Bioversal®

in association with nature

Introductive Info on Bioversal®'s Products & Applications

FIRE ECO HAZARD PREVENTION CONTROL SUPPRESSION

For further information or if you have any questions please do not hesitate to contact us:

Bioversal®
in association with nature
Advanced Bio-Technology Applications

Ioannis Athanasiou
BSc. Msc. Eng. MBA
Director Global Business Development
Sales & Marketing

BIOVERSAL International Gesellschaft m.b.H.
Georg-Sigl-Straße 16
2384 Breitenfurt bei Wien
Österreich / Austria
Office Vienna: +43 (0)2239 4278 0
Mobil: +43 (0)699 171 42099
Fax: +43 (0)2239 4278 18
ioannis.athanasiou@bioversal.com
www.bioversal.com

Bioversal®
in association with nature
Advanced Bio-Technology Applications

Franz Kitzwoegerer
Managing partner

BIOVERSAL International Gesellschaft m.b.H.
Georg-Sigl-Strasse 16
2384 Breitenfurt / Vienna / Austria
Phone: +43 / (0)2239 / 4278-0
Mob: +43 / (0)699 / 144 01 144
Fax: +43 / (0)2239 / 4278-18
franz.kitzwoegerer@bioversal.com
www.bioversal.com

FIRE ECO HAZARD PREVENTION CONTROL SUPPRESSION

The use of oil products is unavoidable in modern society. We are very aware, however, of the potential damage to nature. Bioversal® prevents such damage by harnessing nature. In an environmentally friendly process that combats oil pollution faster and safer than ever before.

Bioversal® contains biodegradable and eco-compatible surfactants optimized by the unique BIO-ACTIVATOR, which catalyzes and accelerates the natural self defense and regeneration mechanisms of the Ecosystem. Bioversal® protects, supports and enhances autochthone bacteria in their natural process of microbiological degradation of toxic hydrocarbon complexes during and after Ecological Hazards. The natural residual products CO_2 and H_2O ultimately remain as the end product of the degradation process. The multifunctional Biotechnology products of Bioversal® redefine the term Biodegradability. Not only that our products are environmentally friendly and surpass demanding international environmental regulations, but the application of our products transforms toxic Hydrocarbons C_n, PAH, BTEX into a feasible and accelerated Biodegradation Job, making NATURE YOUR ALLY.

Bioversal®
in association with nature
Advanced Bio-Technology Applications

Water-based oil-cleaning agents

Environmentally-friendly composition / Accelerated biodegradability / Safe and effective

Success through simplicity

The micro-organisms around us take care of the biological degradation that is an integral part of the processes of life. Often single celled, these "primitive" life forms survive under very extreme and complicated conditions. And they occur on every square millimeter of the earth's surface. Simplicity leads to success, even in complicated situations.

Our revolutionary oil-cleaning agents are based on the success story of these microscopically tiny creatures, very simple as far as cell structure is concerned. Bioversal® products use the micro-organisms present on the scene to accelerate the biodegradation of oilpollution. So the basic concept behind Bioversal® is simple, but it's the sophisticated biochemical process involved that makes our cleaning agents extremely effective.

Revolutionary

The brandname Bioversal®, is the designation for a series of high-quality oil-cleaning agents. These agents represent a total revolution in solving the cleaning problems related to oil products. The way they work is based on an approach that touches the core of the pollution problem. The first stage consists in splitting up the pollution into minuscule oil particles and isolating them from the environment by means of encapsulation. This minimizes the negative effects on the environment. In the second stage, the bioactivator present in Bioversal® stimulates the micro-organisms to a fierce attack on and intensive biodegradation of the pollution.

Bioversal®, in short, is pointing the way to a new approach to cleaning up pollution worldwide.

Ingenious

The blueprint for the direct and elegant Bioversal® solution is readily available in nature, from which we withdraw respectfully after the work has been done.

Bioversal® contains natural components that are also highly biodegradable. At the conclusion of the cleaning process all that's left are two harmless final products: H_2O (water) and CO_2. No nutrients for bacteria are left behind either. This means that no excessive growth of micro-organisms (overfertilization) will occur afterwards.

