



ECO-INNOVATION
WHEN BUSINESS MEETS THE ENVIRONMENT



VOSOLUB

New formulations of sunflower-based biolubricants
with high oleic acid content

Newsletter N°3

Editorial

1. Project partners interview

The demonstration test on RS Clare curve rail grease

2. VOSOLUB project overview

3. Dissemination and events

4. Demonstration tests: Motul Tech cutting oil



Co-funded by the Eco-innovation
Initiative of the European Union





Editorial

VOSOLUB project comes in the context of a more favourable situation compared to a few years ago, where the interest in bio-based products within Industry and consumers has increased. Indeed, evolution of European and National regulation, the development of European Eco label, companies with environmental policies are more concerned about the environment (such as companies ISO14001 certified) or safety issue make increase the development on biolubricant demand and solution.

As the VOSOLUB project ended this August, this newsletter overviews the latest demonstration results. Paul Wilson, technical manager at RS Clare details, is interviewed on their bio-grease performances, which have been compared in the field (curved rail section) to a mineral grease. Motul Tech reveals good tribological performances of their Very High Oleic Sunflower Oil (VHOSO) based cutting oil both with turning and cutting tests.

Those VHOSO based lubricants are promising, and the next and last newsletter will behold their market opportunities

1. Project partners interview The demonstration test on RS Clare curve rail grease

Paul WILSON, Technical Manager at RS CLARE



As seen in the previous newsletter, RS CLARE is in charge of the demonstration site of the curve rail grease with the end-user Sheffield Stagecoach Supertram. This kind of lubricant is crucial to reduce wear between the wheel flange and side rail, avoiding costly rail replacement in curved sections

Paul, what characteristics of the bio-grease were tested ?

Several important Quality Control tests are associated with grease manufacture. These are "Penetration" – which is a measure of consistency, "Oil Separation" – how much oil

will separate from the grease over time, "4 Ball Load and Scar" – indications of wear protection for the surface interfaces and "Water Wash Off" – a test to indicate retention under environmental conditions. As well as these routine tests, Rheometer





work was performed to determine aspects of rheology, biodegradability and toxicity tested by BfB Laboratories and Coefficient of Friction testing completed by IK4-Tekniker.

How was the trial performed? (selection of the site, length, tests...)

Standard curve rail lubrication practice for Rail and Tram Networks in the UK is to apply grease to the curve using a "Grease Dispense Unit" (GDU), which delivers up to 18 beads of grease to the side of rail before the leading edge of a curve in the rail. The principle is that the wheel flange picks up the grease as it passes and the interfaces between rail and wheel flange remain lubricated around the curve (or several curves). This increases the life of the rail by preventing wear, which will eventually reach a safety critical point. Replacement of rail is expensive and is performed by the associated Network Companies (responsibility for the wheel lies with Rolling Stock Companies). We approached "Sheffield Supertram" (SST) and asked if they would allow us to perform a comparison test between the Claretech EcoCurve and a non-Bio (mineral oil based) product. We also asked if they would perform measurements on our behalf. SST agreed to our request and gave access to two similar GDU positions. The trial started in August 2013 with a planned duration of 12 months and rail profile measurement at 6 month intervals. For the duration of the trial, RSC provided the greases and maintained the

levels in the GDU reservoirs. We also monitored grease delivery through the GDU ports to ensure correct lubrication. SST agreed to perform the rail profile measurements. Adhesion and carry down of product was also monitored. These factors are important in ensuring that the complete curve is protected.

What are the first results and conclusions?

Grease delivery performance from the GDUs for both greases was satisfactory and no issues were recorded. Adhesion and carry down targets were achieved by both products. During the summer period, the Claretech EcoCurve showed some discolouration, but we have identified this to be unrelated to any product deterioration. The 6 month rail profile wear measurements have been made and showed no discernible difference in performance between the products under trial. The measurement method, which measures the dimensions of a cross section of rail at a specific location, is not precise enough for the trial period. Time intervals to show any variation on lubricated track are typically higher than 5 years, although a poor lubricant will produce measurable wear much more rapidly. The test results that we have so far show that EcoCurve is performing properly. The second measurement is due at time of writing.

Overall, Claretech EcoCurve has passed the field criteria required for Biodegradable Curve Rail Grease.





- 1) Claretech EcoCurve has performed as a trackside lubricant. It delivers through existing systems and there has been no manufacturing difficulties identified during plant trials.
- 2) The theoretical performance of Claretech EcoCurve based on test data is that over time it will show improved wear characteristics when compared with the Mineral Oil Based Reference Product
- 3) The environmental footprint for Claretech EcoCurve is excellent with particularly high levels of Biodegradability and meets all the requirements of the "Eco Label Standard".
- 4) The base oil price is likely to be the critical factor for commercialisation suitability.

How do the performance characteristics compare against mineral oil products?

Laboratory test data on the selected products show that Claretech EcoCurve provides reduced friction between steel surfaces of the type used in rail construction. This has been tested independently by Tekniker and a full report is available.

