oleon
a natural chemistry

www.oleon.com

INDUSTRIALS

Teaming up for your solution

TEAMING UP FOR YOUR SOLUTION

Developing and perfecting high-performance esters based on vegetal raw materials; that's what we're specialized in at Oleon Industrials! And it doesn't end there. We go the extra mile and partner up with you to look for sustainable and innovative solutions. With an open mind, we take up your challenges throughout the entire value chain.
The number of possible fatty esters is unlimited. So are the combination of functions they can perform. At Oleon, we are committed to find, create and jointly develop the right product for your application.

"Oleochemistry is a tailor-made chemistry; the demands of the consumer can be translated into an ester that yields the required performance"

Jeroen Dirckx,
Managing director derivatives

There are several applications of oleochemicals in plastics.

Typical applications for fatty esters are:

- Antistatic
- Antifog
- Lubricant/ Mold release
- Pigment dispersion
- Plasticizers Viscosity regulator

By changing the following characteristics a wide variety of specifications of the end product, i.e. polarity, steric hindrance, migration speed, … , can be obtained:

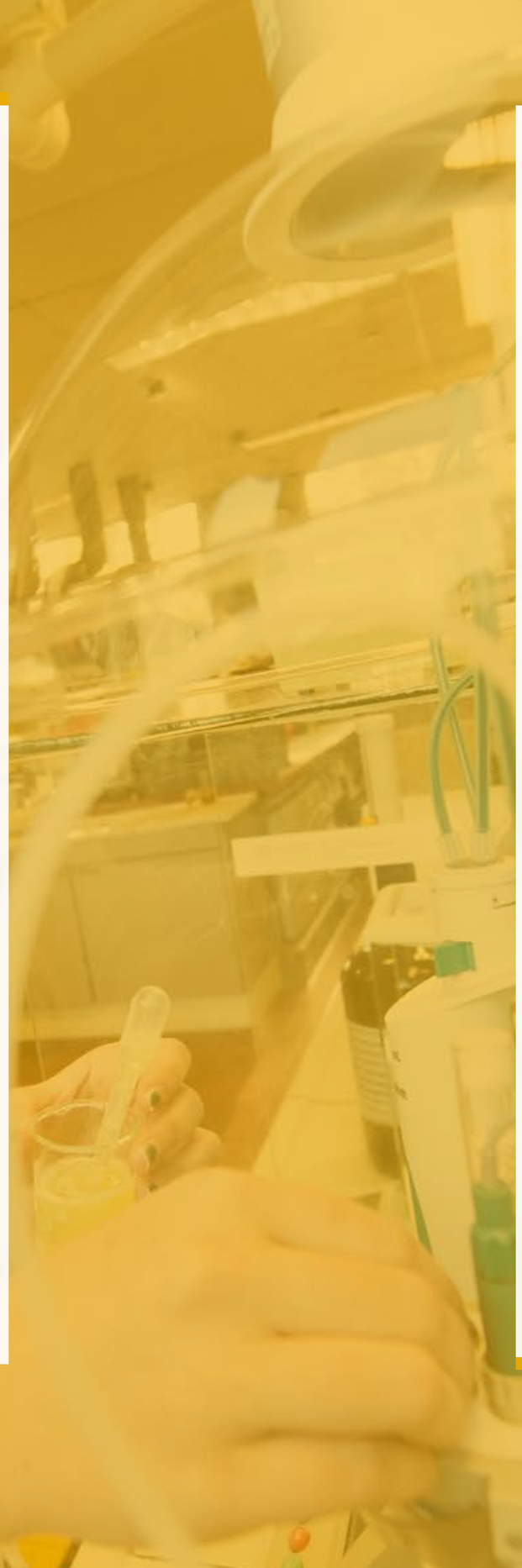
- Alcohol type
- Fatty acid
- Chain length
- Saturation
- Degree of esterification

The harmlessness of oleochemicals ensures that they are extremely **safe** and thus **well suitable for each step of the manufacture of plastics that comes into contact with food**.

OLEON
OUR VISION

“To be a leading global provider of OLEOCHEMICAL SOLUTIONS to our clients worldwide by focusing on customer intimacy, innovation and sustainable development, while providing our employees with a safe and stimulating work environment.”

Since January 2009, Oleon n.v. has been incorporated in the AVRIL GROUP, a leading financial and industrial organization active in the vegetable oils and proteins sector, with activities in food, feed, biofuels and oleochemistry. Consequently, Oleon has joined a group that is involved in the entire oilseed sector -from seed to all of its end products- and that is firmly committed to the development of oleochemistry.



CORPORATE
SOCIAL RESPONSIBILITY

Since 2015, Oleon has a tailor-made sustainability policy with SMART objectives and indicators. This policy is based on strong involvement of all our stakeholders to continuously improve our impact on the environment, the well-being of our people and the financial stability of our company.

>90%
renewable raw materials

yearly targets for
CO_2
emission reduction

strong
SAFETY CULTURE

RSPO MEMBER
Since 2007
RSPO-1106013

COMMUNITY INVOLVEMENT
CSR initiatives

COLLABORATIVE PLATFORMS
Ecovadis, sedex & CDP.