One Product with multiple positive effects and functions

Unique of its kind and functional mechanisms, Bioversal® today offers Innovative and Advanced Biotechnology High Performance Products delivering unmatched results in the field of Fire Extinguishing, Soil-, Water- Bioremediation and Cleaning of Hydro Carbon Complexes.

Extinguishes fire, prevents explosions, encapsulates toxic hydrocarbons, prevents evaporation of volatile hydrocarbons, cleans, degreases, descales, lowers toxicity, accelerates biodegradation on water & soil, disperses hydrocarbons, eliminates slipping, eliminates water surface tension, inhibits corrosion/wetting agent characteristics, prevents hydrocarbons adhesion on surfaces and has ph-neutral characteristics.

QF – High performance fire extinguishing agent

RC – High performance road cleaning

HC – Oilspill antipollution agent

MANTEQ – Industrial cleaning

Bioversal®
in association with nature
Advanced Bio-Technology Applications

Bioversal® is also the designation for a series of high-quality oil-cleaning agents. All these products are composed of environmentally safe biochemical ingredients and accelerate the biodegradation of pollution with the assistance of the microorganisms that occur everywhere in nature. It is exactly because of this environmentally-friendly approach that the cleaning process is so highly effective.

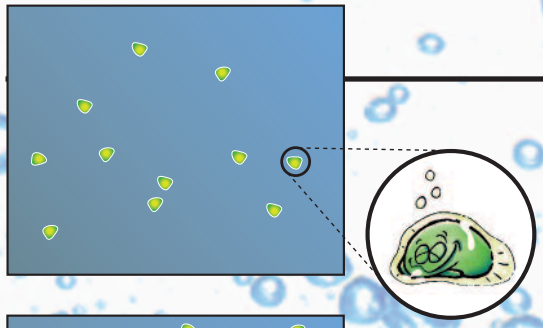
Bioversal International Gesellschaft m.b.H.
Georg-Sigl-Strasse 16
2384 Breitenfurt bei Wien, Austria
Tel: +43 (0)2239 4278 0
Fax: +43 (0)2239 4278 18
info@bioversal.com www.bioversal.com

FIRE ECO HAZARD PREVENTION CONTROL SUPPRESSION

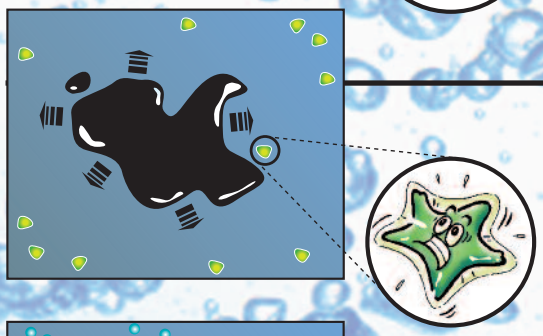
IMPACT BIOVERSAL® PRODUCTS

Petroleum Hydrocarbons are among the most frequent contaminants in soil and ground water because of their widespread use. Although most of the components of mineral oil products can be considered to be readily biodegradable, their natural degradation rates are frequently reduced considerably as a result of the limited natural resources, especially of nutrients and oxygen. Optimizing the environmental conditions within the framework of Enhanced Natural Attenuation (ENA) can significantly increase the performance of pollutant degradation in soil and ground water. Pollutant mobilization has a key role as part of the ENA process. It should be noted in this context that only those surfactants which are themselves completely biodegradable and biocompatible with the existing bacteria should be used. Bioversal® products are surfactants of natural origin. Their biochemical structure is largely related to natural biosurfactants, hence making them especially suitable.

Bioversal®
in association with nature
Advanced Bio-Technology Applications

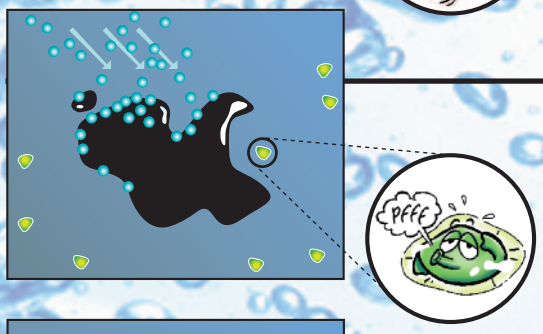


Intact ecosystem A functioning and intact ecosystem with fauna and flora also includes micro-organisms in a stable interrelationship with their environment. They fulfil an important function for sustaining the ecological equilibrium.

