

Solving your cold flow puzzle

VISCOPLEX® Cold Flow Improvers for Biodiesel



Our expertise

Providing solutions for alternative fuels

Evonik RohMax is the business line within Evonik Industries' Business Unit Coatings & Additives dealing with performance additives for fuels and lubes. We are the global supplier of high performance VISCOPLEX® additives for lubricants and alternative fuels. Our broad product portfolio consists of Viscosity Index Improvers (VIIs), Pour Point Depressants (PPDs)

and Cold Flow Improvers (CFI), mainly derived from proprietary polyalkyl methacrylate technology. Our products help formulators and producers to achieve fuel specification and efficiency targets and allow the optimization of cold flow properties. CFI alter the sometimes problematic cold flow properties of biodiesel in single sourced B100 and blends

of several Fatty Acid Methyl Esters (FAME) and of FAME with fossil Diesel Fuel or Heating Oils. Our reliable global network of manufacturing facilities and technology centers enables us to provide customized products and solutions to our customers around the world on short notice.



The challenge: Cold flow optimization of biodiesel

Biodiesel fuels have different low temperature performance, depending on the source from which they are derived. Biodiesel consists of a mix of long-chain fatty acid esters (FAME) which differ in carbon chain length and degree of saturation. Individually, each component of this mix has a melting point somewhere between -35°C and +45°C, a very wide range. Biodiesel derived from different sources (such as rapeseed, palm, tallow, etc.) contains different relative levels of these components, which accounts for the wide range of variation in cold flow properties. The greatest influence on cold flow properties comes from the relative quantities of the higher melting point (mainly saturated) components compared to the lower melting point (mainly unsaturated) components. As the cold flow properties of most biodiesel fuels are inferior to those of fossil diesel, there is a need to improve these properties so they meet the performance standards of current fuel specifications either in pure biodiesel (B100) or in mixtures with fossil fuels (Bxx).

Achieve your targets with VISCOPLEX® CFI

- VISCOPLEX® Cold Flow Improvers have broad applicability and show benefits in many tests and many biodiesel types. In particular, they can:
- Improve the Cold Filter Plugging Point (CFPP), Cloud Point (CP) and Filterability of biodiesel B100 from different sources, such as Soy Methyl Ester (SME), Rapeseed Methyl Ester (RME), Palm Methyl Ester (PME) or Tallow Methyl Ester (TME), enabling:
 - increased value for product sold against a CFPP or CP target
 - expanded sales of biodiesel in colder periods or regions than previously possible without a VISCOPLEX® CFI
 - improved biodiesel low temperature handling properties while minimizing sedimentation and solidification
 - Maximize use of poorer low temperature FAME in blends to meet targets at lower cost.
 - Improve the cold flow properties of biodiesel blends (SME, RME, PME, TME) with fossil diesel, thereby extending the range of blend ratios (B5, B7, B10, B20) that meet the required fuel specifications. The biodiesel with VISCOPLEX® treatment typically contributes positively to the cold flow properties of the Bxx.

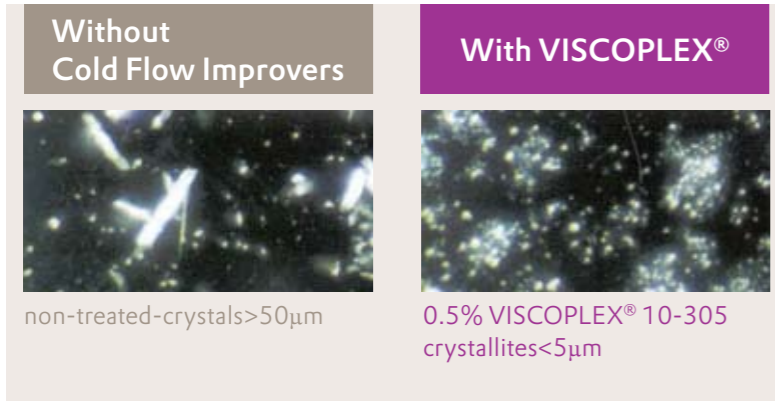
Our technology – specifically developed for low temperature requirements