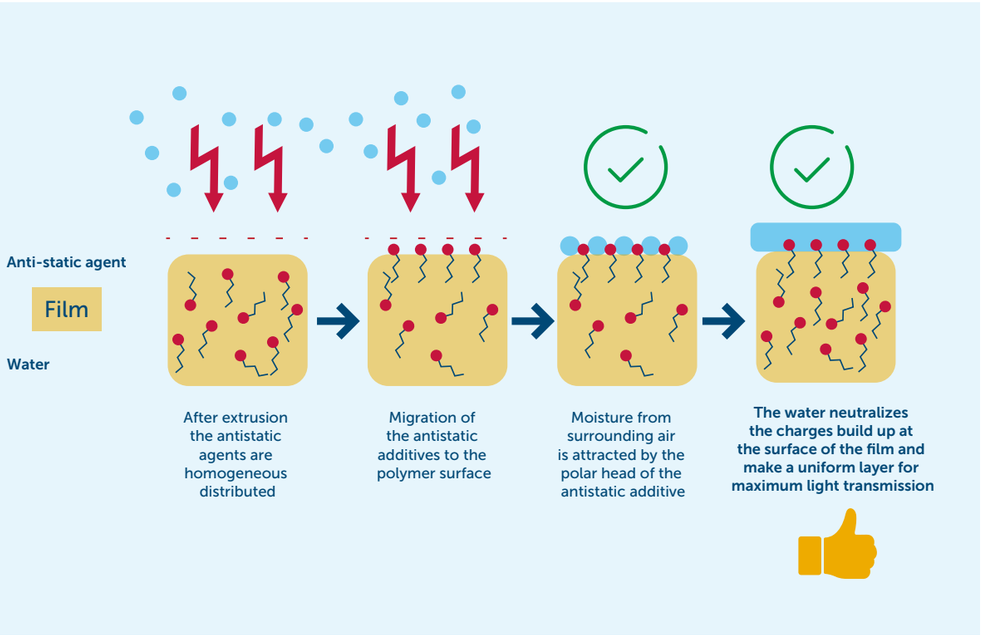
Continuous
ENERGY REDUCTION

RADIA® POLYMER ADDITIVES

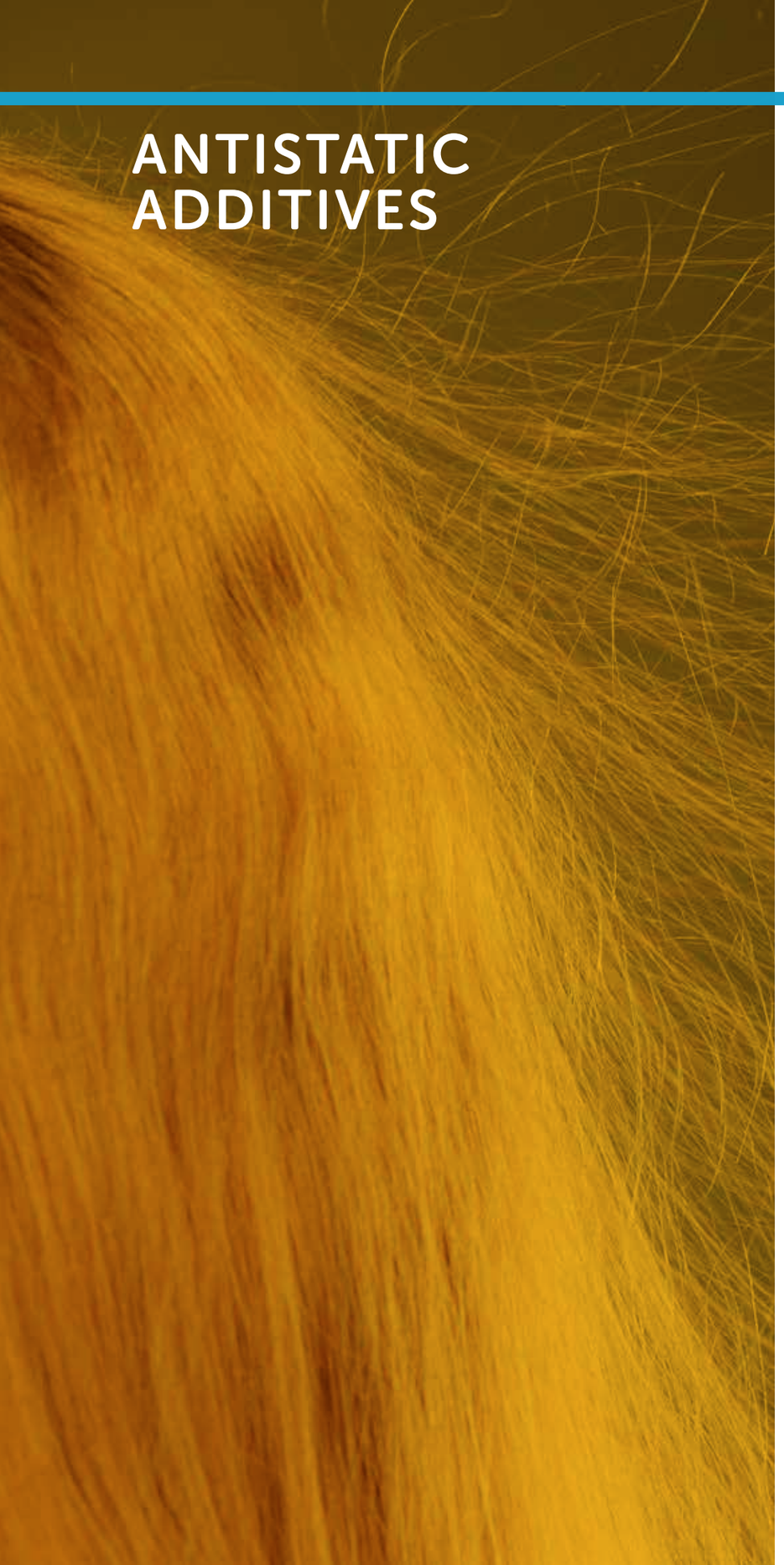
Antistatic

ANTISTATIC ADDITIVES

Oleon offers antistatic agents as a solution to problems related to the built-up of electric charges on plastic material such as dust pick up and fire or dust explosions. The additives are added to the polymer during the extrusion process where they migrate out and have their required effect.



