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MADENİ YAĞ DÜNYASI

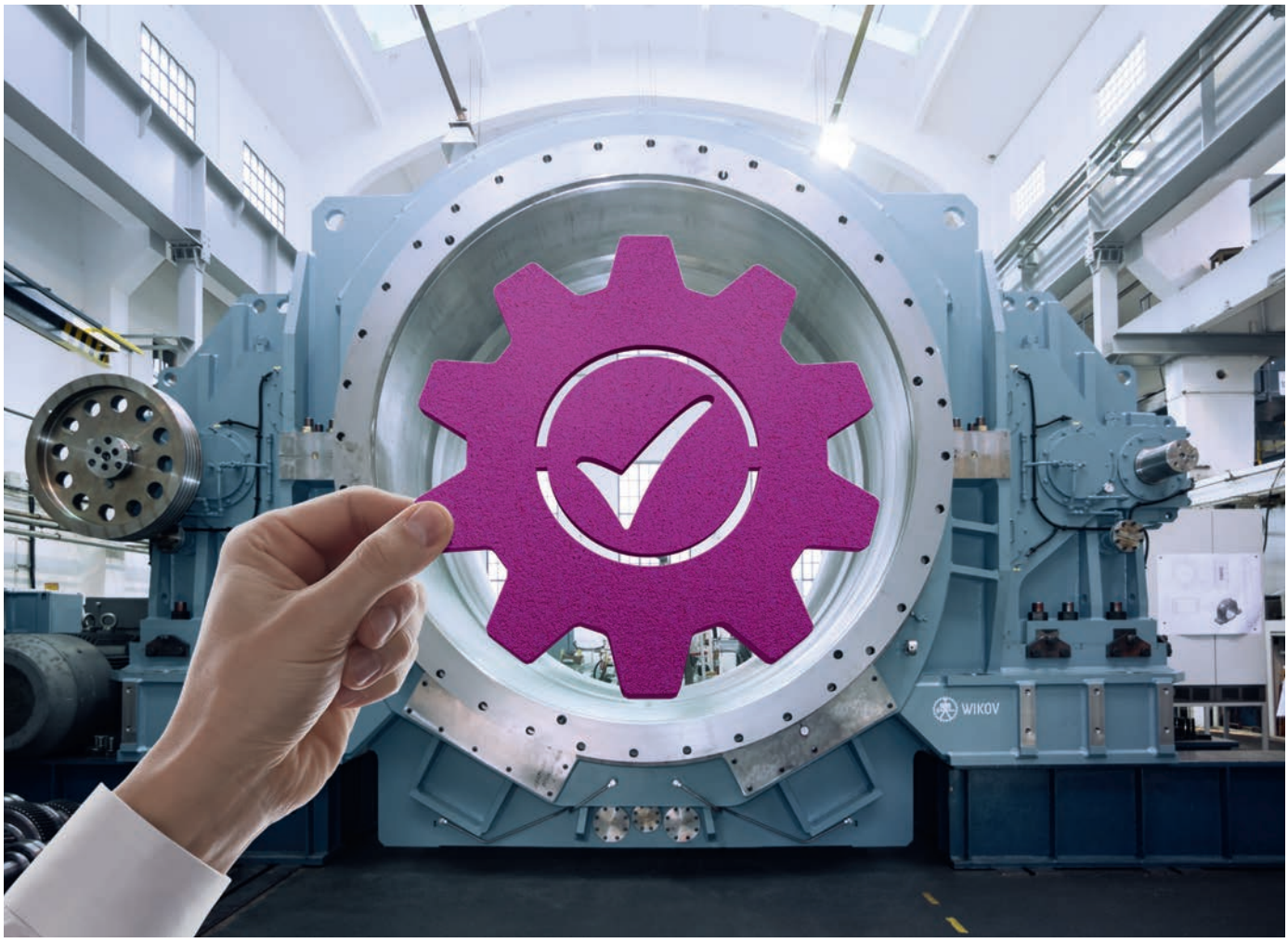
LUBRICANT WORLD

Product selection for food industry lubricants

Lubricant World started hosting webinars

Metalworking fluid emulsion stability and base oil properties

ExxonMobil and INNIO sign long-term global lubricants collaboration agreement



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Editor's Letter

The Covid-19 pandemic has been brought under control in our country to a certain extent, but we should still take care to keep our social distance and always be precautious. In this period, there have been radical changes in many sectors; we have experienced bad situations such as job and employment losses. In this 'new normal' period, businesses have to adapt to the requirements of this era in order to survive. The most important of these is to use technology and social media efficiently and rationally.

As Lubricant World Magazine, we now offer free access to the digital version of the magazine, and we also started to host webinars. Our webinars, where we host key speakers and focus on the topics of interest, attract the audience not only from the lubricants sector but also from many other sectors such as automotive, industry, transportation and chemicals. To access valuable information shared by experts and not to miss our webinar announcements, please follow our social media accounts.

Food grade lubricants can be considered among the most sensitive product groups in our industry. It is very important that these lubricants, which may come into contact with food, are produced with the right components, do not pose any risk to human health and hold the necessary certificates. In this issue, our cover story is on synthetic esters offered by NYCO for food grade lubricants. In our product review section, you can find detailed information about the esters that offer many advantages with the properties they have.

Turkey Edition

As a result of the study conducted by Nynas by comparing naphthenic and paraffinic oils, it was revealed that emulsions prepared with naphthenic base oils have better emulsion stability. In the article wrote by Nynas experts, you can find the details of the study, which was prepared with different base oils and followed for 7 days.

Petrol Ofisi, maintaining its leadership position in the lubricants and chemicals sector for 10 consecutive years according to PETDER 2010-2019 Total Lubricants and Chemicals Data, is now proud to have its Maxima CX 5W-30 engine oil labeled as the 'Voted Product of the Year' as per Nielsen Turkey's Voted Product of the Year 2020 Market Research.

Among the key developments of this issue is the appointment of Mehmet Ünal as Lubricants General Manager at Shell & Turcas. Ünal have been a part of the Shell family for many years and has achieved many successes in his activities. We congratulate him for his new position and wish him continued success.

Enjoy reading.

