



VOSOLUB

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

Newsletter N°4

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1. Project partners interview on market opportunities

« We would expect that **Scandinavian countries** would be attracted to the environmental credentials. »



*Paul WILSON,
Technical Manager
at RS CLARE*



*Olivier VERGNES,
Marketing manager
at MotulTech*

« As long as there is **no regulation** about BaP content in cutting oils, the potential impact on the market remains marginal. »

As the VOSOLUB project ended this Augustus, what do the formulators think of the business opportunities of VHOSO based lubricants, the potential impacts of the product in the European Market?

Why did RS Clare (RSC) and Motul get involved with the project?

Paul: Our Development chemist at the time, Andrew Spencer, heard of the project and believed it was a good fit with our Business. In particular, it aligned with our Marketing Strategy to be leaders in the field for "Biodegradable Curve Rail Lubricants". RSC involvement in the IBIOLAB initiative started in 2006 and eventually developed into VOSOLUB in 2010. We had developed a second generation Curve Rail product, which was widely used in the UK Rail Network, and we were continuing to look for future development routes. We have been actively involved throughout the project and have produced a plant batch of 1734kg.

Olivier: The participation to this project was decided by MotulTech for several reasons:

-It was in line with the trend for safer process lubricants that is seen on the markets, in particular in Europe

-It allowed MotulTech to gain knowledge and understanding of the behavior of the vegetable oils in industrial conditions

-It was an opportunity to demonstrate the ability of MotulTech to innovate on products bringing high performances and safety for the users.

Our Development manager, Cécile DANO, submitted MotulTech's nomination to the project as it was in line with the company strategy of innovation, and in particular in the field for "Biodegradable Cutting Lubricants".

One of the specificities of the cutting lubricants is that they are in direct contact with the machine operators hands and can





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be present in the workshop atmosphere, and thus breathed by the workers.

So the work on the safety of the machining lubricants is more than needed, it is a must. The European regulation about cutting lubricants and in particular the French regulation is getting tougher

In this context, the development of a vegetable oil based lubricant

allows to reduce dramatically the impact on the workers by removing the mineral base oils. Those ones content a variable proportion of BaP depending on their origin and refining level and as BaP (Benzo-a-Pyrene) is a Poly Cyclic Aromatic molecule classified as carcinogenic, it has to be reduced to the smallest proportion in the cutting oils.

Nevertheless, the main challenge is to find vegetable base oils with the same performances as mineral base oils, in particular with the same oxidation resistance. This performance is reached with the Very High Oleic Sunflower Oil (VHOSO) on which we developed the SUPRAGREEN range, a neat cutting oil based on a 100% vegetable oil.

What is the potential impact of the product in the European Market?

Paul: The market is cost sensitive and the product will need to be keenly priced to compete. Further fine tuning of the formulation could deliver improved

performance and reduced cost.

We think that the product will struggle to displace the synthetic biodegradable products used in the UK. We are not experienced in other European markets, but would expect that Scandinavian countries would be attracted to the environmental credentials.

Olivier: As long as there is no regulation about BaP content in cutting oils, the potential impact on the market remains marginal. Indeed, the market is highly cost sensitive and the price difference for similar performances is a barrier today. Further fine tuning of the formulation may reduce the cost, but the WHOSO based products will remain more expensive. Thus they can only be used for high performance products, where the price difference on the base oil is less sensitive.

On the market side, only big international companies with strict Health and Environmental policy start to enforce the BaP limitation in fresh and used cutting lubricants according to the INRS recommendation ND 2356-227-12 and show interest for vegetable based products.

What product do you intend to develop with the VHOSO ?

Paul: The opportunities for product variants that use the same Very High Oleic Sunflower Oil (VHOSO) have potential.

RSC has submitted a sprayable version to SNCF for approval alongside a second product.





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This product is for on board spray as opposed to trackside lubrication. Both processes are for the same lubrication but have different delivery methods and as a consequence have different technical demands. The product has passed the first phase of tests carried out by SNCF and is now through to the next assessments. However, SNCF have stated that they will not act on tender bids until towards the end of 2015. Several other Companies are also bidding for this business.

