Making Eco-Labels a Reality – Standardisation Activities regarding Bio-Lubricants

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Seminario "Biolubrificanti: buone pratiche ed esempi concreti"
25-27 Febbraio 2015 – Cremona, Italy

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Introduzione

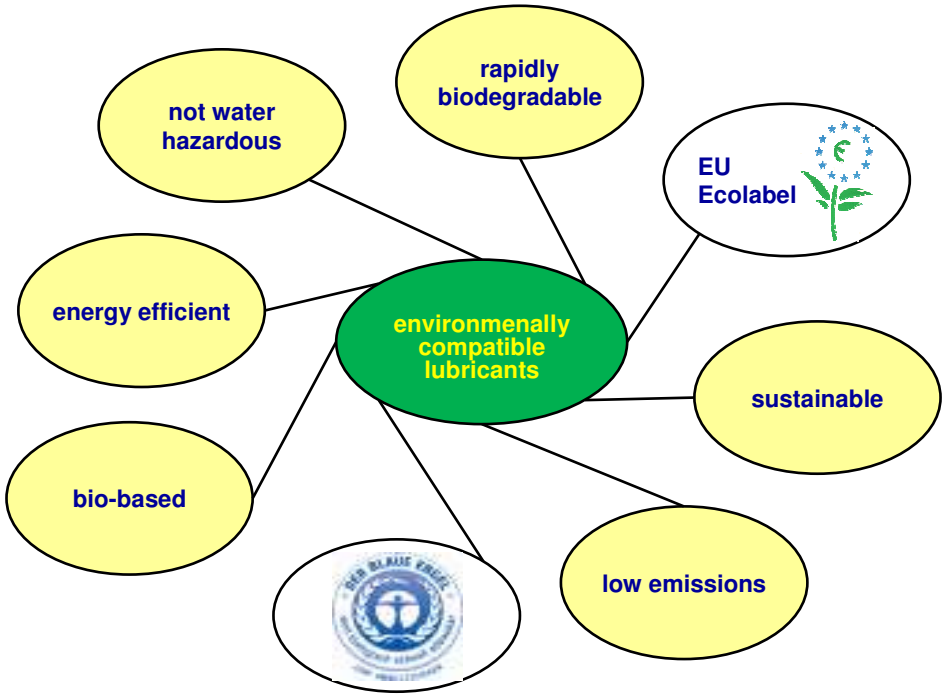
- **In tutti gli aspetti della vita quotidiana, nei maggiori paesi industrializzati, i temi della sicurezza e della protezione dell'ambiente sono sempre più ricorrenti e concorrono a modificare in massa i comportamenti delle persone.**
- **Come le cinture di sicurezza, gli airbag ed il casco sono diventati familiari per gli utenti della strada, analogamente nell'industria, il recepimento di numerose normative nazionali e comunitarie ha reso abituale l'utilizzo dei Dispositivi di Protezione Individuale, la valutazione del rischio e l'adeguamento delle infrastrutture al fine di garantire standard di sicurezza adeguati.**
- **Nella intenzione del legislatore, nei processi industriali occorre, a parità di performance, "sostituire ciò che è pericoloso con ciò che non lo è" rincorrendo, di conseguenza, livelli di sicurezza per l'uomo e per l'ambiente sempre superiori, di pari passo con il progresso delle conoscenze tecnologiche e scientifiche.**

FLUIDI IDRAULICI MINERALI

- **Nella maggioranza delle applicazioni, i fluidi idraulici a base minerale offrono sufficienti garanzie prestazionali e di sicurezza; occorre tuttavia sottolineare come le perdite accidentali, ed in misura non trascurabile anche quelle sistematiche, possono costituire un potenziale pericolo per l'ambiente e per la sicurezza.**
- **I principali rischi connessi con la perdita di oli idraulici a base minerale, nell'ambiente e sul luogo di lavoro, sono riconducibili a:**
  - ***potenziale inquinamento del suolo e delle acque in caso di spargimento sul terreno***
  - ***facile infiammabilità ed elevata tendenza alla combustione ed alla propagazione della fiamma in caso di contatto con superfici incandescenti o con altre forme di innesco***
  - ***formazione di nebbie d'olio o di IPA/PNA (Idrocarburi Policiclici Aromatici)***
- **Per limitare i danni all'ambiente nel caso di spargimento di olio sul suolo trovano sempre più impiego gli oli idraulici biodegradabili, generalmente costituiti da esteri naturali (oli vegetali) o sintetici.**

