Biolubricants

Measuring the environmental friendliness of lubricants

Demonstrably environmentally friendly: when a lubricant has not (yet) been awarded with an ecolabel, (prior to inviting tenders) the proposed product may be submitted to an independent expert for evaluation by way of documentation. This expert should test the product's environmental properties regarding the extent to which it meets the set requirements. When lubricant ecolabels are compared, no pair of ecolabels aresimilar.

Differences exist regarding the criteria the ecolabel considers important. What's more, concepts are not unequivocally defined. For example, all ecolabels contain criteria on the level of aquatic toxicity and biodegradability. However, these concepts are interpreted differently. Because of this variety of concepts and definitions it is essential to determine basic principles regarding the concept of 'eco-friendliness'.

When determining the eco-toxicity of a lubricant, the substance's acute or chronic toxicity may be emphasised. Selections may also be based on the organisms on which the tests need to be performed. With regard to biodegradability, requirements may be set concerning the testing on the product itself, or on the individual components or substances. Furthermore, the ultimate or primary biodegradation may be used as a point of departure. In addition, test requirements can relate to the distinction between readily, inherently or non-biodegradability of a substance or product.

European Chemicals Policy: The EU legislation is directed at chemicals. The introduction of REACH (the regulation EC 1907/2006 on the Registration, Evaluation, Authorisation and Restriction of Chemicals) and GHS (Globally Harmonised System of Classification and Labelling of Chemicals), the new classification system for substances and preparations, is based on the hazards of components within preparations. A combination of hazards and the fractions of individual components in the product determine the risk the product poses to humans and the environment.

In the present situation, efforts are made to link the detrimental effects occurring in the environment or in human health to one or more specific chemical substance. Therefore, it is also important to know where these substances causing these detrimental effects come from. The main European ecolabels are substance-oriented as far as environmental and health criteria are concerned. Technical criteria, on the other hand, are evidently product based.

Product and substance hazards: products and substances can pose a risk to health and the environment in various ways. These have been defined in three risk categories each per product: Physico-chemical hazards (e.g. explosive); health hazards (e.g. irritating and carcinogenic); environmental hazards (e.g. to aquatic organisms and environmental compartments).

The risks are defined by an R-phrase (Risk-phrase). At this moment, 68 single R-phrases have been defined for one substance. Ten (R50-R59) out of those 68 describe environmental hazards. Additionally, R-phrases can be combined; e.g. R50/53. Based on a fraction of a substance bearing a specific R-sentence, an entire product may receive an R-phrase itself. Product Rphrases relating to the environment are R50-R53 and R59. From 2015 onwards, the R-phrases for products such as biolubricants will be replaced by a system based on the Globally Harmonized System of Classification and Labelling of Chemicals (GHS), which was developed by the UN. GHS uses Hazard and Precautionary statements (H and P-statements.) In the EU this will be done via the Classification, Labelling and Packaging (CLP) regulations.

Screening tests: In order to determine the environmental friendliness of a product, screening tests are applied. The substances present in a lubricant must have been subject to one or more screening tests. Tests regarding environmental friendliness focus on biodegradability and aquatic toxicity. All the main European ecolabels are attuned to the tests that are common within the EU substances policy. Information from the MSDS, the Material Safety Data Sheet, may be used to that end.

Biodegradability: Biodegradability means the capacity of small organisms (mainly bacteria) to dissolve materials. These organisms use these substances as a source of energy and biomass (new cells and organisms). Regarding biodegradability, within the EU standard screening tests are applied which determine the ultimate substance disintegration (mineralisation) under oxygen by micro-organisms after 28 days. Sometimes test organisms are given ten days in which to adjust to particular circumstances before the counting begins. This is known as the 10-day window.

Depending on the rapidity of the degradation rate, we regard a substance as readily, inherently or non-degradable. When the substance is fully converted into carbon dioxide and water by the organisms, we speak of ultimate or full biodegradability. If this conversion took place within a screening test of 28 days, we speak of ready biodegradability. If the process takes longer, or if the degradation organisms need to be selected first, we speak of inherent biodegradability.

Only the terms readily and inherently biodegradable have been defined within the chemicals policy. Terms such as good and full biodegradability have not been defined, but are used regularly. Sometimes the disintegration to carbon monoxide and water halts during the process. The precursor has not fully been broken down, even though it has disappeared. This is called primary biodegradation.

Materials that do not disintegrate, or do so very slowly are called persistent substances. Some persistent materials can accumulate in individual organisms. Eventually, they arrive at the top of the food chain. In the organs of the organisms in which these substances accumulate this bioaccumulation can, over time, lead to harmful effects, disease or death.

Aquatic toxicity: Freshwater organisms are usually used for aquatic toxicity tests. Standard screening tests on eco-toxicity have been developed for algae, daphnia (water fleas), and fish. These test results then indicate the substance's risk to the environment and a possible environmental classification. When determining the toxicity, distinction is made between acute and chronic toxicity.

Acute risks are measured by the mortality rate of water organisms at various concentrations of the substance or product within several days. For example the concentration at which 50% of the organisms expire within a limited period of time (LC50; in mg/L). The chronic risks are determined in long-term experiments, usually spanning several generations of the organism, in order to determine the concentration in water at which the

substance no longer causes toxic effects; the NOEC value (No Observed Effect Concentration).

Testing the product or the substance? Biodegradability and aquatic toxicity tests performed on products yield results which may be used to judge the product as a whole, to certify and eventually classify it. If the product is a preparation (mixture of various components), this kind of test does not elucidate which of the components are biodegradable and toxic, and which components are not. In order to ascertain which substance is responsible for the found effects, it is important to also test the substances individually. This provides product developers with knowledge, so the formula can be adjusted to keep the biodegradability and toxicity within the set requirements, while also retaining the required technical properties. However, it may still be useful or even necessary to test the entire product in cases of possible synergetic effects.

Renewability (of lubricants) This is the extent to which a product is based on oils of vegetable or animal origin; in contrast to products based on fossil raw materials. Where lubricants are concerned, renewability is an ecological advantage. It guarantees that the product –during its entire life cycle- causes a lower level of CO2 emission.

Testing laboratories In a laboratory tests are performed according to norms of fully validated own methods. The tests are, if possible, carried out according to identifiable standards. Laboratories that have been awarded with the accreditation logo, have proven that they perform tests with a high degree of certainty and according to the referenced standards or a fully validated method of their own design. Laboratories are accredited according to the ISO/IEC 17025 norm. An overview of specialisations is available on the website of Dutch the Accreditation Council.