RSC has developed a range of products using a new thickener technology, which meet the requirements in the US for use as an environmentally acceptable lubricant (EAL). This allows the products to meet the requirements for issue of a vessel general permit (VGP) which is a regulation introduced in December 2013. RSC is actively looking at opportunities in this market and the products in the portfolio have an option to use VHOSO if it proves to be supply secure and competitive. We expect developments within 2014.

RSC is looking to focus on export markets and has contacts in multiple countries. There may be a marketing advantage for product with the eco label standard for countries such as Turkey, who are looking to enter the Eurozone.

RSC has more recently introduced an additional field trial with Manchester Tram for trackside curve rail lubrication. We feel that excellent environmental profile has a particular commercial advantage with

tramways, due to their closer association than rail networks with the public and public services such as roads.

RSC is continuing to look at further opportunities for use of VHOSO in its products.

Olivier: The SUPRAGREEN range, 100% based on VHOSO vegetable oils has been developed to compete with the very best performing neat cutting mineral oils on the market.

It's been designed for all bar turning operations on hard metals (stainless steel, titanium and Inconel) as well as on non-ferrous metals and standard steels. We believe that the predictable evolution of the regulation about BaP content in cutting lubricants will boost the development of this type of product. MotulTech is continuously trying to be innovative and in advance to enter new markets with new technology products such as VHOSO oil base cutting oil.





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. Life cycle assessment results

In order to evaluate the environmental impact of the VHOSO biolubricants, a life cycle assessment (LCA) was performed. The latest results indicate that the soft refining, the VOSOLUB originality, does less environmental impact than the conventional refining (Figure 1). It remains to collect inventory data of use and end of life phases.

The LCA is a powerful environmental assessment tool because it is multi-steps and multi-criteria. The system boundaries are wide, covering all the life cycle of the product including a disposal scenario. It gives relevant information for decision making as it emphasizes what steps are the most critical to avoid the impacts. The impacts assessed cover all the environmental categories: it avoids impact transfer between categories.

The boundaries include the production of the sunflower seeds, seeds trituration, soft refining, esterification, formulation, use and end-of-life. The environmental impacts assessed are, among others, global warming, abiotic depletion, eutrophication and human toxicity.

Results show that the soft refining does less impact than the conventional refining for all the environmental impacts considered (a reduction comprises between 75% and 90%)

There is still work to do to consolidate the use phase hypothesis of the biolubricant. The motul Supragreen 4020, for instance, is supposed to have the same lifespan and

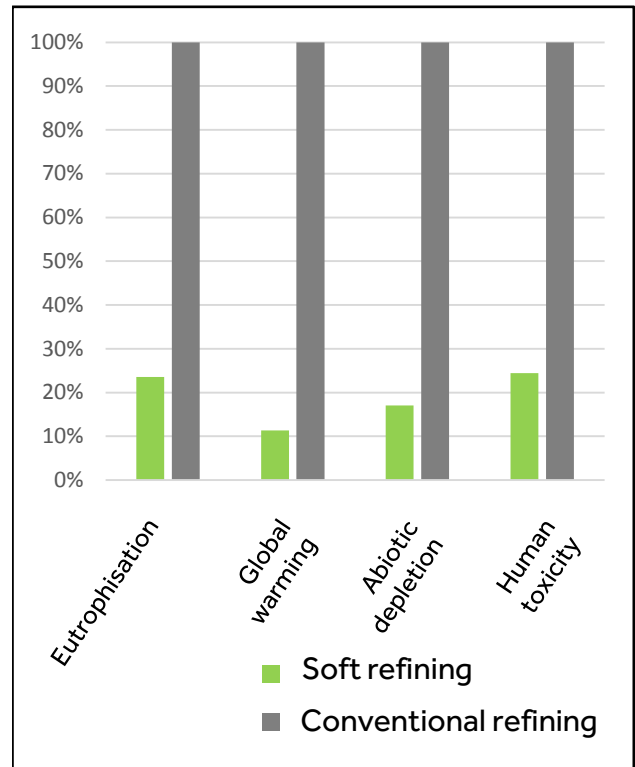


Figure 1 Compared environmental impact assessment of the refining step

degreasing, but has less evaporation and better biodegradability than a mineral lubricant. The estimated economized amount of biolubricant to assure the same function is between 10 and 20%.