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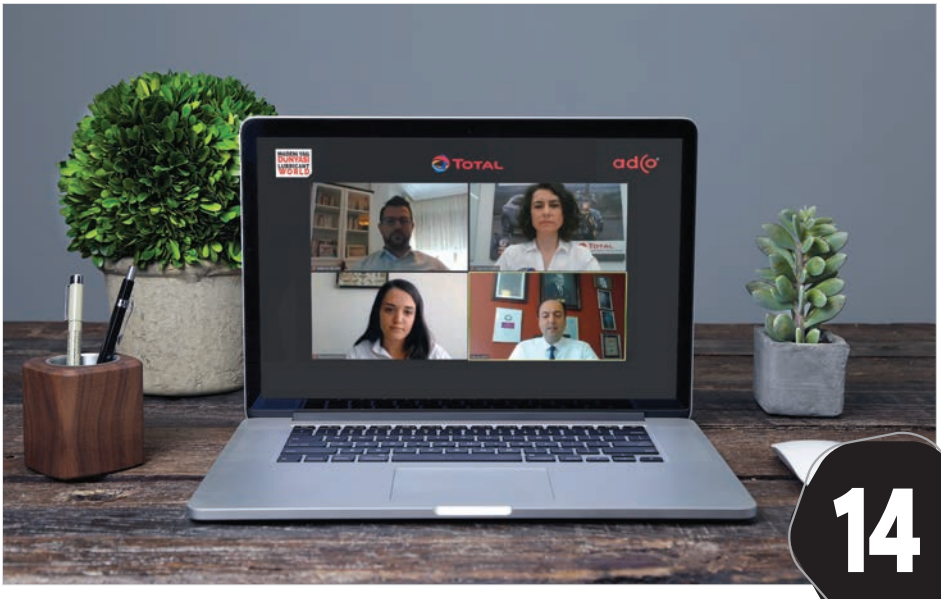
8

ExxonMobil and INNIO sign long-term global lubricants collaboration agreement

24

Metalworking fluid emulsion stability and base oil properties



14

Lubricant World started hosting webinars

22

Product selection for food industry lubricants

06 PANORAMA WORLDWIDE
14 IN-DEPTH
16 PANORAMA
22 PRODUCT REVIEW
24 ARTICLE
28 SUSTAINABILITY, ENVIRONMENT AND BIOLUBRICANTS

18

Mehmet Ünal becomes the new Lubricants General Manager at Shell & Turcas

Petronas releases transmission fluids for 5 different vehicle categories

Producing lubricants to meet ever-increasing performance levels and industry standards in automotive technologies, Petronas launched its transmission fluids range Tutela. The Tutela range has been developed separately for automatic (ATF), automated manual and manual (MTF) transmission systems including the dry type DCT, and axle, differential and direct gear systems. It helps to increase the performance of vehicles with a wide range of products at different performance levels. Petronas offers a range of transmission oils in 5 different categories: cars, light commercial vehicles, heavy commercial vehicles, agricultural machinery and construction equipment.

Offers advantage to vehicle owners and fleets

Being aware of the fact that the performance of a vehicle is not just about the engine, Petronas reduces friction while increasing fuel efficiency with Tutela Transmission Fluids. The optimum friction feature in fluids disperses the resulting temperature and compensates for energy loss. Its anti-abrasion and anti-surface deterioration structure extends the life of the transmission system and maintains differentials with exceptional sudden load durability. Suitable for use in multiple applications with its optimum chemical properties and viscosity, Petronas Tutela also functions as clutch fluid in many transmissions. Tutela improves drivers' comfort by making gear shifts smoother and reducing vibration and noise with its synchromesh compatibility, vibration reducing structure and torque transmission capacity. In addition, Tutela range protects the transmission system even below zero degrees, helping smooth shifts from the moment the engine starts. In commercial vehicles, thanks to its thermal resistance, Petronas Tutela provides longer maintenance intervals by keeping intact under thermal and mechanical stress, thus reduces maintenance costs and work losses due to failures.

Petronas Tutela range also contains solutions that meet the needs and expectations in today's automotive world, where electric vehicles are becoming widespread. It offers lower electrical conductivity, the ability to cope with high temperatures, high thermal conductivity and low evaporation characteristics.

Tested on more than 150 vehicles

Petronas launched the Tutela range with an investment of 12 million dollars. The company carried out product tests with more than 150 vehicles in automobile, minibus, truck and bus grades in the development phase. During the development of Tutela transmission oils, 35 million km of field trials were made, while only for Tutela Multi MTF 700 product, 850 thousand km of field tests were conducted in 37 automobile models representing 21 OEMs in 2 years.

Gazpromneft Marine Lubricants expands presence in Mediterranean

Gazpromneft Marine Lubricants expands a broaden network in the Mediterranean to 27 ports in Greece, 7 ports in Egypt, and 20 ports in Turkey.

To prevent the spread of COVID-19, the company have developed and introduced special procedure of non-contact liaising between Gazpromneft specialists and vessel crew.

Partner's production facilities in Turkey and Greece, as well as a warehouse in Egypt, allow Gazpromneft Marine Lubricants to maintain product availability and provide short notice in the region. Both blending sites have successfully passed technical audit for compliance with international and Gazpromneft standards.

All the lubricants are producing in strict accordance with original Gazpromneft Ocean formulations. Gazpromneft Marine Lubricants product portfolio includes 15 cutting-edge branded engine lubricants for use with various kinds of fuel, and also hydraulic, compressor, gear, turbine oils, special greases. Gazpromneft Ocean engine oils developed in 2017 and meet the latest MARPOL requirements.

''Expansion of our supply network in the Mediterranean region is an important step towards setting up a comfortable infrastructure for customers' businesses. Stable availability of oils in such heavy traffic regions as Suez and the Bosporus, as well as in the majority of other Mediterranean ports, allows to replenish supplies in the nearest point with short notice,'' noted Roman Miroshnichenko, Managing Director of Gazpromneft Marine Lubricants.

ExxonMobil and INNIO sign long-term global lubricants collaboration agreement

ExxonMobil and INNIO have signed a long-term extension to their global lubricant collaboration agreement for INNIO's Jenbacher Type 2, 3, 4, 6 and 9 natural gas engines. Working side by side, the companies will draw on their joint expertise in meeting the evolving needs of natural gas engine lubrication, resulting in the release of a new co-branded gas engine oil and other products in the future.

"We are pleased to build on our co-engineering working relationship with ExxonMobil," said Andreas Lippert, Chief Technology Officer at INNIO Group. "Together, we continue to co-develop a range of high-performance gas engine oil technologies for our reliable and highly efficient Jenbacher Type 2, 3, 4, 6 and 9 natural gas engines, helping our customers achieve their business goals in the global energy transformation."

"This collaboration with INNIO enables us to further strengthen our understanding of the application issues that customers face, in order to develop the right lubrication solution," said Henning Feller, EAME Sales Manager Finished Lubricants. "By combining our lubrication expertise with INNIO's 90 years of gas engine innovation expertise, we can achieve one shared goal: to help INNIO's Jenbacher gas engine customers improve their operational reliability, productivity, profitability and sustainability."

Get a grip on the future

We launched NYTEX® BIO 6200 to help customers in the tyre and rubber industries reach their sustainability targets – without sacrificing key technical properties. And it's working. If you too want to reduce your carbon footprint without compromising on performance.

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NYNAS

Idemitsu Lubricants America raises the bar on fully synthetic engine oils

Idemitsu Lubricants America provides new levels of engine protection with its line of fully synthetic motor oils that meet and exceed the new SP/GF-6A industry standards for more protection, performance and power. Also, Idemitsu has introduced a new 0W-16 SP/GF-6B Ultra-Low Viscosity Motor Oil with robust additive technology that exceeds forward-looking lubrication standards.

