VISCOPLEX® Dewaxing Aids
Optimize wax/oil separation and increase profitability
Evonik Oil Additives is a leading global supplier of high-performance lubricant and refinery additives, and forms part of the Coatings and Additives business unit of Evonik Industries, a market leader in specialty chemicals.

We develop, manufacture and market VISCOPLEX® Viscosity Index Improvers, Pour Point Depressants, and dewaxing aids – derived from proprietary polymer technology.

Our global sales team and technical experts are backed by state-of-the-art Technology Centers in North America, Europe, and Asia, and are committed to providing tailor-made solutions to meet industry needs.

Worldwide manufacturing facilities and a global supply chain enable us to provide customized products and services to our customers around the world.

We are a global technology leader in providing solutions for controlling wax crystallization, and have developed a unique and proprietary VISCOPLEX® dewaxing aid technology used to increase the efficiency of solvent dewaxing.

With more than 30 years of experience in the dewaxing aid business, we offer technical expertise, in-house testing and plant trial support to identify the most effective VISCOPLEX® solution for each refinery.
VISCOPLEX® dewaxing aids increase yield and profitability

VISCOPLEX® dewaxing aids are broadly applicable in solvent dewaxing processes (ketone and propane) with a full range of differing lube oil viscosity classes – especially the highly valued bright stocks. They can be implemented fast and easily and do not require major capital expenditure.

VISCOPLEX® dewaxing aids improve operations in Solvent Dewaxing Units (SDUs) by:

• Reducing the rate of filter blinding
• Reducing the needed filter wash frequency
• De-bottlenecking the rotary drum filters in the SDU
• De-bottlenecking the solvent recovery system in the SDU

VISCOPLEX® dewaxing aids allow Group I lube refineries to increase revenues by:

• Increasing throughput in the SDU
• Increasing dewaxed oil yield in the SDU
• Decreasing oil in wax content of the slack wax in the SDU
Crude oils contain an appreciable amount of wax in all lube fraction viscosity ranges, and this wax must be removed in order to make lubricants with suitable low-temperature properties. Solvent dewaxing is a process that utilizes a solvent to dilute the waxy feedstock in conjunction with refrigeration in order to crystallize the wax, which is then filtered from the oil. Feedstocks that are difficult to filter may benefit from a processing aid, commonly referred to as a dewaxing aid.

Evonik Oil Additives develops and manufactures a broad and robust portfolio of dewaxing aids, which are screened in our lab test with your feedstocks and process conditions. When the right dewaxing aid candidate is determined, Evonik Oil Additives experts help conduct an evaluation of the additive in refinery trials.

**Dewaxing aid mechanism**

VISCOPLEX® dewaxing aids are wax crystal modifiers used at very low treat rates, which interact with long chain paraffins during the solvent dewaxing process. A properly selected dewaxing aid offers better control of the crystallization process, resulting in formation of more uniform wax crystals and generating a more porous filter cake, thereby improving the filtration characteristics of the system. While these aids do not affect the amount of wax precipitated, they do improve the processing rate and the efficiency of the oil-wax separation.

**Optimizing the dewaxing process improves profits**

Crude oils contain an appreciable amount of wax in all lube fraction viscosity ranges, and this wax must be removed in order to make lubricants with suitable low-temperature properties. Solvent dewaxing is a process that utilizes a solvent to dilute the waxy feedstock in conjunction with refrigeration in order to crystallize the wax, which is then filtered from the oil. Feedstocks that are difficult to filter may benefit from a processing aid, commonly referred to as a dewaxing aid.

Evonik Oil Additives develops and manufactures a broad and robust portfolio of dewaxing aids, which are screened in our lab test with your feedstocks and process conditions. When the right dewaxing aid candidate is determined, Evonik Oil Additives experts help conduct an evaluation of the additive in refinery trials.

**The dewaxing process**

[Diagram showing the dewaxing process with and without a dewaxing aid (DWA).]
The Evonik Oil Additives approach: a case study

A Group I lube refinery wanted to increase revenues by taking advantage of the tight global base oil market. They were aiming to increase their production of bright stock without capital investment. The bottleneck in the bright stock production was the solvent dewaxing unit. The refinery enlisted the expertise of Evonik Oil Additives to deliver a dewaxing aid capable of increasing the throughput and yield of the solvent dewaxing unit, while maintaining the specifications upon the dewaxed oil.

An Evonik Oil Additives expert visited the refinery in order to learn about the specific process conditions employed. Through conversations with engineers and operators, the critical aspects of the process were discussed and a detailed process questionnaire was completed.

Recreating the most critical process conditions of the refinery, Evonik Oil Additives conducted a series of laboratory and analytical tests in order to deliver to the refinery the best VISCOPLEX® dewaxing aid from their portfolio of products. VISCOPLEX® 9-321 was found to most significantly increase the throughput and dewaxed oil yield of the bright stock. Evonik Oil Additives proposed a plant trial.