PRODUCT CODE	CHEMICAL NAME	ORIGIN	PHYSICAL FORM	POLYMER		APPLICATION
				PVC	PO	
Radiamuls 7150	Glycerol mono oleate (40%)	Veg	Liquid	X		For flexible PVC in food, in combination with 7157
Radiasurf 2248	Polyglycerol mono stearate	Veg	Flakes, powder		X	Foam & film type, LLD film & LD/EVA film
Radiasurf 7125	Sorbitan monolaurate	Veg	Paste		X	PP
Radiasurf 7137	Sorbitan monolaurate (20EO)	Veg (FA)	Liquid	X	X	Film, food type
Radiasurf 7145	Sorbitan monostearate	Veg	Flakes, powder		X	For agricultural film with less then 8% EVA, PE & EVA film type in combination with R7641
Radiasurf 7157	Sorbtan mono oleate (20EO)	Veg (FA)	Viscous liquid	X		For PVC film in food, in combination with R7902 or R7150
Radiasurf 7403	PEG 400 mono oleate		Liquid	X		For film in combination with R7150
Radiasurf 7423	PEG 400 monolaurate		Liquid	X		Film type
Radiasurf 7641	Glycerol monostearate (50%)	Veg	Solid		X	PE/ EVA. Good balance between antsiatic and lubricant properties
Radiasurf 7152	Sorbitan mono oleate	Veg	Liquid	X	X	
Radiasurf 2249	Polyglycerol mono oleate	Veg	Liquid		X	



ANTISTATIC ADDITIVES

GLYCEROL MONOSTEARATE / GLYCEROL MONOOLEATE

For antistatic application, glycerol monostearate (GMS) and glycerol mono oleate (GMO) are used a lot as food approved polymer additive. To find the right cost/efficiency balance for your application and formulation, Oleon provides several GMS grades to meet the need of a specific mono content, fatty acid distribution or physical form and can select together with you the right grade for your application.

High purity especially designed for polymer use

						PURITY					
	PRODUCT CODE	MONO CONTENT (%)	C16 (%)	C18 (%)	MELTING POINT (°C)	PHYSICAL FORM	WATER CONTENT (%)	ACID VALUE (mgKOH/g)	IODINE VALUE (gI2/100g)	FREE GLYCERINE (%)	APPLICATION
GMS	RADIASURF 7904	95	15	85	72-75	Powder (70µm)	≤ 0,5	≤ 2	≤ 2	≤ 1	EPS
	RADIASURF 7901	90	30	70	65-70	Powder (180/320µm) / Beads	≤ 0,5	≤ 1,5	≤ 2	≤ 1	0,5-2,0% (PE)
	RADIASURF 7900	90	30	70	65-70	Powder (70µm)	≤ 0,5	≤ 1,5	≤ 2	≤ 1	EPS
	RADIASURF 7906	90	40	60	63-69	Powder (180µm)	≤ 0,5	≤ 1,5	≤ 2	≤ 1	0,5-2,0% (PE)
	RADIASURF 7910	90	60	40	63-69	Powder (180µm)	≤ 0,5	≤ 1,5	≤ 2	≤ 1	0,5-2,0% (PE)
	RADIASURF 7600	60	60	40	56-60	Powder (180µm)	≤ 0,5	≤ 1,5	≤ 2	≤ 1	0,5-2,0% (PE)
	RADIASURF 7344	50	60	40	55-60	Powder (180µm)	≤ 0,5	≤ 1,5	≤ 2	≤ 1	0,5-2,0% (PE)
GMO	RADIASURF 7902	90			23-27	Liquid	≤ 2	≤ 1	65-80	≤ 1	0,1-0,5% (PE)
	RADIASURF 7903	90			23-27	Liquid	≤ 2	≤ 3	60-75	≤ 1	0,1-0,5% (PE)

More C18% → Slower migration speed → Longer lasting antistatic efficiency
More C16% → less costly

High mono% → Higher antistatic effect
Lower mono% → more di% → Higher lubricity

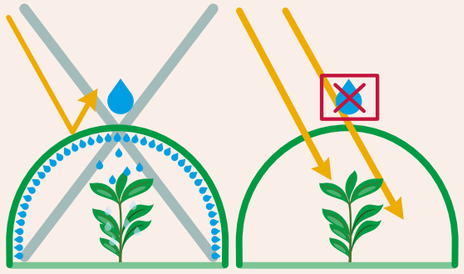
RADIA® POLYMER ADDITIVES

Antifog

ANTIFOG ADDITIVES

Oleon's antifog agents have their effect at the surface of the film, where they attract moisture from the air and form a continuous transparent layer allowing maximal light transmission. This effect is highly appreciated in food packaging as well as in agrofilm applications.