Environmental impact of lubricants: Searching for relevant & measurable criteria

- **From an environmental point of view, lubricants are not a highly risky product group per se; however, spillages and leakages of oils in environmentally sensitive areas can generate considerable environmental impacts**
- **How can lubricants, which are less problematic to the environment, be characterized and distinguished from conventional ones?**
- **What is an environmental compatible lubricant?**



Environmental impact of lubricants: Searching for relevant & measurable criteria

- **Objective, measurable & provable criteria for the environmental relevance of lubricants:**
  - **Biodegradability (which doesn‘t mean self decomposition!)**
  - **Toxicity**
  - **Sustainability of (renewable) raw materials**
  - **Technical performance**
    - → **with these 4 criteria the direct environmental impact of fresh oils to nature can be described**
- **A 'Life Cycle Assessment' of an 'eco-lubricant' should include further aspects:**
  - **Sustainable production of the (renewable) raw materials**
  - **Energy efficiency in the operating time of machines**
  - **Lifetime of lubricant and machine,**
    - → **but for these 3 criteria, standardised methods are not yet available**
- **Consequently, actual Ecolabels for Lubricants are focussed on the first four criteria.**

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Some market numbers with regard to Bio-Lubricants

- The ratio of "environmentally compatible lubricants" is assumed to 3 – 4% (≈ 30‘000 mt/a) in Germany
- In EU-27, the volume of bio-lubricants is assumed to < 2% (≈ 100’000 mt/a)
- From a technical point of view the realizable European market potential for bio-lubricants is assumed to 1.5 million mt/a
- Volume wise hydraulic fluids and total loss lubricants are dominating, due to the relatively high impact to the environment
- For all of these statistical assumptions the environmental aspect refers only to the rapid biodegradability and low toxicity of lubricants
- Since some years, the product group 'Bio-Lubricant' is discussed in a wider perspective: 'Bio' in the sense of using renewable raw materials
- A general definition for this wider understanding of 'Bio-Lubricants' was missed up to now.

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But what means "Bio" in regard to lubricants?

Origin of material	Biodegradability	The meaning of the prefix "bio-"	Example
Renewable	Rapidly biodegradable	Bio-based and biodegradable	Rapeseed oil, tri-methylol-trioleate (TMP-O)
Non-renewable	Biodegradable	Biodegradable	Di-isotridecyl-adipate (DITA)
Renewable	Non or slowly biodegradable	Bio-based	Hydrocarbons from process "Biomass-to-Liquid" (BtL)
Non-renewable	Non or slowly biodegradable	Biocompatible	White oil for food grade lubricants

Biodegradable ester oils can be both petrochemically and oleochemically based:

ALCOHOL	ACID
ALCOHOL	ACID
ALCOHOL	ACID

→

Chronology of 'Bio-Lubricants'

Biodegradable, bio-based, eco-labelled, environmentally compatible lubricant:

1975 Two-Stroke-Oils for outboard engines

1989ff German Eco-Label 'Blue Angel' for special groups of lubricants

2002 ISO 15380 – Specifications for environmentally acceptable hydraulic fluids

2005 EU Eco-Label for Lubricants (EEL) – Directive 2005/360/EC

2011 Revised EEL – Directive 2011/381/EU for special groups of lubricants

2011 CEN Technical Report 16227: General definition of all kind of Bio-Lubricants.

Realized eco-labels and definitions for bio-lubricants in Europe:

Directive	Label	Minimum RRM Content	Product group	Number of products (2013)
EU Ecolabel		45 – 70%	Hydraulic & gear oils, greases, total loss lubricants	88
German 'Blue Angel'		No limit, only reporting	Hydraulic & gear oils, greases, total loss lubricants	207
CEN TR 16227		25%	All types of lubricants, incl. engine oils & metalworking fluids	nn

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The strict view: EU Ecolabel for Lubricants (EEL)