---

Our case study demonstrated processing advantages resulting in an increased margin of +7 million USD/annum for the refinery.
Trial protocol and results

Evonik Oil Additives experts worked closely with refinery engineers and management in order to develop a test protocol that was capable of fully quantifying the benefits of the additive while adhering to the needed refinery production schedule. Evonik Oil Additives evaluated the VISCOPLEX® dewaxing aid at a treat rate of 900 ppm. During the evaluation, the throughput and yield were improved so greatly that the bottleneck in the production of the bright stock moved downstream to solvent recovery. Additionally, all end product specifications were maintained throughout the evaluation.

A typical plant trial test protocol

• Agree upon targets for a successful plant trial
• Use only quarantined feedstock from a single upstream campaign
• Operate solvent dewaxing unit as “normal”
• On day one, obtain baseline performance without additive
• On day two, begin dosing additive at Evonik Oil Additives recommended treat rate and continue operating as normal
• Measure oil in wax values at least once per shift
• Adjust treat rate if necessary
• Run steady with optimized treat rate until end of trial

The process advantages demonstrated during the trial included an increase in throughput (production rate) in excess of forty percent from the baseline without additive, and an increase in dewaxed oil yield in excess of four percent from the baseline without additive.

<table>
<thead>
<tr>
<th>Plant trial technical results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Throughput m³/day</td>
</tr>
<tr>
<td>% absolute</td>
</tr>
<tr>
<td>% relative</td>
</tr>
<tr>
<td>DWO Yield % absolute</td>
</tr>
<tr>
<td>% relative</td>
</tr>
<tr>
<td>Oil in Wax % absolute</td>
</tr>
<tr>
<td>% relative</td>
</tr>
<tr>
<td>DWO PourPoint °C</td>
</tr>
</tbody>
</table>

Throughput = volume of raffinate processed within the solvent dewaxing unit per unit time
DWO = Dewaxed Oil
Yield (Dewaxed Oil Yield) = weight of oil that exits the solvent dewaxing unit divided by the total weight of raffinate that enters the solvent dewaxing unit
Oil in Wax = percentage of oil remaining in the slack wax (ASTM D721)
A customized solution for your solvent dewaxing unit

With more than 20 products and a patented technology, Evonik Oil Additives is looking forward to improving your solvent dewaxing process, not only for bright stock, but for any feedstock.

Our technical experts will work with you all the way from initial laboratory studies to identify the best VISCOPLEX® product for your operation through to a full plant trial. After a successful trial, we can offer reliable technical support in order to set up a dosing unit with all necessary tools required by your refinery. Are you ready to experience the Evonik Oil Additives dewaxing advantage?

Global bright stock demand tends to outpace supply.

Increased base oil production represents increased revenues and margin.

VISCOPLEX® dewaxing aids can increase base oil production.

Since every refinery is different, it is not possible to create a tool to calculate how much value can be generated in each case by using VISCOPLEX® dewaxing aids.

From our many years of experience through working with refineries, Evonik Oil Additives experts can work with you to evaluate whatever your refinery can yield. This can be determined based on any of these parameters:

- Increased throughput, resulting in additional base oil production capacity
- Increased oil yield, resulting in raw materials savings and extra output
- Improved wax quality due to lower oil-in-wax content

The Evonik Oil Additives dewaxing advantage

Global bright stock demand tends to outpace supply.

Increased base oil production represents increased revenues and margin.

VISCOPLEX® dewaxing aids can increase base oil production.

Since every refinery is different, it is not possible to create a tool to calculate how much value can be generated in each case by using VISCOPLEX® dewaxing aids.

From our many years of experience through working with refineries, Evonik Oil Additives experts can work with you to evaluate whatever your refinery can yield. This can be determined based on any of these parameters:

- Increased throughput, resulting in additional base oil production capacity
- Increased oil yield, resulting in raw materials savings and extra output
- Improved wax quality due to lower oil-in-wax content

Added value with VISCOPLEX® dewaxing aids

<table>
<thead>
<tr>
<th>Added value with VISCOPLEX® dewaxing aids</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased Oil Yield</td>
</tr>
<tr>
<td>Improved Wax Quality</td>
</tr>
</tbody>
</table>
This information and all further technical advice is based on our present knowledge and experience. However, they imply no liability or other legal responsibility on our part, including with regard to existing third party intellectual property rights, especially patent rights. In particular, no warranty, whether express or implied, or guarantee of product properties in the legal sense is intended or implied. We reserve the right to make any changes according to technological progress or further developments.

The customer is not released from the obligation to conduct careful inspection and testing of incoming goods. Performance of the product described herein should be verified by testing, which should be carried out only by qualified experts in the sole responsibility of the customer. Reference to trade names used by other companies is neither a recommendation, nor does it imply that similar products could not be used.

VISCOPLEX® is a registered trademark of Evonik RohMax Additives GmbH.
©04/2013 Evonik Industries AG