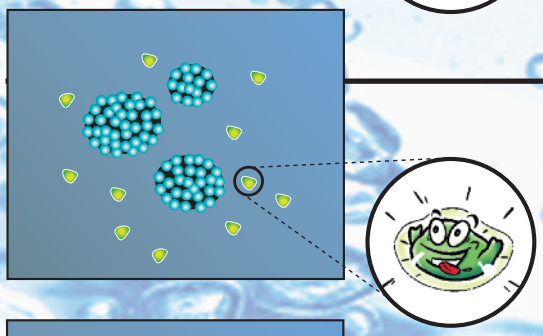


Oil pollution disturbs the structure Oil, grease and other organic pollutants have a massively negative effect on the ecological equilibrium in water and soil structures.

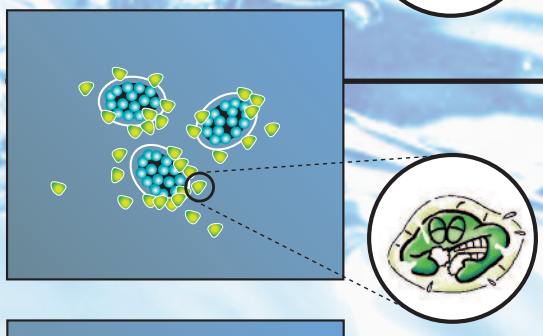
Natural regeneration takes time Natural regeneration takes place without using Bioversal® products, but it takes much longer and ecological damage can not be avoided.



Use for decontamination Bioversal® technology accelerates biological regeneration by enlarging the oil surface. The simultaneous encapsulation of the oil particles inhibits the characteristic adhesive power of the oil to accumulate on solid surfaces. Bioversal® transforms oil surfaces in microscopic stable micelles rising bioavailability by creating a larger working surface.

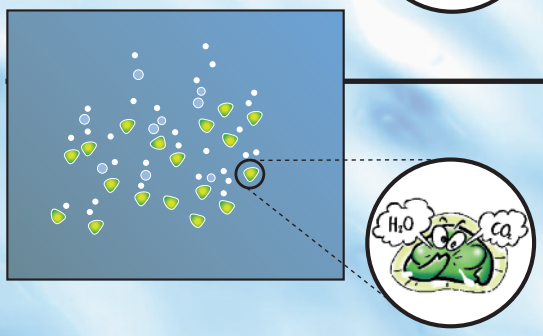


Biological breakdown begins Bioversal® products contain vegetable active substances and a natural BioActivator creating best possible living conditions for micro-organisms. Bioversal® stimulates and catalyzes indigenous micro-organism activity, essential mechanism of the Biodegradation process.



Biodegradation takes place Accelerated Biodegradation is now made possible. Enlarged Pollutant Surface and an increasing population growth of a biodiversity of autochthon micro-organisms appear simultaneously to guarantee enhanced micro-organisms' metabolism.

Accelerated Biodegradation of pollutants The natural process of regeneration of the polluted area is speeded up and ecological equilibrium is restored more rapidly.



The ecosystem is restored! Bioversal®'s Advanced Biotechnology helps to restore the natural self-defense mechanisms and brings an endangered ecosystem back to balance. Whenever Oil pollution has to be removed efficiently, Bioversal® is the ecocompatible solution assuring your vision of a ecosustainable development.

Bioversal® makes NATURE YOUR ALLY!

Bioversal®
in association with nature
Advanced Bio-Technology Applications

Bioversal® is also the designation for a series of high-quality oil-cleaning agents. All these products are composed of environmentally safe biochemical ingredients and accelerate the biodegradation of pollution with the assistance of the microorganisms that occur everywhere in nature. It is exactly because of this environmentally-friendly approach that the cleaning process is so highly effective.