"Idemitsu is ahead of the field again with a line of fully synthetic motor oils that meets and, in many cases, even exceeds the new industry standards designed to protect the unique needs of today's high-revving, high-performance engines," said Oya Yasumasa, Vice President of Sales and Marketing for Idemitsu. "Not only do we have fully synthetic GF-6A oil in three different formulations, we're excited to launch our new 0W-16 motor oil in the Idemitsu brand that surpasses the forward-looking GF-6B standards. Each of our fully synthetic GF-6 oils is 100 percent ready for production and will be rolled out in a strategically phased plan to coincide with markets re-opening in the coming weeks."

Across the line, Idemitsu Fully Synthetic GF-6 Engine Oils provide more than three times (3x) better protection of engine parts at low-temperature starts over GF-6 standards and up to 21 percent greater engine wear protection, even under extreme conditions. Low-speed pre-ignition (LSPI) events are reduced by 91 percent over the new GF-6 standards.

Idemitsu's new Ultra Low Viscosity 0W-16 Engine Oil further bolsters the line of GF-6 synthetic oils, and offers outstanding chemical and viscosity stability to reduce tailpipe emissions and protect emission control systems. It keeps pistons, camshafts, lifters and other engine parts cleaner, even surpassing GF-6 standards, for longer engine life.

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Rymax Lubricants introduces the Apollo ECO line

The new Rymax ECO product line offers a variety of full synthetic engine oils for gasoline, diesel and hybrid engines. The lubricants comply with the latest API SN Plus RC classification, the ILSAC GF-5 & 6 and ACEA C2 standards. The ECO line consists of low viscous, fuel-saving engine oils with maximum protection against LSPI (Low Speed Pre-Ignition). The ECO range offers a 0W-20 and a 0W-30. Additionally, the highlight of the ECO range is a completely new 0W-16 full synthetic engine oil, particularly suitable for modern hybrid engines.

The goal of Rymax is to introduce a product line that focuses on maximum efficiency for gasoline, diesel and hybrid engines. The low viscosity characteristics of the ECO line result in less resistance in modern combustion and hybrid engines. This leads to more efficiency and less emitted CO^2 per driven kilometer. This is an important feature because as per January 2021 it is mandatory that the average CO^2 emission of all new vehicles is less than 95 gram of CO^2 per kilometer. The strict WLTP regulations prescribe these emission values for amongst others Europe, America, India and China. According to the M111 Fuel Economy Test, the ECO line products reduce fuel consumption with over 3 percent compared to higher viscosity oils.

Moreover, the ECO products are introduced in a new, 95 percent recycled bottle. Also, no paint is used to color the bottle. In addition to the recycled bottle, the cardboard box that holds the 4-liter cans is made out of 70 percent recycled paper, including an FSC-mix certification.

The CEO of Rymax Lubricants, Mr. Herman Peene, comments on the introduction of the ECO line: "We strongly feel that as a company with so much expertise in the lubricants industry, we should have full focus on what we can do to make the world a better place for future generations. The introduction of the Rymax ECO product line is just the beginning. We are ambitious and driven by the deeply rooted motivation to improve every day. In the past we have done so by making excellent lubricants and greases and by being a full-service partner to our network of over 55 distributors worldwide. Today, we look at the environment more than ever before. Therefore, we set goals to reduce our carbon footprint whilst remaining an excellent and conscious partner for our sales partners, also asking them to do their part."

NEVER APART

We will never back down in the face of our customers' technical challenges.

Our commitment to designing high-performing synthetic esters and lubricants with you will never waver.

You are always front and center in all we do.

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NYCO
Solutions ahead

Lubricant World started hosting webinars

The times are changing and as a long-established international printed and digital news platform, Lubricant World has diversified the ways it works. The coronavirus outbreak has forced most of the businesses go online or perform jobs on virtual media, and we also did our best to adapt to this evolving era.

With our motive to contribute to the Turkish lubricants industry as the first and only national publication of the lubricants industry in Turkey, we started hosting webinars with key speakers. We focus on hot topics from the industry and invite experts of the subject.

We hosted our first webinar with Exxonmobil Commercial Lubricants Sales and Field Engineering Team. With the participation of Aydın Güney, Aytaç Duran, Ali Burak Kosif and Ömer Koyuncu, we held the "Lubrication Solutions to Increase Efficiency in Your Business" webinar, moderated by Selcuk Akat. Speakers shared valuable information on the selection and proper use of products.

Our second webinar was on the "Transformation of Lubricants in an Era of Electric Vehicles". Mehmet Bilgin, Özgecan Çakıcı and Derya Kocaoğlu from Total Turkey talked about the place of lubricants in an era of electric vehicles, and shared their special fluid and lubricant solutions for these vehicles.

We will continue hosting webinars, which attracted great interest from not only the lubricants industry but also many other sectors such as automotive, industry, mining, chemicals, logistics and construction. As Lubricant World, we will pioneer the sector with such insightful virtual events in Turkey and we will keep sharing valuable information and contributing to the

development of the Turkish lubricants industry.

The first of the webinar series, which was launched to increase the knowledge of the sector and contribute to its development, was held with ExxonMobil. The webinar titled "Lubrication Solutions to Increase Efficiency in Your Business" was organized on Thursday, May 21, under the sponsorship of Adco.

In the webinar moderated by Selçuk Akat, Aydın Güney from Mobil Oil Türk A.Ş. Commercial Lubricants Sales and Field Engineering Team, discussed the criteria that should be taken into account for selecting the right product. He mentioned the importance of operating conditions and the goals of management since cost should not be taken as the only criterion when making a choice. In his presentation, which explains the effect of product choices on the balance sheet, he emphasized that by choosing the right product the need for annual oil and grease can be reduced, the cost of maintenance-repair, spare parts and consumables can be decreased, and energy consumption can be minimized.

Aytaç Duran emphasized the importance of choosing the right engine oil. He underlined that invisible costs should be handled as well as the visible costs when making a product decision. Stating that the price of oil is only the tip of the iceberg, Duran said there are various other cost items under the tip of the iceberg, such as equipment life, spare parts consumption, oil consumption, maintenance-repair costs, environmental regulations, spare equipment, production loss, unplanned downtimes, inventory costs, difficult initial operation, fuel consumption and safety.

Providing information about storage conditions for hydraulic oils, Ali Burak Kosif stated that proper storage is important in terms of cost, safety and ease of use. Kosif gave information about the performance criteria sought in hydraulic oils, and he emphasized the effect of hydraulic oils on equipment life and performance. In this context, he said that proper storage and handling can bring better profitability.

Ömer Koyuncu, on the other hand, discussed the conditions for the efficient use of greases. He talked about what needs to be done to do more with less grease. Mentioning the advantages that can be gained in the context of safety, efficiency and environment with planned engineering services, Koyuncu explained that they prepare an annual work plan to use the equipment and time in the most efficient way.

The Mobil team answered the questions in the Q&A session at the end of the presentation, and they also gave some examples from Mobil's applications in the field.

"Transformation of lubricants in an era of electric vehicles" webinar, the second of the webinars organized by Lubricant World Magazine, took place on Friday, May 29. Mehmet Bilgin, Özgecan Çakıcı and Derya Kocaoğlu from Total Turkey participated in the webinar as speakers, and it was realized through the YouTube channel under the sponsorship of Adco.