- The EEL exists since 2005 (Directive 2005/360/EC), the first revision since 2011 (Directive 2011/381/EU)
- The EEL includes only special groups of lubricants:
  - Category 1: Hydraulic fluids and 'Tractor Transmission Oils'
  - Category 2: Lubricating greases and stern tube greases
  - Category 3: Chain saw oils, Mould release agents, wire rope lubricants and other total loss lubricants
  - Category 4: 2-stroke engine oils
  - Category 5: Industrial and marine gear oils
- The EEL includes a criterion "Minimum amount of renewable resources":

Criterion 5	Hydraulic fluids	Greases	Chain saw oils, mould release agents and niche loss lubricants	Two-stroke oils	Industrial gear oils
Carbon content from renewable raw materials % (w/w)	≥ 50%	≥ 45%	≥ 70%	≥ 50%.	≥ 50%

- Reputation of EEL is based on the certification process
- Disadvantage of EEL:
  Only few lubricants groups – what's about engine oils, metalworking fluids etc?

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Initiative on bio-based products: Implications for Bio-Lubricants

- Over the last decade, the aspect of using renewable, bio-based material came up
- Bio-Lubricants are explicitly mentioned as promising product group within the European 'Lead Market Initiative' (LMI, 2008-2009)
- Standardisation work started under the umbrella of the LMI Mandate M/430: Elaboration of a 'Standardisation programme for Bio-Lubricants'
- CEN, the European Committee for Standardization, established the working Group 'Bio-Lubricants' (TC19/WG33)
- As the first step, a Technical Report concerning "Recommendation for terminology and characterisation of bio-lubricants and bio-based lubricants" was set up
- The CEN Technical Report 16227 "Bio-Lubricants" was published in 2011
- Within TR 16227, the "minimum requirements" for bio-lubricants include renewability, biodegradability, toxicity and technical performance
- Since the TR 16227 operates as a self-committment of the lubricant producers, the approach has to focus on the customer's view:
  Every claim with regard to biodegradability, toxicity and bio-based content should be measurable in the final product by the customer, for better reputation in the market.

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CEN Technical Report 16227: General definition on Bio-Lubricants & Bio-based Lubricants

Minimum requirements for 'Bio-Lubricants' or 'Bio-based Lubricants' (in short):

- **Renewability:**
  Content of renewable raw material ≥ 25 % accord. to ASTM D 6866 (radiocarbon method)
- **Biodegradability:**
  ≥ 60 % according to OECD 301 for oils; ≥ 50 % for lubricating greases
- **Toxicity:**
  Not to be labelled as 'Dangerous to the environment' accord. to CLP directive
- **Performance:**
  'Fit for purpose' or 'Fit for use'.

Next step:
European Standard CEN/EN based on TR 16227

- **prEN 16807: Liquid petroleum products — Bio-lubricants — Criteria and requirements of bio-lubricants and bio-based lubricants**
- **Defining minimum requirements equivalent to TR 16227:**
  - → **Renewability**
  - → **Biodegradability**
  - → **Toxicity**
  - → **Performance**
- **Submitted to CEN-CENELEC Management Centre (CCMC)**
  - → **final ballot running.**

→

United States Environmental Protection Agency: EPA Definition of EALs

- **Environmentally Acceptable Lubricants are defined as :**
  - **Biodegradable**
  - **Minimally toxic**
  - **Not bioaccumulative**
- **Biodegradable means a formulation with at least 90% constituent that**
  - **demonstrates the removal of > 70% dissolved organic carbon**
  - **produces at least 60% of the theoretical CO2 in 28 days or**
  - **consumes at least 60% of the theoretical oxygen demand within 28 days**
  - **Acceptable tests are OECD 301A-F, OECD 306, OECD 310, ASTM D5864**
- **Minimally-toxic means a substance must pass either OECD 201, 202 & 203 for acute toxicity testing, or OECD 210 & 211 for chronic toxicity testing**
- **Of the remaining 10% of the formulation, up to 5% may be none biodegradable (but not bioaccumulative) and the remainder must be inherently biodegradable**

However, this approach neither is certified by authorities (like an eco-label) nor provable by the customer.

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Vegetable oils and their derivatives – as base oils

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Advantages

Technical:

- very high VI (> 200)
- very low evaporation loss
- Acceptable low temperature properties
- good tribological behaviour (very low coefficient of friction)

Economical:

- reasonable price.