Bioversal International Gesellschaft m.b.H.
Georg-Sigl-Strasse 16
2384 Breitenfurt bei Wien, Austria
Tel: +43 (0)2239 4278 0
Fax: +43 (0)2239 4278 18
info@bioversal.com www.bioversal.com

FIRE ECO HAZARD PREVENTION CONTROL SUPPRESSION

QF

Bioversal® QF is an internationally certified fire-extinguishing agent with unmatched performance in fighting class A, B, F and 3D fires. Due to its encapsulation mechanism Bioversal® QF rapidly cools down the combustible, inhibits the formation of explosive vapors and smoke. Bioversal® QF is therefore save for users and environment.

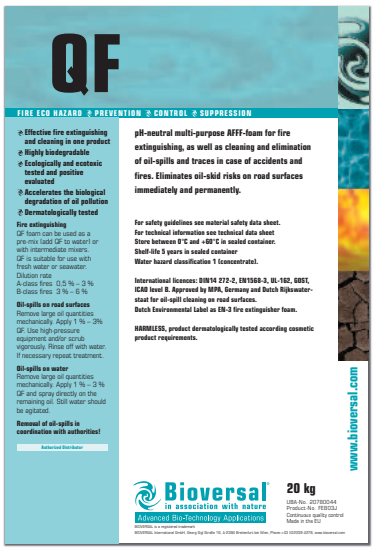
A good extinguishing foam, of course, has to be effective in fighting A, B and F class fires. It also has to prevent re-ignition, must not corrode any materials and it should be skin-friendly. Where such requirements are concerned, Bioversal® QF can match any conventional extinguishing foam.

But when it comes to respond to demanding environmental regulations, QF surpasses all agents of its type. Conventional extinguishing foams are based on environmentally unfriendly and often persistent compounds. On use in open-air environments, they have damaging effects and disrupt the water balance and biological cleansing processes. Bioversal® QF, on the other hand, is non-toxic, rapidly and fully biodegradable. But even more important is that the Bioactivator in QF catalyzes and accelerates biodegradation of oil residues. Bioversal® QF extinguishes and cleans up. It gives back grip to road surfaces and prevents skid risk. This is why Bioversal® QF is outstandingly suited for cleaning oil or other hydrocarbon pollution that has spilled on floors and roads.

Bioversal® QF mitigates the risk of fire or explosion hazard and contributes to enhance fire men safety during missions.

pH-neutral multi-purpose heavy-middle expansion foam for fire extinguishing, as well as cleaning and elimination of oil-spills and traces in case of accidents and fires. Eliminates oil-skid risks on road surfaces immediately and permanently. 0,5–2 % Wetting Agent, 3%–6% AFFF.

Bioversal®
in association with nature
Advanced Bio-Technology Applications



- **Effective fire extinguishing and cleaning without water hazard**
- **Highly biodegradable**
- **Accelerates biological degradation of hydrocarbons**
- **Dermatologically tested**
- **Not corrosion comburant**

pH-neutral multi-purpose foam for fire extinguishing, as well as cleaning and elimination of oil-spills and traces in case of accidents and fires. Eliminates oil-skid risks on road surfaces immediately and permanently.

Fire extinguishing
QF foam can be used as a pre-mix (add QF to water) or with intermediate mixers. QF is suitable for use with fresh water or seawater.
Dilution rate A-class fires 0.5%–3%
B-class fires 3%–6%

Oil-spills on road surfaces
Remove large oil quantities mechanically
Apply 1%–3% QF. Use high-pressure equipment and/or scrub vigorously. Rinse off with water. If necessary repeat treatment.

Oil-spills on water
Remove large oil quantities mechanically.
Apply 1% – 3% QF and spray directly on the remaining oil. Still water should be agitated.
Removal of oil-spills in coordination with authorities!

For safety guidelines see material safety data sheet. For technical information see technical data sheet.

Store between 0°C and +60°C in sealed container. Shelf-life 5 years in sealed container.
Water hazard classification 1 (concentrate).

International licences
DIN14 272-2, EN1568-3, UL-162, GOST, ICAO level B.
Approved by MPA/Germany and Dutch Rijkswaterstaat for oil-spill cleaning on road surfaces. Dutch Environmental Label as EN-3 fire extinguisher foam.