No drift in rail profile measurement at field trial sites shows that Claretech EcoCurve is fit for purpose as a Trackside Curve Rail Lubricant. Longer exposure is required to confirm that laboratory test data is repeated in the field.

The excellent environmental footprint and Eco Label acceptance has a significant marketing advantage over mineral oil products.



Grease dispense unit



Grease dispense unit - detail

Contact:

Christopher JOHNSON, cjohnson@rsclare.co.uk
John NISBET, JNisbet@rsclare.co.uk





2. VOSOLUB project overview

VOSOLUB Partners



Concept and objectives of VOSOLUB Project

One of the most important barriers to the adoption of biolubricants onto the market is their higher price compared to mineral oil based lubricants. In order to improve the market penetration of biolubricants, it is therefore necessary to decrease their purchase cost.

The formulations tested in VOSOLUB project use new bases (developed in the framework of IBIOLAB project, see interview of Carine Alfos) that are obtained from:

- A new variety of oil seeds: **very high oleic sunflower** seeds give an oil with a very good resistance to oxidation and good flow properties.
- A new refining process: a **soft refining** process is used instead of complete and classical refining (reduction of the processing costs due to the tailoring of refining to oils and elimination of useless steps).

The new variety of oil seeds in combination with the soft refining process allow to obtain base oils with high stability, with a low impact on the environment and at a lower cost compared to polyolesters

VOSOLUB contribution

By demonstrating under real conditions the technical and environmental performance of lubricants based on very high oleic sunflower oil and by implementing a **European industrial network of supply** of the high oleic sunflower base oil, VOSOLUB project will contribute to **offer an important alternative feedstock** for the deployment of the biolubricant market in Europe and the development of a new generation of biolubricants as effective and cheap as the actual mineral lubricants. In addition, the soft refining process enables the **reduction of the environmental impact** associated with the production of the base oil.

VOSOLUB at one glance



Very High Oleic Sunflower



Very High Oleic Sunflower seeds



Soft Refining



Very High Oleic Sunflower oil



Network of lubricant SME



Biolubricants





3. Dissemination and events

WEBSITE

The VOSOLUB website is available since February 2013. It provides general information on the project. All content will be reviewed and updated on a regular basis.

www.vosolub.eu



VOSOLUB in conference

Back in July, the VOSOLUB Project was presented in Manchester during Lubmat, the Fourth European Conference and Exhibition on "Lubrication, Maintenance and Tribotechnology". Dr. Amaya Iguarta from IK4 Tekniker outlined that has been realised using a soft refining process for the high oleic sunflower oil able to reduce the processing cost without losing performance.

Contact:

Amaya IGARTUA, amaya.igartua@tekniker.es



Relevant event

ITERG Conference day on vegetable oil valorisation in lubrication

The 2 of October 2014 in Pessac, France, the results of the life cycle analysis of the VHOSO have been presented by Antoine BESNIER, project manager at ITERG, during a day dedicated to vegetable oil valorisation in lubrication. Besides this presentation, Motul presented cutting oil application and Molydal introduced to the VEGALUB and PROLUB project. BfB presented the European Ecolabel applied to biolubricants. A state of the art of biobased molecules will be introduced by ITERG.

Contact:

Fabrice FARRUGIA, f.farrugia@iterg.com

Journée « Valorisation des huiles végétales en lubrification »

Jeudi 2 octobre 2014, PESSAC (33)

Un moment privilégié de partage avec nos experts pour répondre à vos besoins d'innovation.

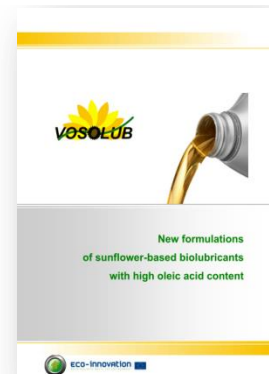


Programme détaillé :

<http://iterg.com/IMG/pdf/programme-0210.pdf>

PROJECT DOCUMENTS

Project documents are available on VOSOLUB website (brochure, poster, presentations...).





4. Demonstration tests : Motul Tech cutting oil

The Very High Oleic Sunflower Oil (VHOSO) produced by Arterris has been used by Motul as a base for cutting oil. In order to prove the efficiency of the VHOSO based cutting oil in real conditions, performance test with machine tool and compatibility tests with the solvent have been conducted.