Applicaties

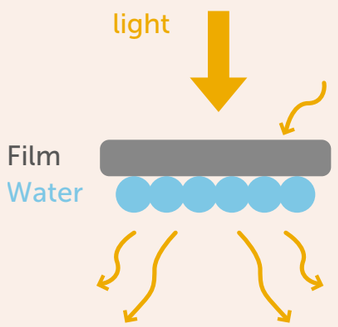


Agrofilm application

Food packaging

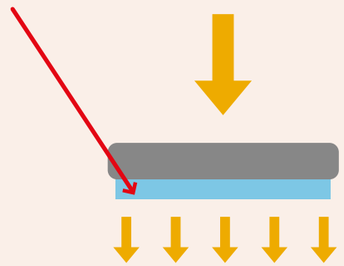
Mechanism

Film without anti-fogging



Condensed water droplets causing light to refract and diffuse

Film with anti-fogging



Water in a uniform layer allowing maximum light transmission

PRODUCT CODE	CHEMICAL NAME	ORIGIN	PHYSICAL FORM	POLYMER		APPLICATION
				PVC	PO	
Radiamuls 7150	Glycerol mono oleate (40%)	Veg	Liquid	X		For flexible PVC in food, in combination with R7157
Radiasurf 7125	Sorbitan monolaurate	Veg	Paste		X	PP
Radiasurf 7137	Sorbitan monolaurate (20EO)	Veg (FA)	Liquid	X	X	Film, food type
Radiasurf 7157	Sorbtan mono oleate (20EO)	Veg (FA)	Viscous liquid	X		For PVC film in food, in combination with R7902 or R7150
Radiasurf 7403	PEG 400 mono oleate	Veg (FA)	Liquid	X		For film in combination with R7150
Radiasurf 7423	PEG 400 monolaurate	Veg (FA)	Liquid	X		Film type
Radiasurf 7901	Glycerol monostearate (90%)	Veg	Solid	X	X	PE/EVA
Radiasurf 7152	Sorbitan mono oleate	Veg	Liquid	X	X	
Radiasurf 2249	Polyglycerol mono oleate	Veg	Liquid		X	PE/ EVA. Good balance between antsiatic and lubricant properties
Radiasurf 7152	Sorbitan mono oleate	Veg	Liquid	X	X	
Radiasurf 2249	Polyglycerol mono oleate	Veg	Liquid		X	

ANTIFOG ADDITIVES

FINDING THE CORRECT SOLUTION FOR YOUR APPLICATION

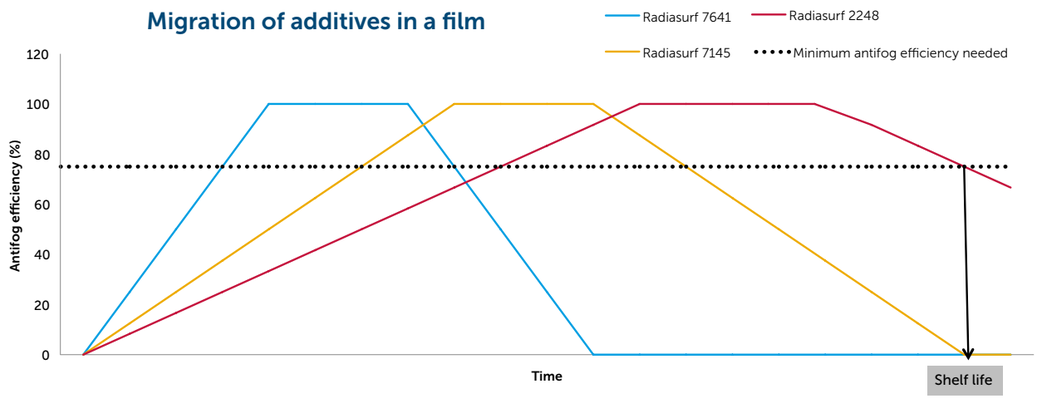
The selection of the right antifog additive depends on several parameters such as requested efficiency in time, the polymer polarity and the environmental conditions. Oleon can help to find together with you the right oleochemical solution for your application.

Indicative values

	OLEON CODE	MONO CONTENT (%)	ADVANTAGE	PURITY				APPLICACITON
				WATER CONTENT (%)	ACID VALUE (mgKOH/g)	IODINE VALUE (gI2/100g)	FREE GLYCERINE (%)	
GMS	RADIASURF 7641	50	Fast efficiency	≤ 0,5	≤ 1,5	≤ 1,5	≤ 1,5	0,5-2,0% (PE & EVA)
PGE*	RADIASURF 2248	-	Long term efficiency	< 0,7	< 2	< 2	< 2	0,3-0,6% (PE & EVA)
SMS	RADIASURF 7145	-	Mid-term efficiency	≤ 1,5	≤ 7	≤ 7	≤ 7	1,0-4,0% (PE & EVA)
GMO	RADIASURF 7902	90	Fast efficiency	≤ 2	≤ 1	≤ 1	≤ 1	0,1-0,5% (PE)
	RADIASURF 7903	90	Fast efficiency	≤ 2	≤ 3	≤ 3	≤ 3	0,1-0,5% (PE)

*PGE = polyglycerol monostearate

Food packaging usually requires fast migration additives, such as Radiasurf 7641 with immediate efficiency. In agrofilm application, long-term efficiency is usually required, where as well as fast migration additives (Radiasurf 7641) as long- & mid-term efficiency (Radiasurf 2248 and Radiasurf 7145) is needed (see graph 1)



Graph 1. Migration of additives Radiasurf 7641 (fast migration), Radiasurf 7145 (mid-term migration) and Radiasurf 2248 (slow-term migration). The combination of these three additives is advised for applications where long term efficiency is needed such as agriculture films.