Environmental:

- rapidly bio-degradable
- non-toxic, skin compatible
- renewable resource

→

Next step:
Sustainable provision of bio-based raw materials

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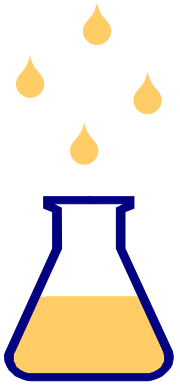
Vegetable oils ...

... can be transformed by chemical modifications ...

Chemical modification

... to synthetic esters:



Adjustment of:

- Viscosity
- Evaporation loss
- Oxidation stability
- Hydrolytic stability
- Biodegradability
- Foam behaviour
- etc.

… can be certificated as sustainable.

→

Sustainable provision of bio-based raw materials

- **INRO: German Initiative for the Sustainable Provision of Bio-Based Raw Materials**
- **A step in this direction already was done before within the Renewable Energy Directive (RED): Since 2010 certification labels are officially acknowledged, f.e.**
  → RSPO (Roundtable of Sustainable Palm Oil)
  → ISCC (International Sustainability and Carbon Certification)
  → REDcert (Renewable-Energy-Directive certification)
- **Since most chemicals and preparations are combinations of different raw materials, the INRO approach concerning bio-based chemistry is actually focussed on certification up to the "first processor in chemistry" (provision of raw materials)**
- **INRO Criteria for good Certification Systems are finalized and published**
- **Discussion about first "pilot projects" has begun:**
  Some projects were defined – one in regard to lubricants.

→

Another approach:
Revision for German Ecolabel 'Blue Angel'

- **Inclusion of the former 'Blue Angels' UZ48, UZ64 and UZ79 under one umbrella as UZ 178; additionally industrial gear oils are included**
- **Criteria similar to European Ecolabel, but in relevant objectives different**
- **Content of renewable raw material (to be measured accord. to ASTM D-6866) only has to be reported; a minimum content is not requested**
- **UZ 178 "Lubricants" officially published in June 2013; "old" labels valid till end of 2014.**

Market demands for Bio-Lubricants: From Push to Pull?

- Value for customers is based on price and performance
- Well-performing bio-lubricants have higher costs
- 'Bio' or 'Eco' properties are so far not regarded as a value for most customers, mostly it is only an add-on
- Customers of Bio-Lubricants pay for biodegradability, low toxicity and 'non water hazardous' characteristics (Germany)
- Customers mostly are not interested in the source of chemistry
- Thus, to justify higher prices, Bio-Lubricants need 'technical added values' like → longer life time, → superior wear properties, → higher energy efficiency
- The R&D behind 'performance' is done by the lubricant manufacturer, but it is a long and hard way to market growth, as long as the competition between different uses of biomass is not fair and the energetic use actually is politically preferred
- One Priority Recommendation of the EU Lead Market Initiative was: "Study the possibility of mandating the use of bio-lubricants and hydraulic fluids in environmentally sensitive areas."
- To switch from the existing technology push to a market pull, a binding political framework for supporting bio-based lubricants would be needed.

→

Which performance level can be stated for today's bio-lubricants ?

- High performance lubricants based on renewable raw materials (synthetic esters) are available on the market
  → Examples:

- **Not water pollutant, rapidly biodegradable hydraulic fluids with eco-label "Blue Angel" or European Eco-Label**
- **Not water pollutant, rapidly biodegradable multifunctional oils for combined use in machine tools (cutting oil & hydraulic fluid)**
- **Rapidly biodegradable high performance gear oils and special greases for modern windmills**
- **Rapidly biodegradable and fuel-efficient high performance engine oils …**

- From a pure technical point of view more than 90% of all lubricants could be bio-based – but performance needs, environmental protection and costs have to be balanced.