UBA-No. 20780044
Product-No. FE 802
Continuous quality control
Made in the EU

Bioversal® contains biodegradable and eco-compatible surfactants optimized by the unique BIO-ACTIVATOR, which catalyzes and accelerates the natural self defense and regeneration mechanisms of the Ecosystem. Bioversal® protects, supports and enhances autochthone bacteria in their natural process of microbiological degradation of toxic hydrocarbon complexes during and after Ecological Hazards. The natural residual products CO_2 and H_2O ultimately remain as the end product of the degradation process. Bioversal®'s multifunctional Biotechnology products redefine the term Biodegradability. Not only that our products are environmentally friendly and surpass demanding international enviromental regulations, but the application of our products transforms toxic Hydrocarbons C_n, PAH, BTEX into a feasible and accelerated Biodegradation Job, making NATURE YOUR ALLY.

Bioversal®
in association with nature
Advanced Bio-Technology Applications

Bioversal® is also the designation for a series of high-quality oil-cleaning agents. All these products are composed of environmentally safe biochemical ingredients and accelerate the biodegradation of pollution with the assistance of the microorganisms that occur everywhere in nature. It is exactly because of this environmentally-friendly approach that the cleaning process is so highly effective.

Bioversal International Gesellschaft m.b.H.
Georg-Sigl-Strasse 16
2384 Breitenfurt bei Wien, Austria
Tel: +43 (0)2239 4278 0
Fax: +43 (0)2239 4278 18
info@bioversal.com www.bioversal.com

FIRE ECO HAZARD **PREVENTION CONTROL SUPPRESSION**

RC

Bioversal® RC is an environmentally-friendly cleaning agent for the removal of oil residues from road and water surfaces. In use on roads, it eliminates skid risk without any damage to the road surface. It is also suitable for the removal of oil spills on inland waterways and in reducing fire and explosion hazard.

The Bioactivator in the agent sees to the accelerated biodegradation of oil residues. Where other oil-fighting products have damaging effects when used in unspoiled nature, Bioversal® RC can be applied without any danger to the environment. It is rapidly and fully biodegradable and poses no threat to water.

Bioversal® RC has been especially designed to de-oil, de-grease solid surfaces in the field of inrastructure and construction. It can be used for oilspill clean up on asphalt, concrete or any ohter surfaces. Its eco-safe composition of high-performance eco-detergents assures immediate encapoulation of oil and gives back the original grip to the treated surface. Oil-Water seperation of collected wastiwaters can be easily treated with standard equipment.

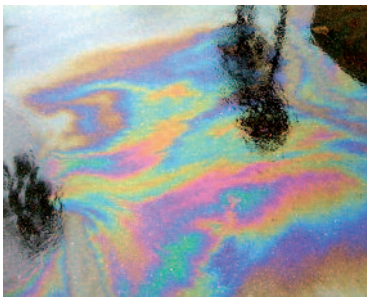
Bioversal® RC is safe for user equipment and nature.

Special, pH-neutral product for ecological cleaning and elimination of oil-spills and residues on road and water surfaces. Eliminates oil-skid risks on road surfaces immediately and permanently.
1–4 % dilution rate

Bioversal®
in association with nature
Advanced Bio-Technology Applications

- **Effective oil-spill cleaning without water hazard**
- **Highly biodegradable**
- **Accelerates biological degradation of hydrocarbons**
- **Dermatologically tested**

Special, pH-neutral product for ecological cleaning and elimination of oil-spills and residues on road and water surfaces. Eliminates oil-skid risks on road surfaces immediately and permanently.



Oil-spills on road surfaces
Remove large oil quantities mechanically. Apply 1%–4% RC. Use high-pressure equipment and/or scrub vigorously. Rinse off with water. If necessary repeat treatment.

Oil-spills on water
Remove large oil quantities mechanically. Apply 1%–4% RC and spray directly on the remaining oil. Still water should be agitated.

Removal of oil-spills in coordination with authorities!
For safety guidelines see material safety data sheet. For technical information see technical data sheet.

Store between +0°C and +50°C in sealed container. Shelf-life > 5 years in sealed container. Water hazard classification 1 (concentrate).