Agriculture remain the largest contributor of the total impact in most of the categories, but other studies have shown that the global warming and the abiotic depletion are lowered up to respectively 80 and 55% by using vegetal oil instead of a mineral one.





4. Conclusion : added value of the project

Performance and comparative studies results of the 3 VHOSO applications are successful.

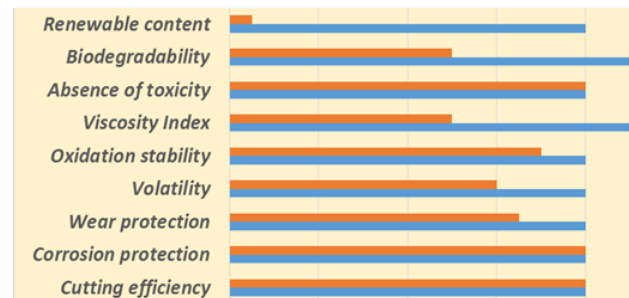
Physico-chemical and tribological analysis confirmed efficiency of biobased lubricant compared to mineral one. Environmental assessment confirmed low toxicity in aqueous medium and high biodegradability (more than 70% in 10 days) allowing ecolabelling for two biolubricants.

Tests realised in real conditions by formulators had confirmed requested technical performances. In some cases biolubricants performances are higher than mineral one.

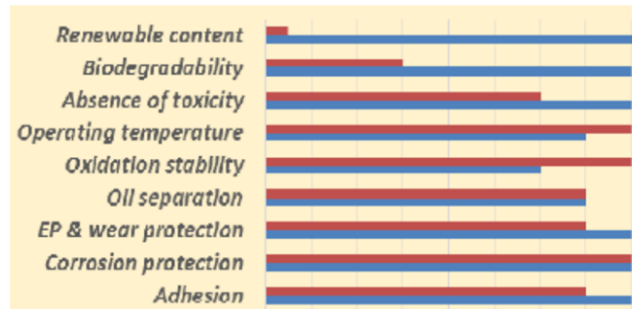
- Claretech EcoCurve performed as a trackside lubricant, have been tested during 1 year on Sheffield tram line, lost to the environment while maintaining performance levels
- Biobased hydraulic fluid, candidate to ecolabel, with high performing properties, ecologically safe in case of incidental release to the environment, have been tested more than 2000 hours in mechanical presses of garbage truck

Further fine tuning of the formulation may reduce the cost, but the VHOSO based products will remain more expensive. Thus they can only be used for high performance products, where the price difference on the base oil is less sensitive. Moreover, benefits of biobased lubricants such as low environmental footprint, high biodegradability or safety for end users (no HAP component) are market drivers that foster development of volume and sales.

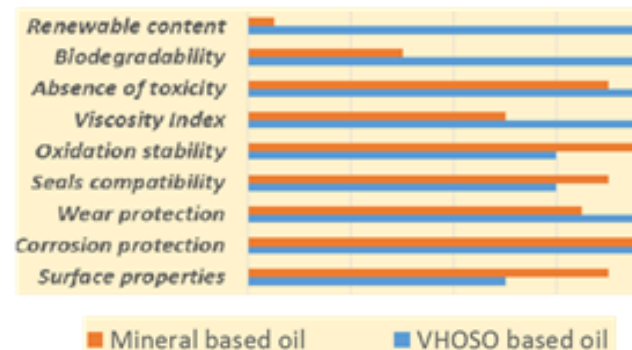
Features & Benefit of VHOSO bio based Cutting oil comparison with mineral based Cutting oil



Features & Benefit of VHOSO bio based Grease comparison with mineral based Grease



Features & Benefit of VHOSO bio based Hydraulic Fluids comparison with mineral based HF



■ Mineral based oil ■ VHOSO based oil