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Summary

- Due to discussions concerning environmental impact and sustainability of resources the product group "Bio-Lubricants" has positive perspectives
- According to different forecasts the volume of bio-lubricants could be quadrupled in the 2020th in case of ambitious legislation levels, up to more than 400'000 t/a
- Mandating the use of bio-lubricants in environmentally sensitive areas could be based on the existing European Eco-Label for Lubricants
- As basic definition of "Bio-Lubricants", for clear & unambiguous communication and for all statistical issues the proposal of CEN TR 16227 (or equivalent CEN/EN) is recommended
- Aspects with regard to sustainability of natural resources should be taken into consideration in future
- These efforts will give support for reaching the goals:
  - Transparency of criteria & claims
  - Reputation & acceptance in the market
  - Sustainable market success.

BROCHURE PLANTO – i vari settori di applicazione

THE WORLD OF BIODEGRADABLE INDUSTRIAL LUBRICANTS

Transport, construction, municipal vehicles

Virtually all vehicles operate outdoors in one way or another, carrying all manner of resources on board. These include fuels, engine oils, gear oils, hydraulic oils, antifreeze, etc., which present a not inconsiderable danger to us and our environment in the event of a spillage or accident.

These dangers can be avoided by using special hydraulic oils such as PLANTOHYD and PLANTOSYN for the mobile sector.

Applications:
Harvesting machines, construction machines, trucks and municipal vehicles, ditch cleaning equipment

Agriculture and forestry

Forests, fields and Alpine grass areas are highly sensitive ecosystems and their modern utilization has long had to be economically viable. Chainsaw lubricants are so-called loss lubricants which, even in their latest versions, enter and remain in the environment when used.

FUCHS focuses on sustainability and economic efficiency and for this reason has developed the rapidly biodegradable PLANTOTAC 68 chainsaw oil, which complies with the special requirements of the European Eco-label.

Applications:
Forestry, land management, agriculture, chain saws, landscaping

Marine

Water is the most important basic source of nutrition, and is often derived from groundwater or rivers. These important reservoirs are almost exclusively polluted by watercraft, e.g. by propeller greases, chain or rope lubricants and many more.

The FUCHS products PLANTOSYN, PLANTOGEAR and PLANTOGEL enable this pollution to be avoided. All PLANTO products, which have been awarded the European Ecolabel, may be used in accordance with the new Vessel General Permit (USA).

Applications:
Fishery, navigation of waters, sail boats and motorboats, locks, oil platforms, dry docks

Energy industry

Renewable energies such as wind power and rapidly biodegradable lubricants share a common background: preservation of the environment and resources.

FUCHS PLANTO lubricants have proven ideally suited to wind energy plants with the most challenging lubricant requirements.

The FUCHS products ECO HYD S PLUS and GEARMASTER ECO 320 were developed specially for application in wind energy plants and are approved, rapidly biodegradable gear oils.

Applications:
Wind energy

Mountainous regions

The most important aspect for commercial use of rapidly biodegradable lubricants in mountainous regions is the preservation of an unspoilt and clean environment.

FUCHS offers a special range of PLANTO products that fulfill environmental protection requirements. These include the PLANTOSYN and PLANTOLUBE POLAR products, which also ensure the best possible lubrication of machinery in mountainous regions.

Applications:
Piste preparation, ski lifts, snowmobiles, snow cannons

Water management

The use of lubricants and greases in areas where they will come into direct contact with water demands a particularly high degree of protection against pollution.