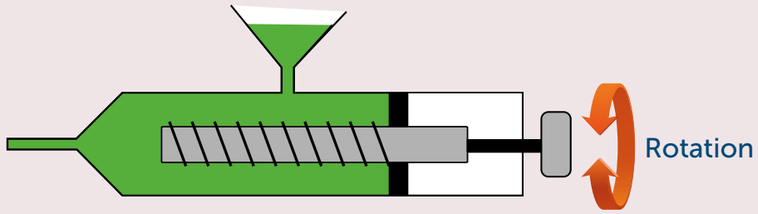
RADIA® POLYMER ADDITIVES

LUBRICANT/ MOLD RELEASE ADDITIVES

Lubricants (both internal and external) reduce friction in process equipments. The polarity and crystallinity of the polymer matrix will direct the selection of the lubricants. Internal lubricants reduce the polymer viscosity in the melt state, while external lubricants and mold release agents migrate from the bulk polymer melt during process, creating a lubricating boundary layer.

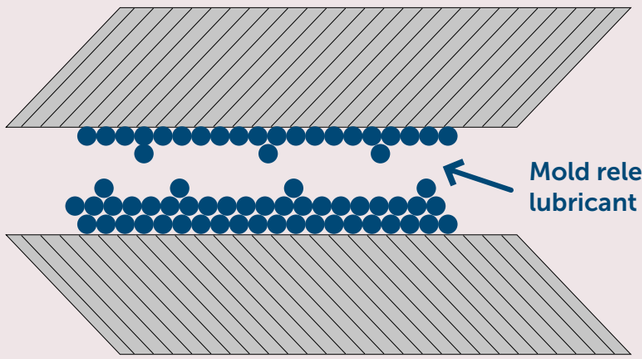
Internal lubricant

Polymer and additive feeding



Internal lubricants = semi-soluble
They reduce polymer viscosity in the melt state

External lubricants



External lubricants = insoluble
They migrate from the bulk polymer melt during process, creating a *lubricating boundary layer*

Mold release = External lubricants
Release agents are added to plastics *to prevent* the molded object from *sticking* to the mold surface.

Polyethylene

OLEON CODE	CHEMICAL NAME	APPLICATION	PHYSICAL FORM	OXYDATION STABILITY	VISCOSITY (mm^2/S)	DOSAGE
Radiasurf 7344	Glycerol monostearate 40%	Internal lube	Solid	++	-	0,2-1,5%
Radiasurf 7150	Glycerol mono-oleate 40%	Internal lube	Liquid	-	77 (40°C)	1,0-2,0%
Radiasurf 7901	Glycerol monostearate 90%	Internal/ external lube	Solid	++	33 (80°C)	0,3-1,0%
Radiasurf 7902	Glycerol mono-oleate 90%	Internal lube	Liquid	-	145 (40°C)	0,1-0,5%

Polypropylene

OLEON CODE	CHEMICAL NAME	APPLICATION	PHYSICAL FORM	OXYDATION STABILITY	VISCOSITY (mm^2/S)	DOSAGE
Radiasurf 7344	Glycerol monostearate 40%	Internal lube	Solid	++	-	0,5-1,5%
Radiasurf 7150	Glycerol monooleate 40%	Internal lube	Liquid	-	77 (40°C)	1,0-2,0%
Radiasurf 7901	Glycerol monostearate 90%	Internal/ external lube	Solid	++	33 (80°C)	0,2-0,3%

Polystyrene

OLEON CODE	CHEMICAL NAME	APPLICATION	PHYSICAL FORM	OXYDATION STABILITY	VISCOSITY (mm^2/S)	DOSAGE
Radia 7051	n-butyl stearate	Internal lube	Paste	++	7,2 (40°C) 2,6 (100°C)	3,0-5,0%
Radia 7131	2-ethylhexyl stearate	Internal lube	Liquid	++	10 (40°C) 3,1 (100°C)	1,0-2,0%
Radia 7241	Isobutyl stearate	Internal lube	Liquid	++	7,2 (40°C) 2,6 (100°C)	1,0-2,0%
Radia 7501	Stearylstearate	Internal lube	Solid	++	5,7 (100°C)	0,2-0,8%
Radia 7512	Glycerol tristearate	External lube	Solid	++	-	0,3-0,5%

LUBRICANT/ MOLD RELEASE ADDITIVES

Polycarbonate

OLEON CODE	CHEMICAL NAME	APPLICATION	PHYSICAL FORM	OXYDATION STABILITY	VISCOSITY (mm^2/S)	DOSAGE
Radia 7176	Pentaerythritol tetrastearate	Internal lube	Solid	++	17 (100°C)	0.1-0.5%
Radia 7176	Pentaerythritol tetrastearate	External lube	Solid	++	17 (100°C)	0,2-1,5%
Radia 7501	Stearylstearate	External lube	Solid	++	5,7 (100°C)	0,5-1,0%

Polyurethane

OLEON CODE	CHEMICAL NAME	APPLICATION	PHYSICAL FORM	OXYDATION STABILITY	VISCOSITY (mm^2/S)	DOSAGE
Radia 7171	Pentaerythritol tetra-oleate	Internal lube	Liquid	-	65 (40°C) 14 (100°C)	0,2-1,5%
Radia 7176	Pentaerythritol tetrastearate	External lube	Solid	++	17 (100°C)	0,2-1,5%
Radiasurf 7150	Glycerol mono-oleate 40%	External lube	Liquid	-	77 (40°C)	1,0-2,0%