Mehmet Bilgin shared his predictions about how the automotive and lubricants sector will transform both during and after the pandemic and in line with developing technology and evolving demands. Indicating that the next decade will be a transformation decade, Bilgin said that companies will survive according to their ability to keep up with this transformation.

At the beginning of her presentation, Özgecan Çakıcı gave information about the sales of electric vehicles in the world. Çakıcı said that there are companies announcing that they will restrict diesel vehicle production and even stop it completely in the long run. She mentioned that the EV market would expand gradually. Sharing information on Total's product range for electric vehicles, she talked about their lubrication solutions specific to hybrid and electric vehicles and explained the changing lubrication needs.

Derya Kocaoğlu discussed the charging infrastructure for electric vehicles, and said that Europe has the weakest infrastructure in this sense. She stated that the charging market will mostly concentrate in homes and businesses, and she explained the solutions Total offers in this field.

At the end of the presentations and discussions, questions asked by participants on social media were answered at the Q&A session. The speakers tried to answer as many questions as possible. Live broadcast ended after a very comprehensive and useful webinar.

Petrol Ofisi reiterates its place as market leader

Petrol Ofisi maintains its position as the traditional leader in Turkish fuel sector with a market share up to 22.5 percent, as per the new EMRA – Petroleum Market 2019 Sector Report domestic sales volume of license holders. The company has become the leader of the Turkish lubricants market with a share over 27 percent (*). Petrol Ofisi has strengthened its achievements in both sectors with the results of an independent survey with actual consumers that represent Turkey (**). V-Max with Active 3 technology fuels in the fuel market where Petrol Ofisi is the leader, and Maxima CX 5W-30 lubricants in the lubricants market where the company is also the leader, has received the highest number of votes and become the 'Voted Product of the Year' in their respective sectors.

Selim Şiper, CEO of Petrol Ofisi, underlined that Petrol Ofisi is not only the market leader but also the sector leader in the fields of fuels and lubricants. He said: ''We strive to provide the most ideal service and contribute to our country and customers with our unique infrastructure and power. In the lubricants sector, we offer ideal solutions under a single roof to meet almost all needs of our country in terms of lubricants with our unprecedented development center POTEM, production capacity, technology, 16 thousand sales points across the country and vast product range.''

Leader of Turkish fuels and lubricants sector

As per EMRA – Petroleum Market 2019 Sector Report, total domestic sales decreased by 3.85 percent to 26.737.749 tons in 2019 compared to the previous year. According to domestic sales volumes of license holders, Petrol Ofisi maintains its position as the traditional leader of the market with a share of 22.5 percent approximately. Petrol Ofisi achieved the same success in the lubricants and chemicals market in 2019 (*). Increasing its share in this shrinking market, Petrol Ofisi has become the leader of the lubricants and chemicals market for 10 consecutive years according to PETDER data. Moreover, Petrol Ofisi also became the leader of the lubricants market in 2019.

Independent research with actual consumers

Nielsen shared the results of the 'Voted Product of the Year' market research that it conducts in 44 countries for 33 years. In the research which is conducted independently to represent Turkey, assessment of actual consumers that meet special criteria are collected for each category. In the fuels and lubricants category, consumers who own a car and make their own decision regarding fuel preferences, voted for products in terms of appeal, innovation and satisfaction. In the research, Petrol Ofisi, leader of Turkish fuels and lubricants sectors, achieved success in both fields with its innovative products. V/Max with Active–3 technology received the highest number of votes and become the 'Voted Product of the Year' in the fuels category, and Maxima CX 5W-30 in the lubricants category.

Petrol Ofisi Maxima CX 5W–30

Petrol Ofisi Maxima CX 5W-30, developed by Petrol Ofisi Technology Center (POTEM), which is the most developed center of its field not only in Turkey but also the surrounding region, offers innovative solutions for new generation environment-friendly cars with diesel particulate filters. Maxima CX 5W-30, with its special formulation, provides 2 times better engine protection compared to standards and extends the exhaust emission systems' life. The new generation engine oil lowers emissions and provides wear protection up to 10 times. Maxima CX 5W-30 also offers optimization even for large fleets consisting of different brands by providing solutions for several models with a single product.

(*) PETDER 2010-2019 Total Data on Lubricants and Chemicals
(**) Nielsen 2020 Market Research on Turkey's Voted Product of the Year

Mehmet Ünal becomes the new Lubricants General Manager at Shell & Turcas

Mehmet Ünal has been appointed as Lubricants General Manager at Shell & Turcas as of June 1, 2020. Having been a part of the Shell & Turcas family since 2006, Mehmet Ünal took office as Retail Sales Manager for the Istanbul Region at Shell & Turcas until 2010, and was assigned as the Project Leader for sales increase at Shell Ukraine.

Mehmet Ünal took charge as Retail Sales Operations Manager in 2011. He made a contribution to improving operational excellence in retail sales by simplifying business manners with new projects and thus increasing market share as a result of raising customer satisfaction. Following his position as Operations Manager in Turkey, he became the Sales Manager at Shell Bulgaria in 2013 and achieved significant growth and market share increase with a customer-oriented strategy by ensuring reorganization in Bulgaria. Moreover, by contributing to the strategy change in petroleum station markets, he took a key role in the restructuring of and gaining additional profitability at Shell Bulgaria.

Following this achievement, Ünal came back to Turkey in March 2015 and worked as Fleet Solutions Director at Shell & Turcas since then. He followed a customer and growth-oriented strategy in fleet solutions. In addition to ensuring permanent growth under all market conditions, he pioneered in the launch of products that creates value for customers and will make Shell & Turcas distinguish in its sector, such as Shell Fleet Platform, Shell Practical Card, Shell Road Services, etc.

Besides, LNG (Liquefied Natural Gas) Line of Business has been established in Turkey under the leadership of Mehmet Ünal, and Turkey's first LNG station was opened.

Mehmet Ünal graduated from Istanbul Technical University and then received his MBA diploma from Indiana University.