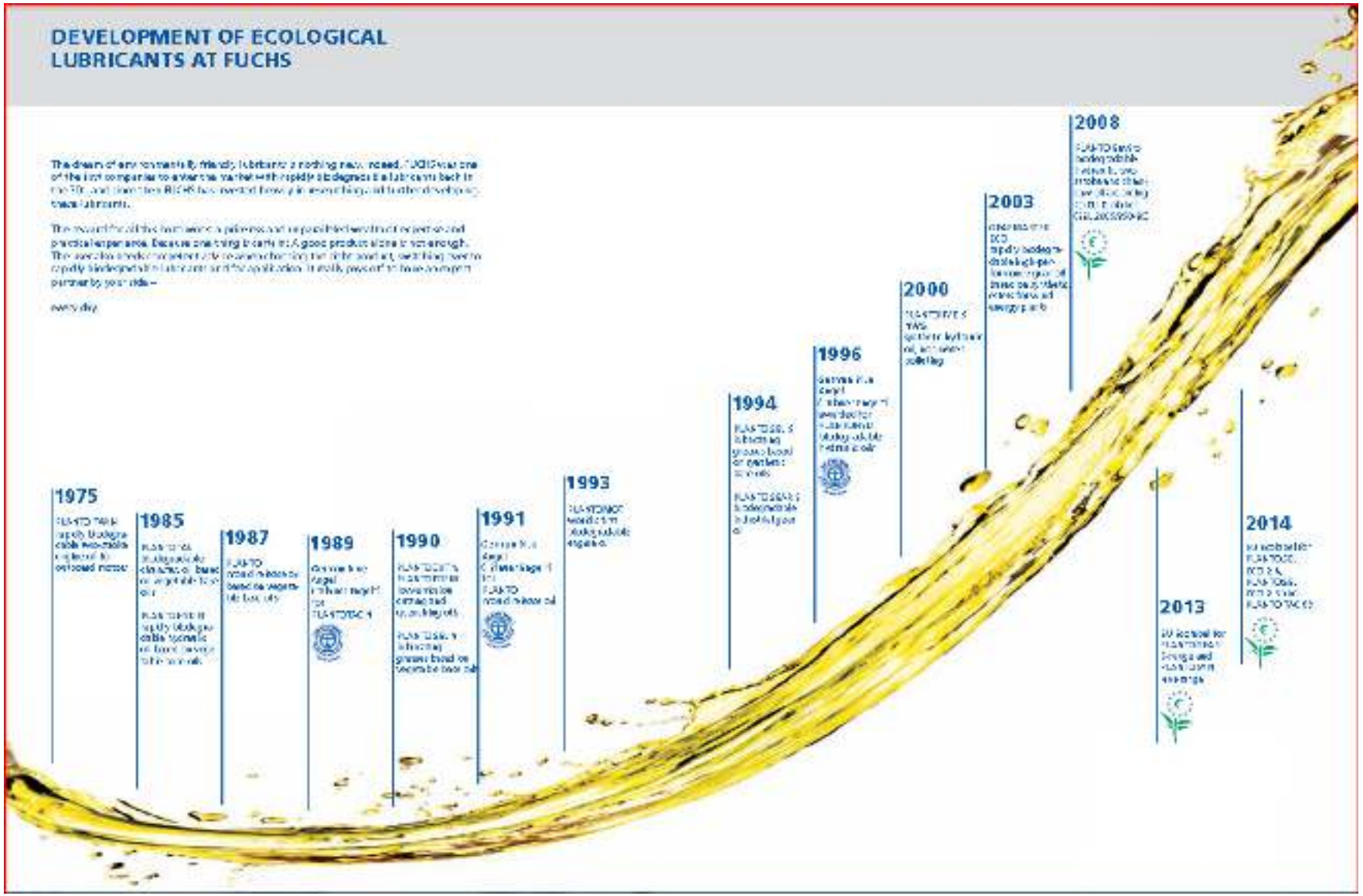
Greases are needed for gears, pumps, hubs and much more, for drinking water treatment, sewage plants or for operating locks.

Alongside excellent performance and a high level of water resistance, the lubricants also need to be rapidly biodegradable in order to protect the environment.

For such applications, FUCHS offers numerous products, including the rapidly biodegradable PLANTOGEL ECO 2 N and PLANTOGEL ECO 2 S lubricating greases, which have also been awarded the Ecolabel (BEL).