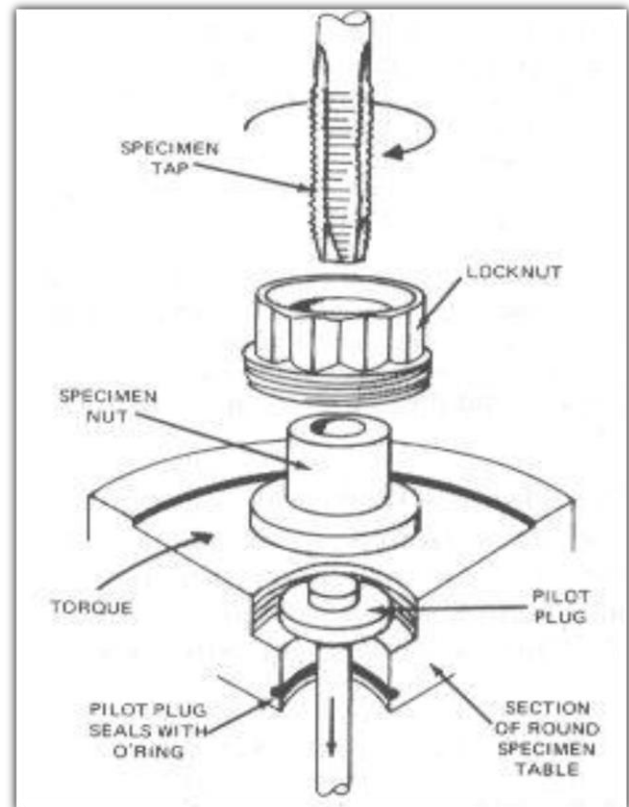
A first series of physical and chemical test have been conducted on the VHOSO, concluding that the base oil quality is in accordance with the specification required, in particular on free fatty acid content minor to 0.1 % (m/m), phosphorus content minor to 3 (mg/kg), and an oleic acid content superior to 87%. The environmental behaviour of the VHOSO based cutting oil was analysed by Bfb showing an ultimate biodegradability of 86,2 % and an acute toxicity (LC 50) on fishes, daphnia inferior to 1010 mg/l.

PERFORMANCE TESTS

The tribological properties of the VHOSO based cutting oil have been tested by means of cutting tests and turning tests in comparison with the mineral Motul oil SUPRACO 4018. Those tests have been conducted by the technological partner IK4-Tekniker. Both tests reveal that the VHOSO based cutting oil holds the comparison with the mineral oil.

Cutting test

The cutting test is based in ASTM D5619 Standard Test Method for Comparing Metal Removal Fluids Using the Tapping Torque



Tapping torque test machine

Test Machine. The torque required to tap a thread in a blank specimen nut while lubricated with a metal removal fluid is measured and compared with the torque required to tap a thread in a blank specimen nut while lubricated with a reference fluid.

The ratio of the average torque values of the reference oil to the VHOSO tested, when using the same tap, is expressed as the percent efficiency of the fluid. The efficiency of two or more fluids can be compared when the average torque values of the reference fluid on different taps are considered to be





statistically equivalent.

Under the selected testing conditions (Steel and Titanium, around 250 rpm) it can be concluded that no significant differences between the tested fluids can be observed. The VHOSO based cutting oil offers the same level of performance on steel and titanium than the conventional mineral cutting oil.

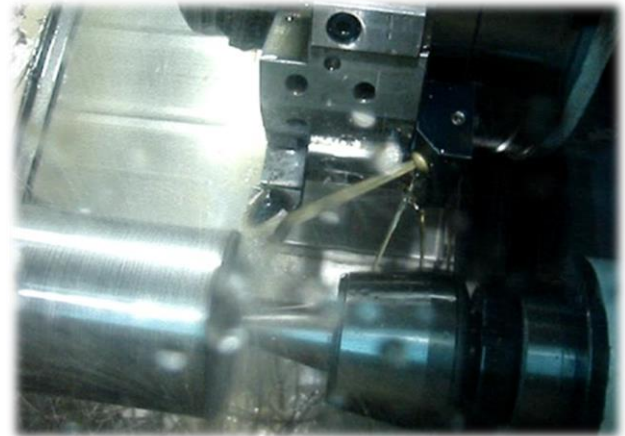
Turning test

Tests have been performed in a CMZ TL 15 lathe (5000 rpm, 14 Kw) that is equipped with different cooling/lubricant systems. Both cutting oils have been used in pure conditions without emulsifying and have been projected to the cutting zone with an angle of 20 degrees through the conventional piping system.

The cutting conditions have been selected from the catalogue recommendations given by Mitsubishi (cutting speed of 210-355 m/min, feed rate of 0.1-0.4mm/rev and depth of cut of 0.3-2mm) taking into account mainly some extreme conditions in this interval in order to look for a significant wear during a machining operation of about 20min and a moderate consumption of machining material. During machining tests tool wear and workpiece surface quality have been monitored. The maximum flank wear was recorded with a contact microscope and the roughness (Ra) was obtained by a portable profilometer every 1 or 2 cuts.

Turning tests under the two different cutting

conditions with the two studied cutting oils have offered similar results concerning workpiece roughness and tool wear, which is the main aspect to take into account regarding the general machining performance.



Turning test with the CMZ lathe

PRE TESTS

Before using the cutting oil in real condition with the Bouverat machine tool, compatibility with the solvent and miscibility with the actual mineral cutting oil needed to be checked first. The compatibility means that the oil doesn't co-distillate with the solvent, which could conduct to solvent and machine degradation. The test shows that the vegetable oil is compatible with use in solvent degreasing machine. The miscibility test shows that there was two different phases in proportion 80:20, meaning that it is not desirable to mix them in the central.

Contact: *Cécile DANO*, cdano@motul.fr