International licences
Approved by MPA, Germany and Dutch Rijkswaterstaat for oil-spill cleaning on road surfaces.

UBA-No. 20780011
Product-No. FE702
Continuous quality control
Made in the EU

Bioversal® contains biodegradable and eco-compatible surfactants optimized by the unique BIO-ACTIVATOR, which catalyzes and accelerates the natural self defense and regeneration mechanisms of the Ecosystem. Bioversal® protects, supports and enhances autochthone bacteria in their natural process of microbiological degradation of toxic hydrocarbon complexes during and after Ecological Hazards. The natural residual products CO_2 and H_2O ultimately remain as the end product of the degradation process. Bioversal®'s multifunctional Biotechnology products redefine the term Biodegradability. Not only that our products are environmentally friendly and surpass demanding international enviromental regulations, but the application of our products transforms toxic Hydrocarbons C_n, PAH, BTEX into a feasible and accelerated Biodegradation Job, making NATURE YOUR ALLY.

Bioversal®
in association with nature
Advanced Bio-Technology Applications

Bioversal® is also the designation for a series of high-quality oil-cleaning agents. All these products are composed of environmentally safe biochemical ingredients and accelerate the biodegradation of pollution with the assistance of the microorganisms that occur everywhere in nature. It is exactly because of this environmentally-friendly approach that the cleaning process is so highly effective.

Bioversal International Gesellschaft m.b.H.
Georg-Sigl-Strasse 16
2384 Breitenfurt bei Wien, Austria
Tel: +43 (0)2239 4278 0
Fax: +43 (0)2239 4278 18
info@bioversal.com www.bioversal.com

FIRE ECO HAZARD

PREVENTION CONTROL SUPPRESSION

HC / HC SOILTEQ / HC AQUATEC

HC is a special Bioversal® oil-cleaning agent for cleaning oil polluted soil used for environmental engeneering methods in-situ & ex-situ.
Thanks the adding SOILTEQ, the biodegradation of hydrocarbons, fats, PCBs and PAHs is greatly accelerated, making cleaning faster and cheaper. Thanks the use of SOILTEQ, already existing cleaning systems can be greatly improved and the processes involved speeded up. This results in shorter cleaning times and improved efficiency in current cleaning methods.
SOILTEQ oil-cleaning agents are derived from the unique basic product HC, hence fully retaining their environmentally-friendly characteristics. That means that the application of SOILTEQ does not additionally polute the soil matrix to be bioremedeated.
SOILTEQ is designed for soilwashing techniques where cleaning performance and eco-toxicological bio-compatibility find the right balance. Waste water can be easily treated with Bioversal®'s mobile/permanent TWIN REACTOR SYSTEM.
AQUATEQ has been developed for use in microbiological waste-water treatment plants, bioreactors and microbiological purification systems. They accelerate the biodegradation of oil products, considerably increasing the capabilities of these systems.
AQUATEQ immediately encapsulates the contaminants, making them far less toxic to micro-organisms. AQUATEQ transforms toxic hydrocarbons C4–C40, BTEX, PAH in to a feasible and accelerated job for microbiology, reestablishing natural balance in water treatment plants.
AQUATEQ has an impressively high rate of biodegradability (in line with OECD 301) and the biodegradation process requires relatively little oxygen (COD=133 g/liter).
AQUATEQ does contain a bioactivator, catalyzing and speeding up the biodegradation of oil products. This pHneutral product is non-toxic and it has a German water hazard classification of 1.

pH-neutral oil-cleaning agent for immediate ecological defence, cleaning and elimination of large scale oil-spills at sea, on lakes, rivers, shores and beaches. Suitable for operations using special equipment.

Bioversal®
in association with nature
Advanced Bio-Technology Applications

- **Highly effective oil-spill cleaning without water hazard**
- **Highly biodegradable**
- **Accelerates biological degradation of hydrocarbons**
- **Dermatologically tested**

pH-neutral oil-cleaning agent for immediate ecological defence, cleaning and elimination of large scale oil-spills at sea, on lakes, rivers, shores and beaches. Suitable for operations using special equipment.

Oil-spills at sea, on lakes and rivers
Remove large oil quantities mechanically. Dilute HC with water and spray directly on the remaining oil. Still water shoud be agitated. HC is suitable for special equipment and can be used with fresh water or seawater.