Polymethylmethacrylate

OLEON CODE	CHEMICAL NAME	APPLICATION	PHYSICAL FORM	OXYDATION STABILITY	VISCOSITY (mm^2/S)	DOSAGE
Radia 7176	Pentaerythritol tetrastearate	Internal/ external lube	Solid	++	17 (100°C)	0,1-0.5%

Polyamide

OLEON CODE	CHEMICAL NAME	APPLICATION	PHYSICAL FORM	OXYDATION STABILITY	VISCOSITY (mm^2/S)	DOSAGE
Radia 7176	Pentaerythritol tetrastearate	External lube	Solid	++	17 (100°C)	0,2-1,5%
Radia 7501	Stearylstearate	Internal/ external lube	Solid	++	5,7 (100°C)	0,2-0,8%

Acrylonitrile butadiene styrene

OLEON CODE	CHEMICAL NAME	APPLICATION	PHYSICAL FORM	OXYDATION STABILITY	VISCOSITY (mm^2/S)	DOSAGE
Radia 7051	n-butyl stearate	Internal lube	Paste	++	7,2 (40°C); 2,6 (100°C)	0,1-0,5%
Radia 7176	Pentaerythritol tetrastearate	Internal lube	Solid	++	17 (100°C)	0,1-0,5%
Radia 7176	Pentaerythritol tetrastearate	External lube	Solid	++	17 (100°C)	2.0-4,0%
Radia 7512	Glycerol tristearate	External lube	Solid	++	-	0,5-2,0%

Polyethylene terephthalate

OLEON CODE	CHEMICAL NAME	APPLICATION	PHYSICAL FORM	OXYDATION STABILITY	VISCOSITY (mm^2/S)	DOSAGE
Radia 7176	Pentaerythritol tetrastearate	Internal/ external lube	Solid	++	17 (100°C)	0,2-1,0%
Radia 7501	Stearylstearate	Internal/ external lube	Solid	++	5,7 (100°C)	0,2-0,8%

Polybutylene terephthalate

OLEON CODE	CHEMICAL NAME	APPLICATION	PHYSICAL FORM	OXYDATION STABILITY	VISCOSITY (mm^2/S)	DOSAGE
Radia 7176	Pentaerythritol tetrastearate	External lube	Solid	++	17 (100°C)	0,2-1,5%

Polyvinylchloride

OLEON CODE	CHEMICAL NAME	APPLICATION	PHYSICAL FORM	OXYDATION STABILITY	VISCOSITY (mm^2/S)	DOSAGE
Radia 7051	n-butyl stearate	Internal/ external lube	Paste	++	7,2 (40°C) 2,6 (100°C)	0,1-1,0%
Radia 7175	Pentaerythritol mono/di/ tri-stearate	Internal lube	Solid	++	20 (100°C)	0,5-1,0%
Radia 7176	Pentaerythritol tetrastearate	Internal/ external lube	Solid	++	17 (100°C)	0,5-1,0%
Radia 7500	Cetylpalmitate	Internal/ external lube	Solid	+	5,4 (100°C)	0,5-1,5%
Radia 7501	Stearylstearate	Internal/ external lube	Solid	++	5,7 (100°C)	0,5-1,5%
Radia 7512	Glycerol tristearate	Internal/ external lube	Solid	++	-	1,0-2,0%
Radia 7513	Isotridecyl stearate	Internal/ external lube	Liquid	++	16 (40°C) 4,1 (100°C)	0,3-2,0%
Radiamuls 2248	Polyglycerol monostearate	Internal/ external lube	Solid	++	15 (100°C)	0,5-1,5%
Radiamuls 2249	Polyglycerol mono-oleate	Internal lube	Liquid	-	-	0,5-1,5%
Radiasurf 7344	Glycerol monostearate 40%	Internal lube	Solid	++	-	0,5-1,5%
Radiasurf 7150	Glycerol mono-oleate 40%	Internal lube	Liquid	-	77 (40°C)	0,5-2,0%
Radiasurf 7162	Glycerol dioleate	Internal lube	Liquid	-	39 (40°C)	1,0-2,0%
Radiasurf 7902	Glycerol mono-oleate 90%	Internal lube	Liquid	-	145 (40°C)	0,1-0,5%
Radia 7203	Propylene glycol mono-oleate	Internal lube	Liquid	-	-	0,5-1,5%

LUBRICANT/ MOLD RELEASE

RADIA 7176 – PENTAERYTHRITOL TETRASTEARATE

Engineering plastics (PA, PC, PET, TPU, ...) are processed by injection molding. To follow the market demand, increasing process & demolding speeds is crucial. This latter can be achieved by increasing process temperature.

