	bowl, cup ...		straws	3D filament	

Detailed technical data sheets are avalaible on website.

www.nonoilen.com

Injection moulding

Typical properties of biodegradable NonOilen® injection moulding blends

	Standard	Unit	NonOilen® IM 3065-2	NonOilen® IM 3066-1	NonOilen® IM 3361-7	NonOilen® IM 3066-9
Renewable content	-	%	100	100	100	100
Biodegradability	ISO 14855 ISO 17556	-	TÜV Austria OK compost INDUSTRIAL	OK compost HOME [a]	OK compost HOME [a]	OK compost HOME [a]
Food contact approval	EU 10/2011	-	√[b]	√[b]	√[b]	√[a]
Tensile strength	ISO 527	MPa	43	22,5	28	12
Elongation at break	ISO 527	%	11	25	5	450
Tensile modulus	ISO 527	GPa	2,5	1,3	1,5	0,4
Flexural Modulus	ISO 178	GPa	3,3	1,2	1,7	0,5
Impact strength Charpy +23°C (unnotched)	ISO 179	kJ/m²	15	78	40	63
Impact strength Charpy -30°C (unnotched)	ISO 179	kJ/m²	13	12	13	11
HDT	ISO 75, B	°C	110	90	103	60
Density	ISO 1183	g/cm³	1,2	1,2	1,2	1,2

a - certification in progress
b - available on request, food contact limitations, for more information please contact info@panara.eu

Processing conditions

Melt temperature should not exceed 190°C, optimally it should range from 155 to 165°C (barrel) and 175°C on the nozzle. Mould temperature in range between 30 -70°C is recommended according to material composition and product geometry.

Injection blow moulding

Typical properties of biodegradable NonOilen® injection blow moulding blends

	Standard	Unit	NonOilen® IBM 3066-1	NonOilen® IBM 3361-7
Renewable content	-	%	100	100
Biodegradability	ISO 14855 ISO 17556	-	OK compost HOME [a]	OK compost HOME [a]
Food contact approval	EU 10/2011	-	√[b]	√[b]
Tensile strength	ISO 527	MPa	22,5	28
Elongation at break	ISO 527	%	25	5
Tensile modulus	ISO 527	GPa	1,3	1,5
Flexural Modulus	ISO 178	GPa	1,2	1,7
Impact strength Charpy +23°C (unnotched)	ISO 179	kJ/m^2	78	40
Impact strength Charpy -30°C (unnotched)	ISO 179	kJ/m^2	12	13
HDT	ISO 75, B	°C	90	103
Density	ISO 1183	g/cm^3	1,2	1,2

a - certification in progress
b - available on request, food contact limitations, for more information please contact info@panara.eu

Processing conditions

Melt temperature should not exceed 190°C, optimally it should range from 155 to 165°C (barrel) and 175°C on the nozzle. Mould temperature in range between 30 -70°C is recommended according to material composition and product geometry.

Extrusion blow moulding

Typical properties of biodegradable Nonoilen® extrusion blow moulding blends

	Standard	Unit	NonOilen® EBM 3361-8
Renewable content	-	%	100
Biodegradability	ISO 14855 ISO 17556	-	OK compost HOME [a]
Food contact approval	EU 10/2011	-	√[b]
Tensile strength	ISO 527	MPa	17
Elongation at break	ISO 527	%	23
Tensile modulus	ISO 527	GPa	0,6
Flexural Modulus	ISO 178	GPa	1
Impact strength Charpy +23°C (unnotched)	ISO 179	kJ/m^2	94
Impact strength Charpy -30°C (unnotched)	ISO 179	kJ/m^2	13
HDT	ISO 75, B	°C	70
Density	ISO 1183	g/cm^3	1,2

a - certification in progress
b - available on request, food contact limitations, for more information please contact info@panara.eu

Processing conditions

Melt temperature should not exceed 190°C, optimally it should range from 150 to 170°C (barrel) and 175°C on the nozzle. Mould temperature in range between 30 -70°C is recommended according to material composition and product geometry. If homogeneity of the melt is not perfect (unmelted pellets), higher shear on the barrel is recommended more than higher temperature.