Applications:
Sewage plants, water treatment, docks, locks

BROCHURE PLANTO – l'impegno del gruppo nel tempo



BIO-LUBRIFICANTI esempi - PLANTOHYD S NWG

- **I PLANTOHYD S – NWG sono costituiti integralmente da sostanze classificate non inquinanti per i sistemi acquatici (NWG) ed offrono una notevole serie di vantaggi rispetto ai prodotti convenzionali:**
- *in caso di spargimento sul suolo e nelle acque non sono pericolosi per la flora e per la fauna.*
- *sono rapidamente biodegradabili oltre il 90% secondo la metodologia CEC-L-33-A-93.*
- *non contengono metalli pesanti e non sono pericolosi per l'uomo.*
- *presentano indici di viscosità molto elevati (>190) e pertanto garantiscono un eccellente comportamento viscosità-temperatura, contenendo le variazioni di viscosità in presenza in servizio di escursioni termiche elevate. Il campo di temperatura di esercizio sostenibile è compreso fra i –30 ed i + 90° C.*
- *sono molto resistenti a fenomeni di invecchiamento causati dalle elevate temperature di esercizio e dalla presenza di umidità.*
- *garantiscono un'efficace azione di protezione contro l'usura degli organi costituenti il circuito idraulico.*
- *sono molto stabili all'azione di taglio degli organi meccanici e mantengono nel tempo invariata la viscosità a differenza dei prodotti ad alto indice di viscosità a base minerale; quest'ultimi soffrono di riduzioni notevoli di viscosità a causa dello "shear" cui sono sottoposti i polimeri impiegati per aumentare l'indice di viscosità.*
- *sono dotati di buone caratteristiche di "air release"; consentono quindi di evitare fenomeni di cavitazione ed usura conseguenti al difficile rilascio dell'aria dalla parte in pressione del circuito. Questa caratteristica è particolarmente importante nei sistemi mobili che normalmente operano con volumi di olio ridotti.*
- *Sono insolubili in acqua e dotati di buone caratteristiche di demulsività che facilitano l'eventuale scarico dell'acqua di condensa dal fondo del serbatoio.*

BIO-LUBRIFICANTI esempi - PLANTOHYD S NWG

- **I PLANTOHYD S – NWG sono particolarmente raccomandati:**
- *nei sistemi idraulici ove perdite accidentali possono inquinare il terreno*
- *nei circuiti idraulici soggetti ad alte escursioni termiche ambientali*
- *in sistemi a funzionamento intermittente operanti in climi particolarmente rigidi*

In Italia Fuchs fornisce alcune centrali idroelettriche dell'ENI con il Plantohyd S NWG proprio perché si garantisce in questo modo un impatto nullo in caso di sversamento accidentale in acqua.

BIO-LUBRIFICANTI esempi di prodotti ECOLABEL

- **PLANTOHYD 15 S**
- **PLANTOHYD 22 S**
- **PLANTOHYD 32 S**
- **PLANTOHYD 46 S**
- **PLANTOHYD 68 S**
- **PLANTOSYN 3268 ECO**

Possono essere utilizzati fino a -30 ° C

Al di sotto di -30 ° C si consigliano

i PLANTOLUBE POLAR S serie
anch'essi con buona biodegradabilità,
ma non ECOLABEL

- **PLANTO SCHALUNGSÖL N** - mould release agent (distaccanti per edilizia)
- **PLANTO TAC 68** - chain saw oil (olio motoseghe)

PLANTOFLUX AT/46-S e PLANTOFLUX AT/68-S

Si tratta di fluidi idraulici basati su esteri oleici del TMP che vengono impiegati nella lubrificazione di circuiti idraulici soggetti al rischio incendio.

Ad esempio in comandi idraulici in accierie, altiforni e cokerie, in processi di colata continua o per la movimentazione porte forni da trattamento termico. In Cina è stato utilizzato nei circuiti idraulici di una enorme fontana pirotecnica.

I due prodotti sono certificati Factory Mutual (approval 3014386).

FM è un ente americano che si occupa di certificare apparecchiature ed impianti antincendio, la cui influenza è riconosciuta in tutti i continenti.

I Plantoflux vengono prodotti solo in Italia da Fuchs ed esportati nelle consociate in tutto il mondo.

PRODOTTI per METALWORKING base estere

…ma la CHIMICA VERDE non si ferma al mondo della lubrificazione, ma ormai è pesantemente entrata nel vasto settore del METALWORKING, i fluidi per la lavorazione dei metalli, con prodotti che, pur non potendosi fregiare del marchio ECOLABEL, sono in grado di offrire agli operatori vantaggi come:

- **Minor pericolosità ambientale e verso l'uomo.**
- **Miglior resa meccanica.**
- **Maggior durata utensili e minor costo smaltimento esausti (cariche con più vita utile)**
- **Risparmio economico (pur avendo un costo maggiore) che tiene conto dei minori costi dei materiali e delle minori spese per adeguamenti normativi.**

PLANTOCUT, ECOCUT SYNT, ECOCOOL, RENOFORM, RENOCLEAN, THERMISOL sono brand FUCHS nel settore del metalworking.

Grazie per l'attenzione!

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