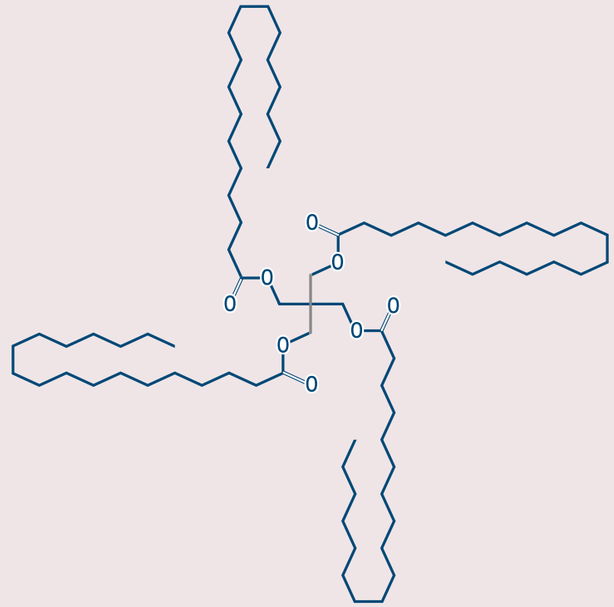
Radia 7176 is a lubricant especially designed to meet the crucial stability need at high temperatures.

Advantages

- Does not soften the polymer
- Not sensible to hydrolysis
- Good thermal stability
- Not volatile at high temperatures
- Good compatibility with polymers (good transparency)

Polymers: used in rigid PVC, PC, PMMA, TPU

Dosage: 0.1-1.2 parts per hundred resins (lower than traditional lubricant)



RADIA® POLYMER ADDITIVES

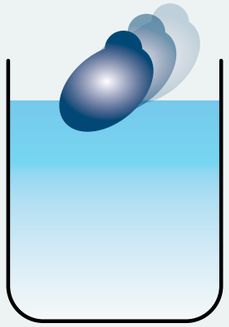
Pigment dispersion

PIGMENT DISPERSION ADDITIVES

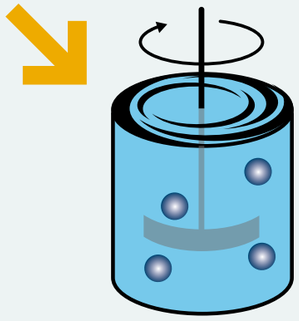
Powdered pigments have in production a high tendency to clump together and form aggregates or agglomerates, resulting in several problems such as color shift, gloss reduction, settling and rapid clogging of filters. To avoid these problems, carefully selected pigment dispersion additives need to be added to the mixture. Sometimes, a blend of different pigment dispersion additives need to be added for sufficient efficiency.

Pigment dispersion can be broken down into three steps:

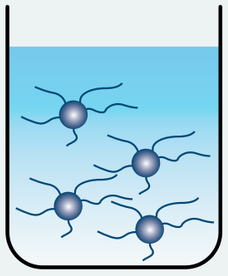
Wetting



Dispersion



Stabilization



PRODUCT CODE	CHEMICAL NAME	PHYSICAL FORM	HLB
Propylene and Glycerol Esters			
Radiasurf 7204	Propylene glycol dioleate	Liquid	2
Radiasurf 7150	Glycerol monooleate	Liquid	3
Sorbitan Esters			
Radiasurf 7355	Sorbitan trioleate	Liquid	3
Radiasurf 7155	Sorbitan monooleate	Liquid	5
Radiasurf 7125	Sorbitan monolaurate	Liquid	8
Radiasurf 7357	Polyoxyethylene sorbitan trioleate (20 moles)	Liquid	11
Radiasurf 7157	Polyoxyethylene sorbitan monooleate (20 moles)	Liquid	15
Radiasurf 7137	Polyoxyethylene sorbitan monolaurate (20 moles)	Liquid	17
Polyoxyethylene Esters			
Radiasurf 7402	Polyoxyethylene-200 monooleate	Liquid	7
Radiasurf 7442	Polyoxyethylene-400 dioleate	Liquid	7
Radiasurf 7444	Polyoxyethylene-600 dioleate	Liquid	10
Radiasurf 7403	Polyoxyethylene-400 monooleate	Liquid	12
Radiasurf 7423	Polyoxyethylene-400 monolaurate	Liquid	13
Radiasurf 7404	Polyoxyethylene-600 monooleate	Liquid	13
Others			
Radialube 7368	Trimethylolpropane tricaprylate/caprate	Liquid	-
Radia 7513	Isotridecyl stearate	Liquid	-
Radia 2130	Acetylated monoglyceride	Liquid	-

PIGMENT DISPERSION

RADIASURF 7345
is a **solid** dispersing agent
for polar pigments in non-polar polymers
(PE)

RADIAMULS 2130
is a **liquid** dispersing agent
for non-polar pigments in polar polymers
(PVC)

RADIASURF 7137
is a **liquid** dispersing agent
for non-polar dyes in polar polymers
(PET)

OLEON CODE	CHEMICAL NAME	PHYSICAL FORM	HLB
Radiasurf 7155	Sorbitan mono oleate	Liquid	5
Radiasurf 7345	Sorbitan tristearate	Solid	2,1
Radiasurf 7137	Ethoxylated sorbitan monolaurate (20EO)	Liquid	17
Radiasurf 7357	Ethoxylated sorbitan trioleate (20EO)	Liquid	11
Radiamuls 2130	Acetylated monoglyceride	Liquid	-