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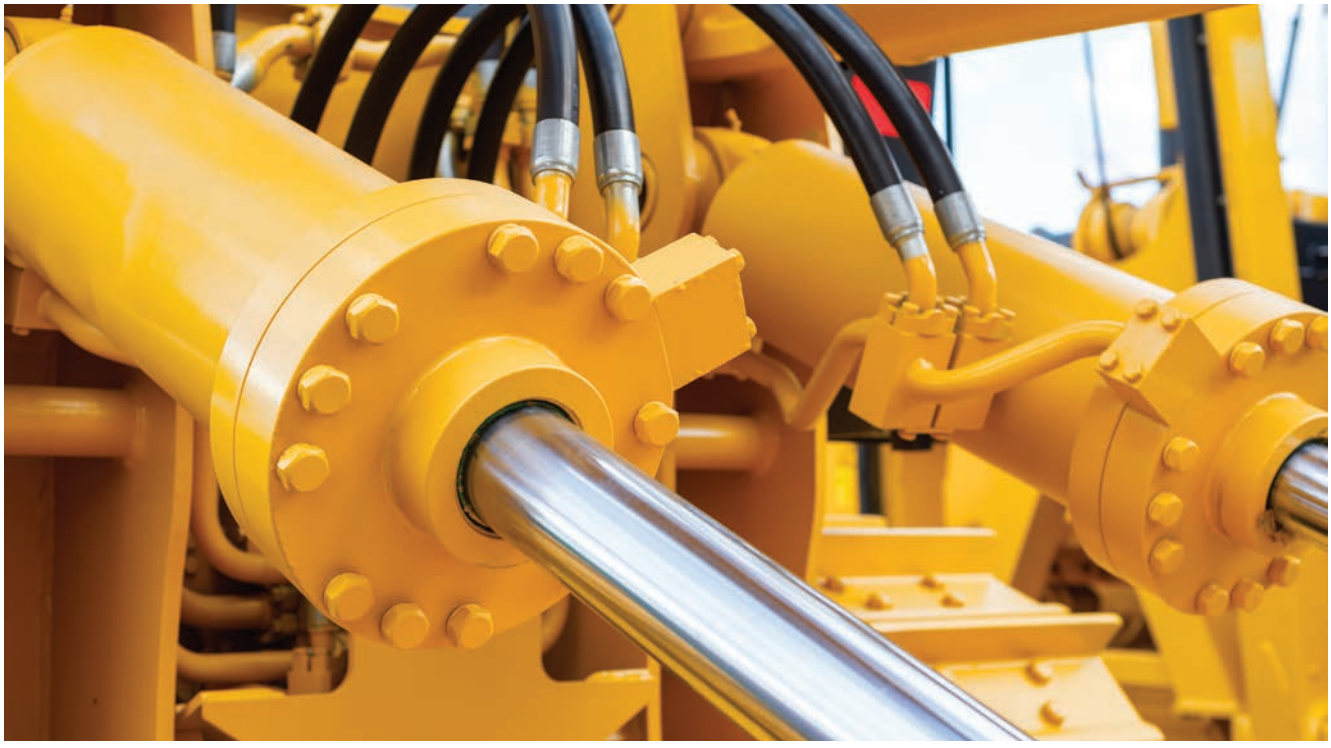

ExxonMobil launches Mobil DTE™ 20 Ultra Series in Turkey

ExxonMobil™ announced the launch of Mobil DTE™ 20 Ultra Series, a technologically advanced series of hydraulic oils, in Turkey. The new series is designed for all types of hydraulic systems and components such as close clearance servo-valves and high accuracy numerically controlled (NC) machine tools. Designed to deliver up to twice longer oil life and exceptional performance under the harshest conditions, the new series help industries achieve unprecedented performance goals easily.

The Mobil DTE 20 Ultra Series can lower maintenance frequency, thus minimizing man-machine interaction, which makes the site safer for industrial workers. In addition to this, with twice the oil life, it can reduce hydraulic oil consumption. Mobil DTE 20 Ultra Series also delivers superior wear protection to extend component life, the company said.

"We estimate that around 80 thousand tons of hydraulic oil is consumed in Turkey annually. Under optimum environment and operating conditions, Mobil DTE 20 Ultra Series can decrease this amount by up to 50 percent. Decreasing the oil consumption by 50 percent brings together less waste oil, up to 50 percent less contact with machine, increased worker safety and lower oil costs, said Münci Bilgiç, General Manager of Mobil Oil Türk A.Ş.

He adds: "When used efficiently and for a long period of time, lubricants can play a key role in terms of sustainability, from carbondioxide emissions to waste reduction. Besides, they can lower the costs of businesses to a great extent and increase workers safety. When it is taken into consideration that hydraulic oils constitute 40 percent of industrial applications, new Mobil DTE 20 Ultra Series gains more importance."

REXOIL®

LUBRICANTS & GREASES

REXOIL DIAMOND PRO FE 5W/30

Is full synthetic engine oil for new generation engines which is developed with high performance additives and synthetic base oils. It is made with a proprietary blend of leading edge components formulated to be fully compatible with the latest Diesel Particulate Filters (DPF's) and Gasoline Catalytic Converters (CAT's). Helps to reduce particulate build up in Diesel Particulate Filters and reduce deposits and sludge build-up to enable long and clean engine life.

Product selection for food industry lubricants

The use of lubricants in the food processing industry constitutes a hygiene risk, and food contamination may have serious consequences, as illustrated by instances of expensive product recalls.

In addition, in some areas of food processing, high temperature conditions may be found. For instance, lubricants may be exposed to temperatures of up to 300°C in the bakery industry, which represents a technical challenge for proper lubrication of the equipment as well as for fire safety.

The National Sanitary Foundation (NSF) registers food grade lubricants and components, using the H1 (acceptable product as a lubricant with incidental food

contact for use in and around food processing areas) and HX-1 (acceptable ingredient for use in H1 lubricants) categories.

NYCO's NSF registered synthetic products provide food safety as well as outstanding technical performance. They are also Kosher and Halal certified.

Synthetic neopolyol esters

NYCO's synthetic neoplyol esters provide excellent performance features in terms of lubrication, cleanliness, behavior in ultra-high or ultra-low temperature environment, and fire safety. The use of such products results in reduced maintenance costs and downtime.

NYCO's food grade synthetic product line offers HX-1 certified base fluids covering a wide range of viscosities and applications, and may be used in hydraulic oils, gear oils, compressor oils, chain oils and greases. NYCO also offers an ISO VG 220, H1 certified fully formulated high temperature chain oil for the food industry.

Advantages and benefits

Excellent lubricity	>	**Added protection against friction and wear**
Excellent low temperature behavior	>	**Performance in food freezing applications**
Resistance to high temperatures	>	**Increased lifetimes and improved cleanliness** **Reduce fire outbreaks**
Low volatility	>	**Better protection against wear and heat**
High polarity	>	**Better and quicker water/oil and oil/air separation**

Metalworking fluid emulsion stability and base oil properties

Prof. Thomas Norrby
Nynas AB, Naphthenics TechDMS
Dr. Pär Wedin
Nynas AB, Naphthenics Research
Ms. Linda Malm
Nynas AB, Naphthenics TechDMS

Emulsion stability is key to metalworking fluid usefulness. Nynas conducted an emulsion stability study comparing the properties of naphthenic and paraffinic type base oils. The study indicates that the naphthenic base oil emulsions display the highest stability.

Introduction

Metalworking fluids (MWF) are used to aid the process of metal machining, mainly by providing lubrication of the workpiece and tool, by providing cooling and corrosion protection. Many different MWF formulations are needed for the vastly differing needs under varying operating conditions! In metal cutting, the metalworking fluid flow has another very important task, which is breaking and flushing away the chips and swarf as these forms. That explains the prevalence of low viscosity fluids for cutting operations.

Metalworking fluids can be generally categorized as being either emulsions ("coolants"), which mainly cool and protect against corrosion, or neat oils, which can handle better high deformation, severe boundary lubrication and offer improved tool wear protection.

