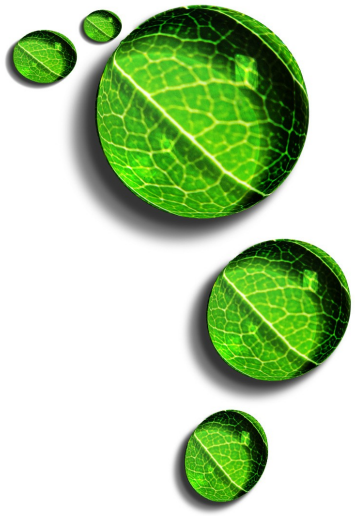
Trilene® for Biodegradable Lubricants

August 2010

- *Trilene® can be used to make **Ultimate Biodegradable** fluids.*
- *Trilene® is soluble in vegetable oil.*
- *Trilene® as a thickening agent for lubricants, hydraulic fluids and other functioning fluids.*
- *Trilene® is an excellent Viscosity Index improver.*
- *Trilene® has excellent shear stability suitable for marine, transportation & industrial gear oils.*
- *Trilene® is soluble in mineral oil & synthetic fluids .*



Introduction

Trilene® liquid polymers are a family of viscous, low molecular weight ethylene-propylene copolymers and ethylene-propylene non-conjugated diene terpolymers. They are polymerized randomly to produce liquid elastomers with stable, saturated hydrocarbon backbones.

If Biodegradable, how biodegradable is the material?

Claims like "Environmentally Acceptable", "Environmentally Friendly", "Environmentally Preferable", and "Environmentally Responsible" are also used to describe a material that was produced by biodegradable materials or, in most cases, part biodegradable material without knowing if the whole formulation could be rated as biodegradable. In many cases, when the word "Biodegradability" is used, it meant that the lubricant product is more biodegradable than petroleum base oils or formulas.
A Biodegradable classification was needed for a very complex system, and the industry recognized the following tests to determine biodegradability of lubricants:

§ **OECD 301B Modified Sturm** § **ASTM D-5864** § **CEC L-33-T-82**

Standardized Biodegradability Definitions

Referenced from Lubrizol's Biodegradability Review of Current Situation

(Dr. Stephanie Harold)

Biodegradability is not only a property or characteristic of a substance, but is also a system's concept, i.e. a system with its conditions determines whether a substance within it is biodegraded. When material is released into the environment, its fate depends upon a whole range of physiochemical processes and its interaction with living organisms. The most stable compound of carbon is **Carbon Dioxide**. All the more reduced organic compounds are thermodynamically unstable and will be randomly attacked by microbial enzymes, provided that they have some structural similarity to naturally occurring substrates.

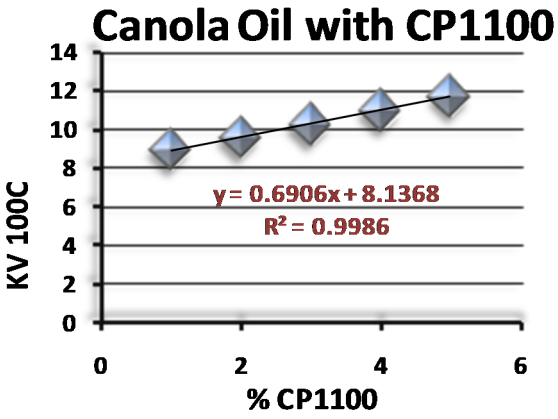
Summarizing, typical biodegradability values in the CEC L-33-T-82 Biodegradability Test for common hydrocarbons are:

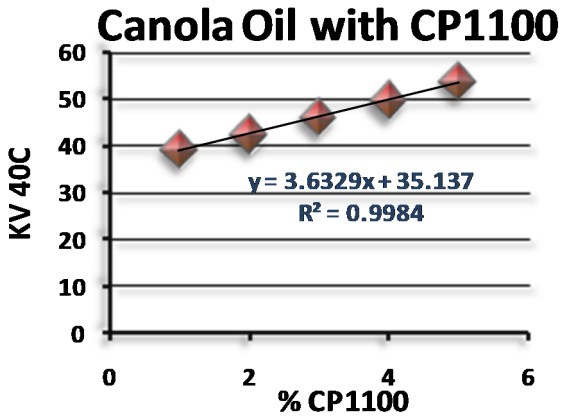
Mineral Oil	15 to 35%
White Oil	25 to 45%
Natural Oil & Vegetable Oil	70 to 100%
PAO	5 to 30%
Polyether	0 to 25%
PIB	0 to 25%
Phthalate & Trimellitate Esters	5 to 80%
Polyols & Diesters	55 to 100%

Canola Oil with Trilene CP1100

For "ultimate biodegradability" the customer can use CP1100 as a viscosity modifier. No mineral oil is needed!

Canola Oil	KV @ 100C	KV @ 40C	Viscosity index	Thickening Power
3% CP1100	10.159	45.936	217.22	1.856





Canola Oil with Trilene CP80

Mixing CP80, mineral oil, and canola oil. Concentrate of 20% Trilene CP80 in Paralux 6001 mineral oil and dissolved this concentrate in canola oil.

These are the concentrations in the final solution:

* Concentrate made up of 20% CP80 in Paralux 6001 mineral oil					
Concentrate	Canola Oil	Paralux 6001	cst KV 40C	cst KV100C	VI
15g	80g	5g	68.77	13.99	212.49

Other mineral oil could be used.

Here are two example formulations using CP-80:

Trilene® CP-80	1.0 %	1.5 %
Conoco 110N Oil	19.0 %	18.5 %
Canola Oil	80.0 %	80.0 %
Kinematic Viscosity 40°C	37.91 cSt	41.87 cSt
Kinematic Viscosity 100°C	8.53 cSt	9.24 cSt
Viscosity Index	212	212

Different levels of Biodegradability

Ultimate Biodegradation

This is complete biodegradation. Molecular cleavage must be sufficiently extensive to remove biological, toxicological, chemical, and physical properties associated with the use of the original product, eventually forming carbon dioxide and water.

The **Degradation/Accumulation Expert Group** of the **OECD Environment Committee** has established a series of tests which classify compounds as:

Readily Biodegradable

Rapid and complete mineralization.

Inherently Biodegradable

20-70% biodegradable in 28 days. Requires 'Worst Possible Case' estimates of likely environmental concentrations and therefore further simulation tests may be required.

For more information on these and other oils used with Trilene please contact

Lion Copolymer Marketing

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