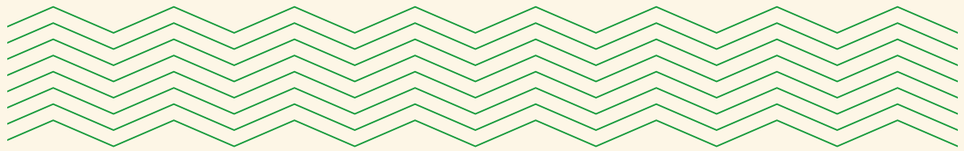
RADIA® POLYMER ADDITIVES

Plasticizers

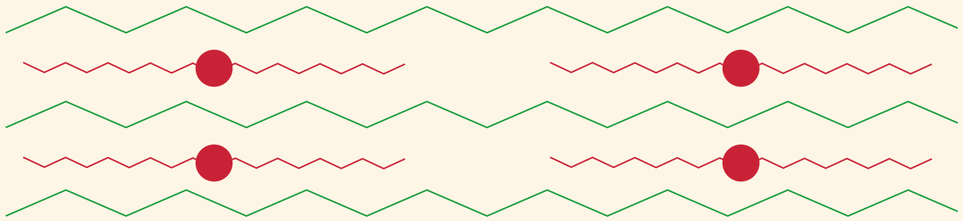
Viscosity regulator

PLASTICIZER/ VISCOSITY REGULATOR

Plasticizers play an important role in the applicability of polymers like PVC. Plasticizers from oleochemical origin have the advantage that they are approved for food contact applications. This makes them suitable for applications like food wrap films, children's toys and medical devices. Additionally, compared to many of the classical solvents used, Radia esters have the advantage of being non-VOC.



Unplasticized (rigid) PVC structure



PVC structure in the presence of a plasticizer

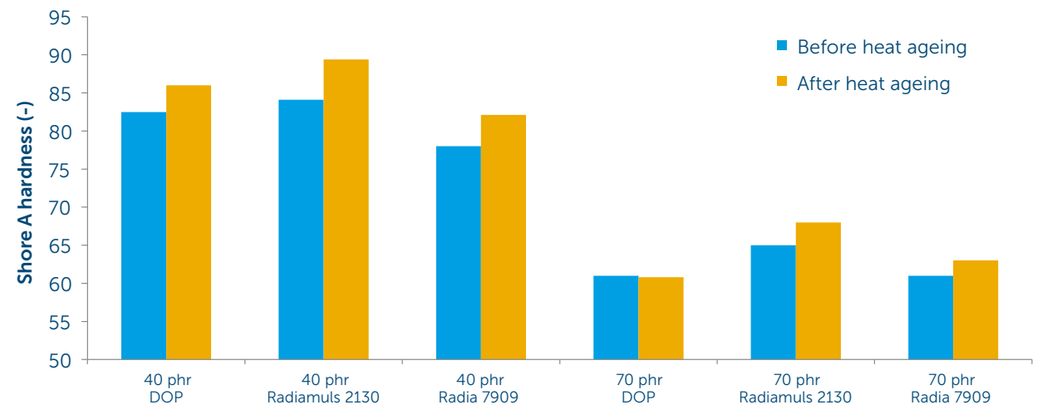
PRODUCT CODE	CHEMICAL NAME	PHYSICAL FORM	PVC	PO	ABS	PS
Radiamuls 2130	Acetylated monoglyceride	Liquid	General purpose plasticizer			
Radia 7051	Butyl stearate	Paste	Secondary plasticizer	Viscosity regulator	Viscosity regulator	Viscosity regulator (3-5%)
Radiasurf 7125	Sorbitan monolaurate	Paste	Processing aid			
Radia 7127	2-ethylhexyl laurate	Liquid	Viscosity regulator (0-9%, typically 5%)			
Radiasurf 7137	Sorbitan monolaurate (20 EO)	Liquid				
Radiasurf 7150	Glycerol mono oleate	Liquid		Viscosity regulator		
Radia 7241	Isobutyl stearate	Liquid				Secondary plasticizer for chloroprene & cellulosic, viscosity regulator Dosage = 20%
Radia 7331	2-ethylhexyl oleate	Liquid	Viscosity regulator (0-9%, typically 5%)			
Radia 7131	2-ethylhexyl stearate	Liquid	Viscosity regulator			
Radiasurf 7403	PEG 400 mono oleate	Liquid	Viscosity regulator			
Radiasurf 7909	Acetylated monoglyceride	Oily liquid	General purpose plasticizer			

PLASTICIZER/ VISCOSITY REGULATOR

NON-PHTHALATE PLASTICIZERS FOR PVC

The most commonly used plasticizers for PVC are phthalates. However, there are concerns regarding potential toxicity of certain phthalates. This causes an increasing pressure from both public authorities and customers to shift towards the use of phthalate-free alternatives.

A problem occurring with commercially phthalate-free alternatives is their effect on the end properties of the polymer, such as the hardness. For this, Oleon has successfully developed Radiamuls 2130 and Radia 7909 with little effect on the hardness of PVC. Radia 7909 has high plasticizer performance, while Radiamuls 2130 is designed to have next to its plasticizer activity also lubricant properties.



Abbreviations

Polymers

PVC = polyvinylchloride
PO = polyolefins
PE= polyethylene
PP = polypropylene
PS = polystyrene
PET = polyethylene terephthalate
PBT = polybutylene terephthalate
POM = polyoxymethylene
PC = polycarbonate
PUR = polyurethane
PMMA = polymethyl methacrylate
PA = polyamide
ABS = acrylonitrile butadiene styrene
EPS = expanded polystyrene
EVA = ethylene vinyl acetate

Oleon products

GMS = glycerol monostearate
GMO = glycerol mono oleate
SMS = sorbitan monostearate
PGE = polyglycerol monostearate

Other

DOP = dioctyl phthalate
Phr = parts per hundred resin