The make-up of a typical metalworking fluid emulsion is a dilution (hence not a "neat" oil!) of 5 to 10 volume-% mineral oil concentrate in water. This water could be tap water, with whatever water hardness the local source offers, of demineralised (Demin) or Reverse Osmosis (RO) water, which is very soft. The mineral oils content is high, typically 60-70 percent of the concentrate, and the

remainder being oil soluble additives: Emulsifiers, Lubricity additives, Corrosion inhibitors, Biocides, Antifoams and Mist suppressants. Applications for emulsions include use as cutting fluids, corrosion protecting fluids and hot rolling fluids. Emulsions are suitable for high-speed cutting operations where much heat is generated.

Naphthenic base oils provide several advantages to MWF formulations. High solvency allows for the dissolution of high amounts of additives, and contributes to increased emulsion stability. In addition, a lower density difference between naphthenic oil and water compared to paraffinic oils also provides increased emulsion stability, as gravity has less of a density difference to pull on. This also increases emulsion resistance to centrifugal forces during pumping.

Emulsion stability is key to metalworking fluid (MWF) usefulness- if the emulsion breaks, it has ceased to function. Investigations of the relationship between formulation and emulsion stability thus is a first step towards better understanding of the complex chemistry of a fully formulated MWF. Test variables in the study were base oil type selection, water hardness and emulsifier chemistry and Hydrophile-Lipophile Balance (HLB) value selection. We sought to understand how the properties of the base oils, especially solvency (as indicated by the Aniline Point), and the water hardness (°dH) would influence emulsion stability over test period up to one week. A second investigation was made utilizing a semi-synthetic formulation giving translucent micro-emulsions with the same base oil slate.

Experimental work

Metalworking fluid emulsions

A metalworking fluid (MWF) Soluble Oil (Conventional Oil) emulsion stability study was set up, comparing the properties of a Naphthenic base oil, versus three paraffinic type base oils of similar viscosity, ca. 20 cSt (100 SUS) at 40 °C, see Figure 1. NYNAS® T 22 is a good example of the quintessential "100/100" metalworking fluid oil, having a viscosity of 100 SUS at 100 °F. As Group I oils we picked a traditional SN 100 oil, and the NYBASE® 100, which belongs to a new range (NR) of Group I replacement products. These have been designed to have Kinematic Viscosity (KV), Viscosity Index (VI) and Aniline Point (AP) closely matching those of existing Solvent Neutral Group I base oils. The properties of these new products are described in a previous publication [1] and more information is available on www.nynas.com.

The solvency, as indicated by the Aniline Point (AP), varies across the base oils studies:

1. Naphthenic NYNAS® T 22 (~100 SUS), AP = 76 °C
2. SN 100, AP = 100 °C
3. NYBASE® 100, AP = 101 °C
4. HP4, a Group II base oil, 20 cSt @ 40 (4 cSt @ 100 °C), AP = 108 °C

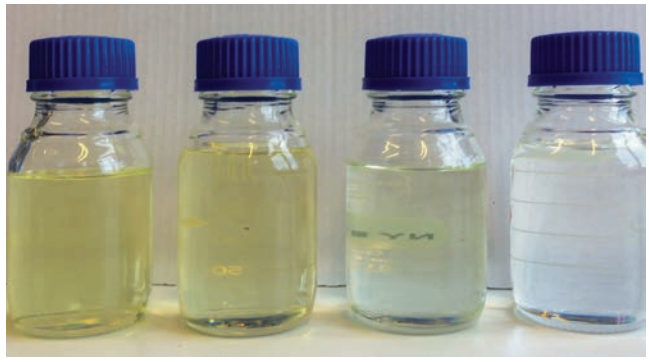

Figure 1. *From left: NYNAS® T 22, SN 100, NYBASE® 100 and HP4.*

Standard emulsifiers (surfactants), Span 80 (Sorbitan monooleate), with a Hydrophile-Lipophile Balance (HLB) number of HLB 4.3 and Tween 80 (Polyethylene glycol sorbitan monooleate), HLB 15, were utilized to make nine different blends with HLB:s ranging from 9 to 13, in half-steps. Butyldiglycol was employed as solubiliser (co-emulsifier, coupling agent).

All emulsion concentrates were of the same oil content, with surfactants to make up the required HLB value. The concentrate was added to the water at ca. 5 v/v-%, and sonicated at low power for three minutes.

Droplet size distribution experiments

The Soluble oil (milky) emulsion droplet size distribution (DSD) was determined at three different times; at mixing, after one day, and again after seven days. The droplet size was measured at high dilution by a Malvern Mastersizer 3000 E.

The droplet size distribution varies over two orders of magnitude, from very small (1 µm or less) to close to 100 µm, see Figure 2. The smaller the droplet size, the more stable the emulsion.

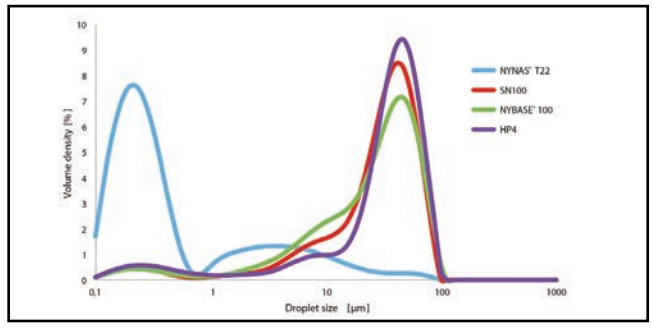

Figure 2. *Droplet Size Distribution at HLB 12, soft water (0 °dH).*

In Figure 3, the droplet size distribution statistical mean value is plotted versus HLB. These graphs typically will show an "U"-shaped minimum where the emulsion droplet size is the smallest, and hence at which HLB the most stable emulsions are formed. Similar plots were obtained for the Group I, NYBASE® new range Group I replacement, and Group II formulations.

An increase in mean droplet size over time is observed: Day 0 (Blue bar), Day 1 (Red bar) and Day 7 (Green bar) in general show increasing value with time (larger droplet size). Since a gradual increase of droplet size would be the earliest warning sign and the first steps towards coalescence and emulsion break-up, this is very interesting information.

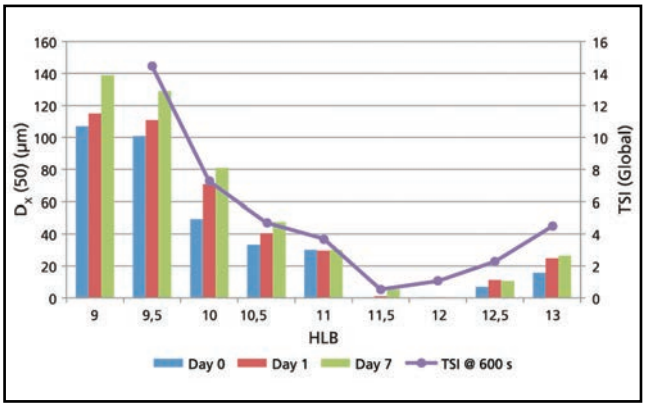

Figure 3. *DSD development over 7 days versus TSI (10 minutes) for a NYNAS® T 22 based milky emulsion, soft water (0 °dH).*

For the more paraffinic oils the optimum HLB was close to 10, but the value of the minimum droplet size was in no case below 10 µm, more than 20 times larger than for the naphthenic NYNAS® T 22 oil. One example is shown in Figure 4.