		CP	CFPP	Filterability	PP/Storage
RME	VISCOPLEX® 10-305	●	●	●	●
	VISCOPLEX® 10-330			●	
	VISCOPLEX® 10-505, 10-605	●	●		●
	VISCOPLEX® 10-340, 10-530				
SME	VISCOPLEX® 10-305			●	
	VISCOPLEX® 10-330	●	●	●	
	VISCOPLEX® 10-505, 10-605		●		
	VISCOPLEX® 10-340, 10-530	●	●		●
PME	VISCOPLEX® 10-305				
	VISCOPLEX® 10-330	●	●	●	●
	VISCOPLEX® 10-505, 10-605				
	VISCOPLEX® 10-340, 10-530	●	●		●
TME*	VISCOPLEX® 10-305				
	VISCOPLEX® 10-330	●		●	
	VISCOPLEX® 10-505, 10-605				
	VISCOPLEX® 10-340, 10-530	●			

*Please ask for customized solutions for all Animal Fat Methyl Esters.
 CP = Cloud Point, ASTM D 2500
 CFPP = Cold Filter Plugging Point, ASTM D 6371
 Filterability = e.g. Cold Soak Filter Test, ASTM D 7501-09b
 PP/Storage = Pour Point, ASTM D 97

Effect of VISCOPLEX® CFI

Cold Flow Improvers work by modifying the growth of the crystallizing particles. As crystals form, Cold Flow Improvers act as nucleators and co-crystallize with the saturated hydrocarbon chains, and hence modify the crystal size and shapes typically from plate- to needle-like. The smaller crystals more easily pass filters and are less able to form the three-dimensional gel structures that impair the flow of the fuel. The impact on cold flow properties is that while CP is little affected, dramatic improvements in CFPP and PP can be obtained. An added benefit of VISCOPLEX® CFI is that on re-warming of fuel that contains solids, the smaller, more dispersed crystal structure means that the fuel is more quickly and easily returned to a useful fluid state.



CP/CFPP

Cloud point (CP) refers to the temperature at which wax in diesel or in biodiesel starts to crystallize and results in a cloudy appearance. The cloud point indicates the potential for trouble under low temperature operating conditions.

The Cold Filter Plugging Point (CFPP) is the highest temperature, expressed in 1°C steps, at which a given volume of fuel fails to pass through a standardized filtration device in a specified time when cooled under certain conditions.

Filterability

The filterability is measured by the Cold Soak Filterability Test (CSFT). This test determines the time in seconds it takes for biodiesel that has been preconditioned at a cold temperature to pass through a 0.7 micron filter. For producers and blenders, poor filterability can be related to choice of feedstock, as well as incomplete removal of by products during processing. For distributors and end users, high filtration times indicate the potential for fuel filter plugging. In addition to the CSFT, the Filter Blocking Tendency (IP 387) has to be mentioned.