Oil-spills on shores and beaches
Remove large oil quantities mechanically. Dilute HC with water and apply. Treat the pollution area vigorously using high-pressure equipment and/or manually.
The dilution rates of HC to water vary from
crude oil 1 : 50 to 1 : 100
refined oil 1 : 200 to 1 : 300

For safety guidelines see material safety data sheet. For technical information see technical data sheet.

Store between +0°C and +50°C in sealed container. Shelf-life > 5 years in sealed container. Water hazard classification 1 (concentrate).

International licences
Approved by MPA, Germany and Dutch Rijkswaterstaat for oil-spill cleaning on road surfaces.

Removal of oil-spills in coordination with authorities!

UBA-No. 20780046
Product-No. FE102
Continuous quality control
Made in the EU

Name	pH-value 10 g/l	Dilution range	Product description
HC	app. 7	0.5%–6%	pH-neutral oil-cleaning agent for immediate ecological defence, cleaning and ellimination of large scale oil-spills at sea, on lakes, rivers, shores and beaches. Suitable for operations using special equipment.
HC AQUATEQ	app. 7	0.5%–10%	pH-neutral product to enhance and accelerate the biological degradation of oil. For use in biological water treatment plants, bioreactors etc.
HC SOILTEQ	app. 7	2%–10%	pH-neutral product for decontamination of hydrocarbon polluted soil and heavily hydrocarbon polluted soil e.g. PCBs, PAHs etc. Suitable for soil washing equipment (biophysical extraction methods). Suitable for in-situ and on-site methods.

Bioversal® in association with nature
Advanced Bio-Technology Applications

Bioversal® is also the designation for a series of high-quality oil-cleaning agents. All these products are composed of environmentally safe biochemical ingredients and accelerate the biodegradation of pollution with the assistance of the microorganisms that occur everywhere in nature. It is exactly because of this environmentally-friendly approach that the cleaning process is so highly effective.

Bioversal International Gesellschaft m.b.H.
Georg-Sigl-Strasse 16
2384 Breitenfurt bei Wien, Austria
Tel: +43 (0)2239 4278 0
Fax: +43 (0)2239 4278 18
info@bioversal.com www.bioversal.com

FIRE ECO HAZARD PREVENTION CONTROL SUPPRESSION

MANTEQ

Water-based Bioversal® oil-cleaning agents are the new standard for cleaning in the industrial and cleaning-service sectors. These revolutionary agents sharply accelerate the biodegradation of pollution. This unique characteristic makes them powerfully effective, safe and environmentally friendly. The products themselves are also highly biodegradable, surpassing the highest OECD standard (OECD 301). Following completion of the biodegradation process, only CO_2 and water are left behind. This means that Bioversal® oil-cleaning agents are not harmful to the natural environment. Thanks to their environmentally-friendly composition, they can be discharged without problems into a biological water-treatment plant. They will even accelerate biodegradation there.

MANTEQ has been specially developed for various manual cleaning operations in the industrial and professional-cleaning sectors. MANTEQ is water-based and non-flammable, non-toxic, non-irritating and non-corrosive. It releases no harmful vapors in use.

MANTEQ has been approved in dermatological testing and meets the highest occupational health and safety standards of any government. This ensures maximum industrial safety for users.

The standard MANTEQ product is a powerful, pH-neutral cleaner, suitable for all materials and surfaces. Its unique characteristics make MANTEQ an outstanding solution for cleaning tasks in the open air, where the burden on the environment must be as low as possible. Special MANTEQ variants are available for more specific problems, such as the removal of rust, scale and other stubborn contaminants. All MANTEQ oil-cleaning agents are derived from the unique basic product, thus fully retaining their environmentally-friendly characteristics. All MANTEQ variants are listed in the table overleaf. The qualities of MANTEQ show off to best advantage with use of Bioversal®'s (mobile) TWIN REACTOR SYSTEM for cleaning waste water destined for recycling or discharge.

Product family designed to respond to highest technical and environmental requirements in the field of industrial cleaning. Basic, neutral and acidic pH assure unmatched results for deoiling, degreasing, descaling. Compatible with any high-pressure equipment at any range of pressure, at any temperature.