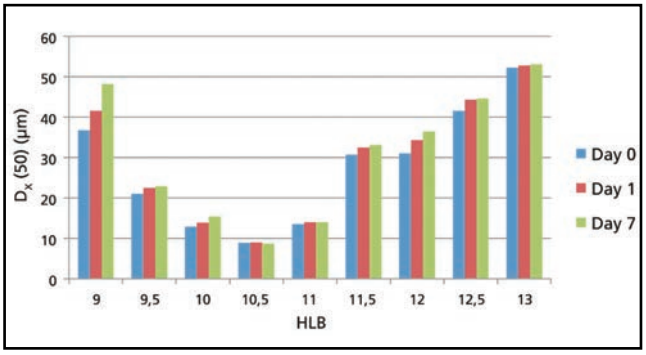

Figure 4. *Emulsion based on NYBASE® 100 in soft water (0 °dH) displaying a minimum droplet size at HLB 10.5.*

Emulsion phase thickness and stability determination

The emulsion phase thickness was determined by light scattering determination at different time intervals utilizing a Turbiscan LAB, measurements at actual concentration "as-is". The Turbiscan Stability Index (TSI) was utilized to characterise emulsion stability. The TSI development during the first ten minutes after sonication is shown for nine samples with HLB from 9.5 to 13. The most stable properties for the NYNAS® T 22 based emulsion were found around HLB 12, similar to what the droplet side distribution (DSD) experiment indicated. A good correlation was found between the DSD established, and the TSI calculated from the emulsion phase thickness measurements utilising the Turbiscan instrument, for those oil and emulsifier combinations that gave good (small) droplet sizes. In Figure 3, the "U-shape" of the DSD is mirrored by the TSI values (the thin purple line).

Semi-synthetic translucent micro emulsions

As a second phase of the study, we made semi-synthetic translucent micro emulsions of the same four base oils. The emulsion concentrate contained 36% water, 30 % base oil, and a range of additives (34% in all): Tall Oil Fatty Acid (TOFA) as the main emulsifier, a non-ionic Fatty alcohol alkoxylate as co-emulsifier, aminic bases, steel and yellow metal corrosions inhibitors, coupling agents and a biocide. The concentrate was added to the water at ca. 5 v/v-%, and sonicated at low power for three minutes.

The resulting semi-synthetic micro emulsion droplet size distribution (DSD), Figure 5, showed some interesting differences versus the milky Soluble oil emulsion, Figure 2. All four oils, in hard or soft water, display droplet sizes below 10 µm. For the T 22 in soft water (both on Day 0 and Day 7), most of the droplet sizes are below 1 µm (the absorption peak below 1 µm). In contrast, in hard water, T 22 displays two peaks, at 0.3 µm and one about 1.3 µm. The SN 100 in hard water displays a broad peak around 0.5 µm (both Day 0 and Day 7). In soft water, the peak is shifted up towards 0.8 µm and is narrower in shape. The Group II oil (HP 4) display narrow peaks centred around 1 µm in both hard and soft water. The NYBASE® 100 at Day 7 displays broader peaks centred around 1.2 µm, in

hard water, a broad peak (0.5 µm to 5 µm) above 1.1 µm, possibly obscuring a bi-phasic behaviour, which is not baseline separated. In contrast, in soft water the peak at 1.2 µm is (somewhat) more narrow.

An attempt to summarize the above results would be that T 22 in soft water yields the most stable emulsion with the smallest mean DSD. For hard water, the result spread is larger, and both SN 100 and T 22 display notable peak maximum shifts, but in opposite directions of change with water hardness.

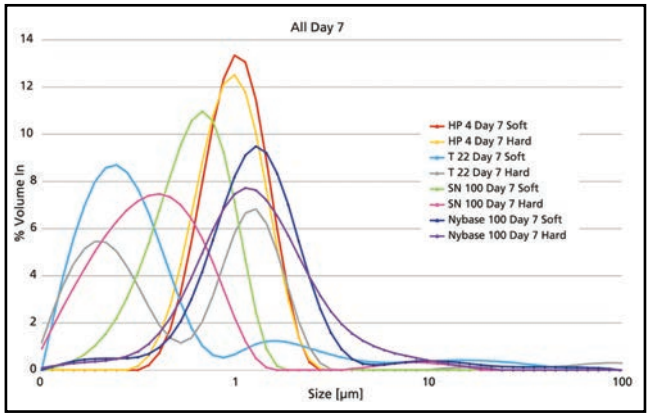

Figure 5. *The Semi-Synthetic formulation, droplet size after 7 days under hard (20 °dH) and soft (0 °dH) water conditions,*

Results and discussion

In this study, we set out to investigate different parameters affecting the primary emulsion stability of model metalworking fluids. We could determine the optimal HLB value for the different base oils, and could also observe large differences in emulsion stability. The primary contribution to stability, as demonstrated by a low (1 µm or less) mean droplet size, was found to be solvency; the lower the aniline point, the more stable the emulsion formed in the Soluble oil coarse (milky) emulsion system based on non-ionic emulsifiers. The Naphthenic base oil emulsions display the highest stability, followed by the Group I and Group I replacement base oils, then Group II. The solvency, as indicated by the aniline point (AP), mirrors this order, and thus apparently plays an important role for emulsion stability in the systems investigated.

The second part of the study was made on semi-synthetic formulations, based on anionic and non-ionic surfactants. For these samples, the droplet size in general was much smaller, indicating an even higher emulsion stability. The semi-synthetic formulation did display a greater sensitivity towards water hardness, as expected from the anionic surfactant chemistry. The extent and character of this effect was different for the different base oils. The clear bi-phasic nature of the T 22 based translucent micro emulsion in hard water, warrants closer study. Also, the peak area around 10 µm would be expected to grow at longer observation times, and would be interesting to follow. Possibly this is a similar bi-phasic behaviour, but shifter up towards much larger droplet size? However, the general stability trend follows what we found for the milky emulsions: Naphthenic > Group I > Group II.

Conclusions

Two complementary methods for the determination of droplet size were utilised to study emulsion stability: droplet size distribution (DSD), and light scattering and transmission. The two methods yield comparable results, especially for small droplet sizes (''good'' emulsion quality).

We could determine a preferred HLB value for each base oil type, where the optimum conditions for emulsion stability were found. This HLB value was found to be about two (2) units higher for the naphthenic base oil compared to the paraffinic Group I and II base oils, and would serve as a rule of thumb recommendation. The droplet size and stability nevertheless was found to be better for the naphthenic base oil systems, showing an inherent difference under these varying conditions.