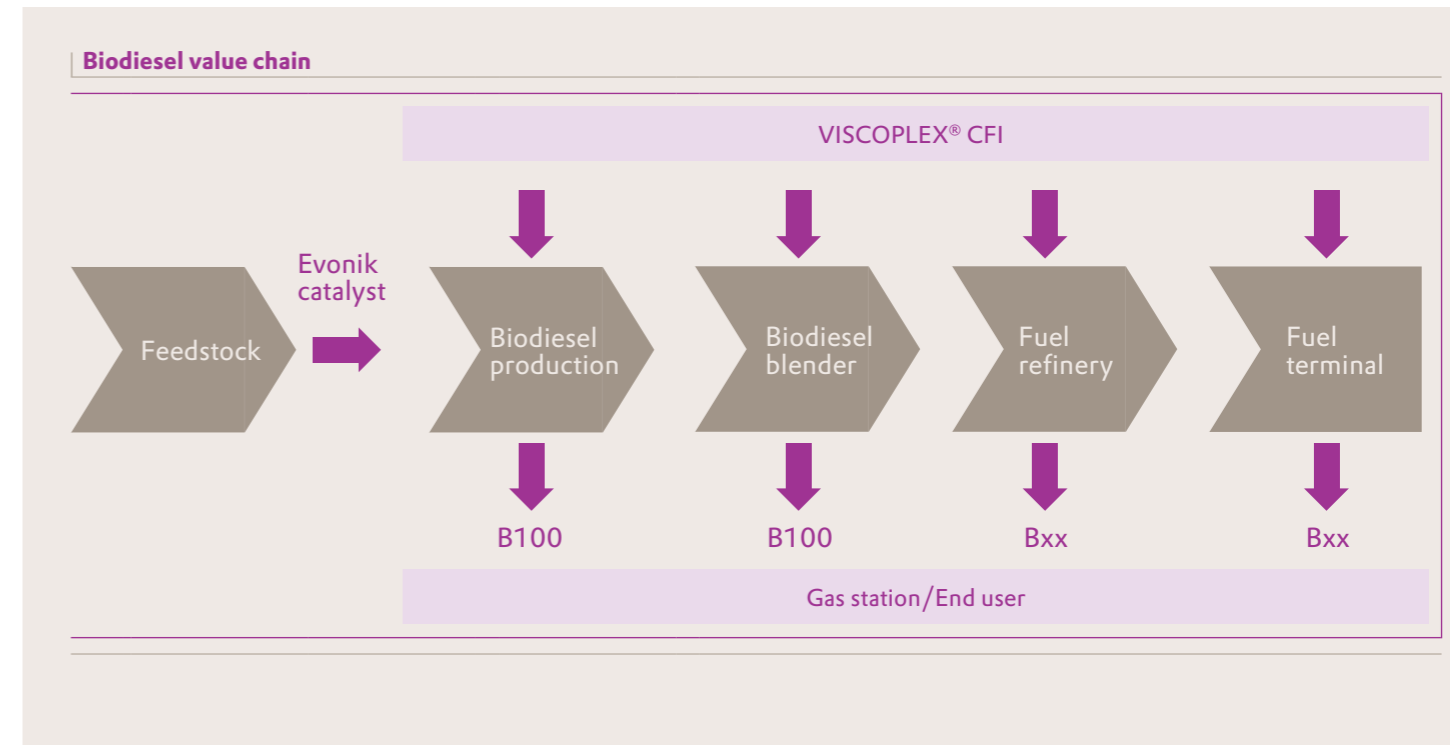
Sedimentation in Bxx

When Bxx fuels are stored at temperatures below their CP, wax crystals might settle down over time. Typical wax sedimentation tests run at temperatures approximately 3-10°C below the CP for several hours or days (typically 16 hours). After the cold storage, it is meaningful to investigate the sediment, e.g., by looking at the 20% bottom phase of the fuel and comparing the CP and CFPP against the fuel before sedimentation. Wax sedimentation has the potential to cause trouble when fuels are stored, for example, in a vehicle fuel tank over a cold night. The attempt to start the engine in the morning might fail because the fuel sucked from the bottom of the tank immediately blocks filters and fuel lines.

Adding value to biofuels

The biodiesel value chain is significantly enhanced through the use of VISCOPLEX® Cold Flow Improvers. Biodiesel producers see enhanced biodiesel value due to passing tighter specifications. Biodiesel blenders gain greater flexibility and reduced feed stock costs. Refineries, terminals and gas stations

see cost savings and enhanced performance when using treated biodiesel as a blend component. The end user gains confidence that the fuel in their vehicles can withstand harsher conditions. In these ways, VISCOPLEX® CFI delivers results from end to end of the value chain.

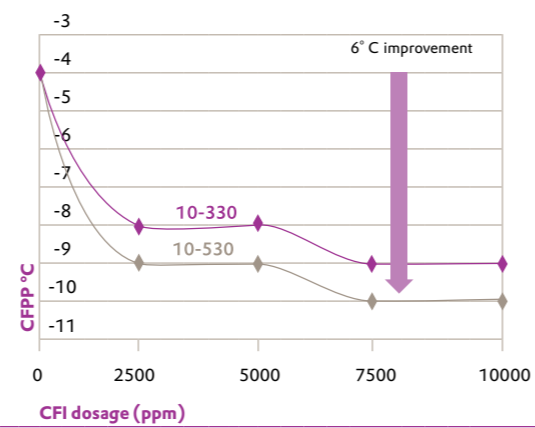


Performance of VISCOPLEX® CFI

CFPP in SME

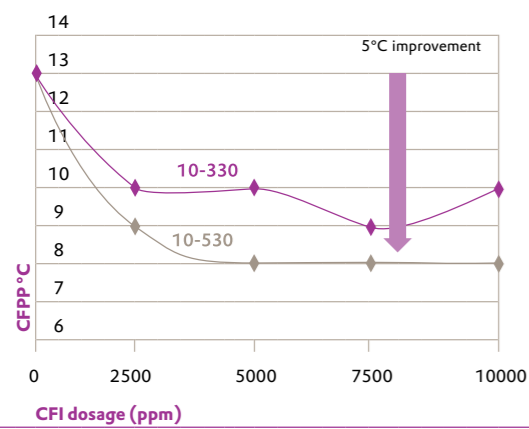


CFPP with VISCOPLEX® 10-330 and 10-530 in SME



A 5°C (9°F) improvement in CFPP can be achieved in SME with 0.25% VISCOPLEX® 10-530 weight/weight treat rate. Typically, cloud point will be improved by 1–4°C and pour point by 6°C (11°F).