Film blowing

Typical properties of biodegradable NonOilen® film blowing blends

	Standard	Unit	NonOilen® FB 3046-5		NonOilen® FB 3361-6	
Renewable content	-	%	100		100	
Biodegradability	ISO 14855 ISO 17556	-	TÜV Austria OK compost INDUSTRIAL		OK compost HOME [a] OK biodegradable SOIL;[a]	
Food contact approval	EU 10/2011	-	√[a]		√[b]	
			MD	TD	MD	TD
Tensile strength at break	ISO 527	MPa	22	17	19	13
Elongation at break	ISO 527	%	290	330	230	400
Tensile modulus	ISO 527	GPa	0,2	0,1	0,5	0,2
Tear resistance	ISO 6383	N/mm	11	24	15	77
Density	ISO 1183	g/cm³	1,2		1,2	
Transparency	-	-	Translucent		Translucent	

a - certification in progress
b - available on request, food contact limitations, for more information please contact info@panara.eu
MD - machine direction
TD - transversal direction

Processing conditions

Standard film blowing line for LDPE processing is recommended. Melt temperature should not exceed 170°C, optimally it should range from 140 to 160°C on the blown film die.

Extrusion and thermoforming

Typical properties of biodegradable NonOilen® extrusion and thermoforming blends

	Standard	Unit	NonOilen® TF 3360-1		NonOilen® TF 3066-8		NonOilen® EX 3361-9	
Renewable content	-	%	100		100		100	
Biodegradability	ISO 14855 ISO 17556	-	OK compost INDUSTRIAL [a]		OK compost INDUSTRIAL [a]		OK compost HOME [a]	
Food contact approval	EU 10/2011	-	√[b]		√[b]		√[b]	
			MD	TD	MD	TD	MD	TD
Tensile strength	ISO 527	MPa	49	42	37	24	17,5	12
Elongation at break	ISO 527	%	2	1,7	5	14	117	5,5
Tensile modulus	ISO 527	GPa	4	3,9	2	1,4	0,8	0,6
HDT	ISO 75, B	°C	107		107		85	
Density	ISO 1183	g/cm³	1,2		1,2		1,25	
Transparency	-	-	Opaque		Opaque		Opaque	

a - certification in progress
b - available on request, food contact limitations, for more information please contact info@panara.eu
MD - machine direction
TD - transversal direction

Processing conditions

Melt temperature should not exceed 200°C, optimally it should range from 160 to 180°C on the die. NonOilen® is suitable for cast film (sheet) extrusion with thickness up to 1 mm – semi-product for thermoforming. Thermoforming process parameters have to be adjusted according to specifics of production line and product shape.

3D printing

Typical properties of biodegradable Nonoilen® 3D printing blends

	Standard	Unit	NonOilen® 3D 3065-2
Renewable content	-	%	100
Biodegradability	ISO 14855 ISO 17556	-	TÜV Austria OK compost INDUSTRIAL
Food contact approval	EU 10/2011	-	√[b]
Tensile strength	ISO 527	MPa	43
Elongation at break	ISO 527	%	11
Tensile modulus	ISO 527	GPa	2,5
Flexural Modulus	ISO 178	GPa	3,3
Impact strength Charpy +23°C (unnotched)	ISO 179	kJ/m²	15
Impact strength Charpy -30°C (unnotched)	ISO 179	kJ/m²	13
HDT	ISO 75, B	°C	110
Density	ISO 75, B	g/cm³	1,2

a - certification in progress
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Processing conditions

For 3D filament production melt temperature should not exceed 190°C, optimally it should range from 160 to 180°C on the die. Filaments with diameter 1,75 mm or 2,85 mm are usually produced. For 3D printing the base plate temperature is recommended 20-50°C. Filaments on spool are also pre-dried.

Panara a.s.

NonOilen® is a registered trademark of Panara a.s. The company Panara a.s. is the owner of patents and industrial know-how, based on which it develops and manufactures a wide range of NonOilen® materials at its production plant in Nitra, Slovakia, with a total capacity of more than 4200 tons per year.

The environmental vision of Panara is to focus on development and production of new ecological plastics. Its goal is to replace the largest possible share of the commonly used plastics from fossil

...panara

www.nonoilen.com

OK compost TÜV AUSTRIA INDUSTRIAL S2777

BIOBASED > 85 % DIN Geprüft