The key base oil property difference identified was solvency, as expressed by the aniline point. The water hardness played little role in the non-ionic surfactant (emulsifier) systems, but made a difference in several ways in the semi-synthetic emulsion systems, containing also anionic surfactant.

Increasing the fundamental understanding of important oil and emulsion properties hopefully is a useful tool for formulators and developers in different parts of the world, where water hardness differs and the choice of base oils available may be bewildering!

Referanslar: *[1] Norrby, T., Salomonsson, P., and Malm, L. ''Group I Replacement Fluids – a Hydraulic Fluid Formulation and Compatibility Study'', Tribologie + Schmierungstechnik, Cilt 64, No. 1 (2017), sf. 31-41.*

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Lubricants and biodiversity

Soil and water pollution caused as a result of production, transportation and consumption of lubricants throughout their life cycle and dispersion, leakage and spillage of lubricants in waste oil management have been a threat against the biodiversity of our planet. Most of the lubricants do not degrade in nature due to their hydrocarbon composition and they continue to exist in the ecosystem by affecting the species. Therefore it is of significant importance to use "Biodegradable Lubricants" particularly in the forest, national parks and natural protected areas and to prevent direct interaction between all lubricants and natural life.

Physical, chemical and biological impacts of lubricants are against human health and the sustainability of species on our planet. Releasing lubricants into the nature is regarded as a danger and threat against human health as per environmental toxicity. In ecotoxicity, the ecological danger of lubricants is analyzed in terms of biodiversity. Lubricants affect the earth and water ecosystems when they interact with soil and/or water, and they harm the biodiversity. That's why the "Ecotoxicological Effects" of lubricants and waste lubricants are highly important. It is essential for lubricant producers and waste oil processors (re-refiners) to track "Ecotoxicity Values". Biodegradability and ecotoxicity of lubricants must be analyzed in coordination, and ecotoxicological effects must be minimized or completely prevented. At this point, we should envisage an otter covered by lubricant spilled in the sea and think about the problem of inclusion of lubricants into our food chain.

According to the general view, 1 million species out of 13 million plants, animals and microorganisms on our planet are going extinct. Biodiversity, which makes our lives incomparably pleasant and functional, is in danger. Water and earth ecosystems must be recovered, renewed and protected. Degradation harms the welfare of 3.2 billion people. This year, the importance of biodiversity was highlighted with the motto "Our solutions are in nature" on May 22, International Day for Biological Diversity. Besides, the theme for June 5, World Environment Day is selected as biodiversity to make 2020 a year of opportunity and solution for biodiversity with the relevant organs of the United Nations (UN). UN General Assembly identified the period from 2021 to 2030 as the "UN Decade on Ecosystem Restoration" and took steps that suit the necessities of water supply, food security, climate crisis and restoration of destroyed and degraded ecosystems for biodiversity. Due to the pandemic, widespread impact has been achieved on the issues of regaining our nature and stopping the biodiversity loss with a digital campaign from May 25 to June 5, 2020 using "ForNature" hashtag. We keep going. We need to raise our voices and take action to "keep the ecotoxicological effects of lubricants from our nature, ForNature".

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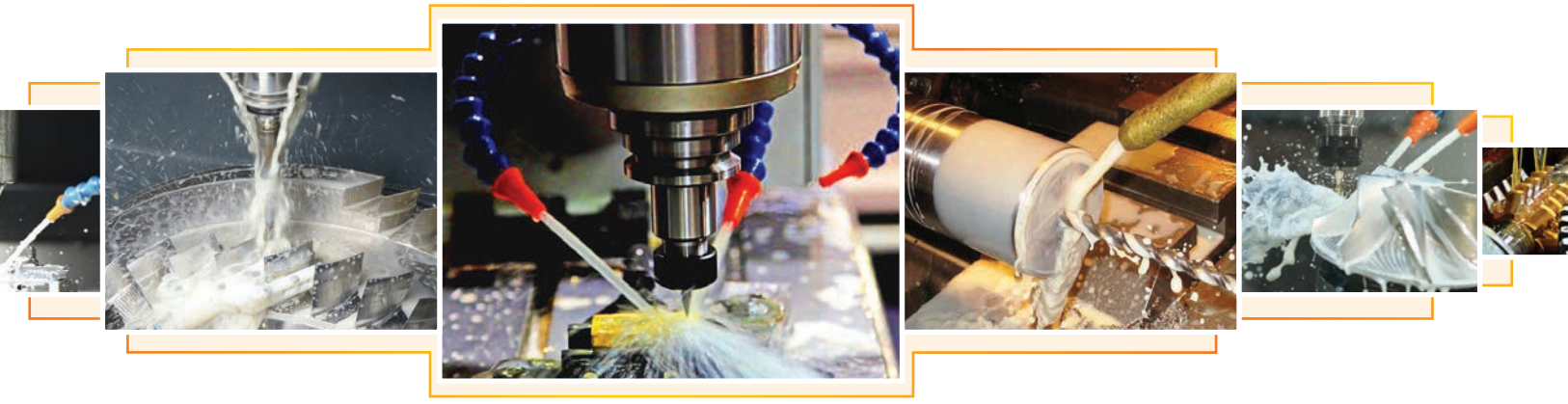

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Engine oil
user guide

VISCOSITY GRADE: is the main feature of an engine oil and is important for product selection

Signification of grades

xx W- yy

xx refers to viscosity when cold

(measured at different temperatures)

The lower the viscosity when cold, the more fluid the oil is at low temperatures and the more easily it can be pumped.

For example, a 0W-20 or 5W-30 oil will make start-ups easier and will protect engines during trips to cold regions. These high technology "fluid" oils will meet the requirements of recent engines.

yy refers to viscosity when hot

(measured at 100 °C)

The higher the viscosity when hot, the more viscous the oil is.

For example, a 15W-40 or 20W-50 oil has been developed for use in hot countries, and their "viscous" nature makes them suitable for older engines.

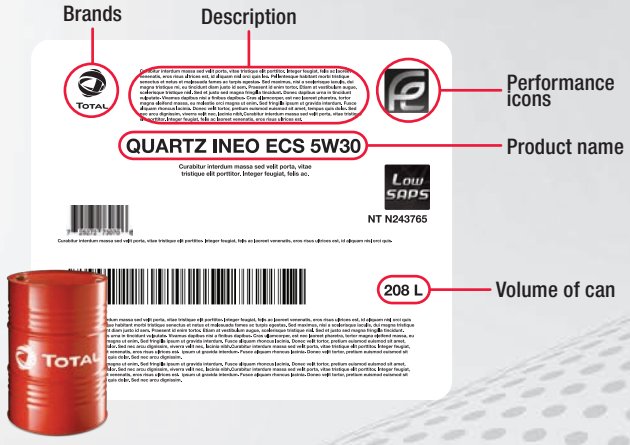
POINTS TO REMEMBER

New-generation engine oils and those currently being developed by TOTAL are of increasingly fluid grades: 0W-20, 5W-20, 0W-30 and 0W-16.

How to read a product label for product selection?

Small packaging:

Large packaging:



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