CFPP with VISCOPLEX® 10-330 and 10-530 in PME

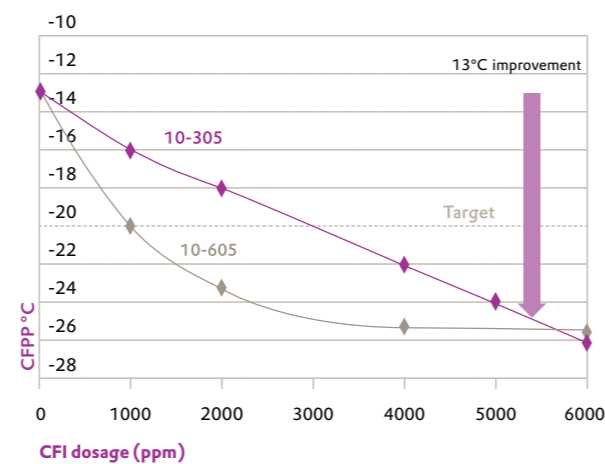


A 5°C (9°F) improvement can be achieved in PME with 0.5% VISCOPLEX® 10-530 weight/weight treat rate. Typically, pour point and cloud point will be improved by up to 3°C (5°F).

CFPP in PME



CFPP with VISCOPLEX® 10-305 and 10-605 in RME



A 10°C (18°F) improvement in CFPP can be achieved in RME with 0.2% VISCOPLEX® 10-605 weight/weight treat rate. A 1–4°C improvement in cloud point and >24°C (43°F) improvement in pour point can also be achieved.

CFPP in RME

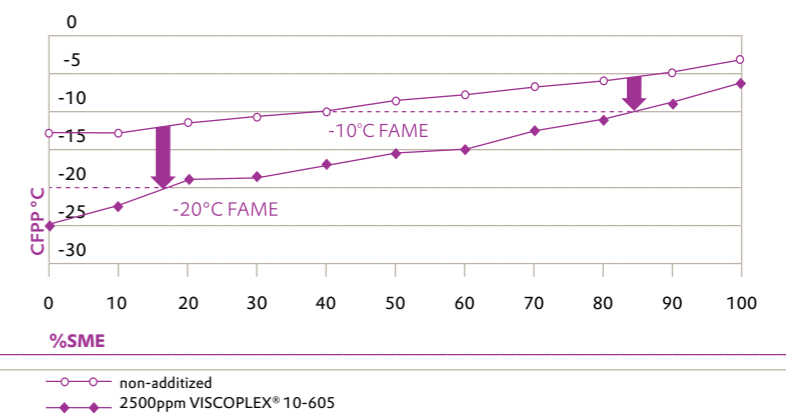


RME + SME

Focus on “-10°C FAME”:
Less expensive SME can be blended in higher proportions together with VISCOPLEX®.

Focus on “-20°C FAME”:
Specification targets can be met by additization with VISCOPLEX®.

VISCOPLEX® CFI effect on the CFPP of RME + SME blends



Filterability

VISCOPLEX® can improve the CSFT of FAME from a fail to a pass.

Filterability of B100

Sample	Canola ME ¹	Canola ME ¹ +	Palm ME ¹	Palm ME ¹ +
VISCOPLEX® 10-330 (ppm)	-	2500	-	2500
CSFT ASTM D 7501 (s)	>720	113	446	161
Volume filtered (mL)	250	300	300	300
Result	fail	pass	fail	pass

¹ ME = Methyl Ester

Sedimentation

VISCOPLEX® can improve the ΔCP in Bxx sedimentation tests.

Investigation of the wax sedimentation process¹

B10 (RME)		B10 (RME) with MDFI ³ + WASA ⁴ + VISCOPLEX® 10-605	
CP -6.8	ΔCP = 3.1	CP -6.8	ΔCP = 0.5
CFPP -27		CFPP -28	
CP(B) ² -3.7		CP(B) ² -6.3	
CFPP(B) ² -19		CFPP(B) ² -27	
fail		pass	

¹ According to the Aral sedimentation test procedure, all values given in °C

² (B) = 20% bottom phase

³ MDFI = Middle Distillate Flow Improver

⁴ WASA = Wax Anti Settling Agent

Additional Information

For additional information on product availability, performance data and Material Safety Data Sheets and Technical Data Sheets, please find your regional contact on www.rohmax.com.

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