Bioversal®
in association with nature
Advanced Bio-Technology Applications

- **Highly effective oil-spill cleaning without water hazard**
- **Highly biodegradable**
- **Accelerates biological degradation of hydrocarbons**
- **Dermatologically tested**

Oil cleaning agent for high performance industrial cleaning. Water-based agents for de-oiling and degreasing.

Composition
Aqueous combination of detergents, polyvalent compounds and hetero-organic substances.

Instructions
Dilute MANTEQ with water and apply by using brush, scrubber, cloth, sponge etc. Ensure sufficient agitation. Rinse thoroughly with water.

For safety guidelines see material safety data sheet. For technical information see technical data sheet.
Store between +0°C and +50°C in sealed container. Shelf-life > 5 years in sealed container.
Water hazard classification 1 (concentrate).

UBA-Nr.: 20780016
Product-No. MA112
Continuous quality control
Made in the EU

Name	pH-value 10 g/l	Application	Product description All Manteq products are suitable for manual use
MANTEQ PERFORMANCE	ca. 7	ready2use	pH-Basic, very powerful water-based ready to use Premix-product for cleaning, de-oiling, degreasing and dewaxing of any surface or material.
MANTEQ DYNAMICS	ca. 7.5	1%–5%	pH-Basic Water-based product for intensive cleaning, de-oiling and de-greasing of metallic surfaces and solid materials.
MANTEQ EXTRA	ca. 8.5	1%–5%	Slightly basic pH, MANTEQ with temporary corrosion protection for cleaning, de-oiling and de-greasing. For use on oxidizing metallic surfaces and materials.
MANTEQ FORCE	ca. 12	1%–5%	Strongly Basic pH, Enhanced MANTEQ with temporary corrosion protection for cleaning, de-oiling and degreasing. Specially for strongly adhering contaminants on oxidizing metallic* surfaces or materials.* *do not apply on Al, Mg, Zn, Sn, Pb and alloys of these materials.
MANTEQ SPECIAL	ca. 7	1%–4%	pH-neutral, water-based product for ecological cleaning and elimination of oil spills and oil residues on road surfaces. MANTEQ SPECIAL can be used manual or with (high-)pressure equipment.
MANTEQ SUPER	ca. 7	1%–5%	pH-neutral, water-based product for de-oiling, degreasing and cleaning adhering contaminants from various surfaces or materials.
MANTEQ ULTRA	ca. 11	1%–5%	Powerful water-based product for de-oiling, degreasing and cleaning strongly adhering contaminants from various surfaces or materials.* *do not apply on Al, Mg, Zn, Sn, Pb and alloys of these materials.
MANTEQ TOP	ca. 3	1%–5%	Acidic water-based product for cleaning, de-oiling, degreasing and decalcifying various surfaces or materials.
MANTEQ FIT	ca. 2	1%–4%	Powerful acidic, water-based product for intensive decalcifying, de-rusting and de-oiling of various surfaces or materials.

Bioversal®
in association with nature
Advanced Bio-Technology Applications

Bioversal® is also the designation for a series of high-quality oil-cleaning agents. All these products are composed of environmentally safe biochemical ingredients and accelerate the biodegradation of pollution with the assistance of the microorganisms that occur everywhere in nature. It is exactly because of this environmentally-friendly approach that the cleaning process is so highly effective.

Bioversal International Gesellschaft m.b.H.
Georg-Sigl-Strasse 16
2384 Breitenfurt bei Wien, Austria
Tel: +43 (0)2239 4278 0
Fax: +43 (0)2239 4278 18
info@bioversal.com www.bioversal.com

FIRE ECO HAZARD PREVENTION CONTROL SUPPRESSION

TWIN REACTOR MBR300A

Biological Water Treatment System

Environmentally-friendly composition / Accelerated biodegradability / Safe and effective

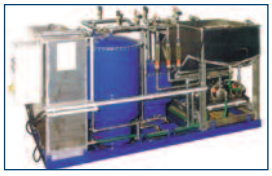
The Bioversal® TWIN REACTOR is an ultracompact, process-integrated system that achieves the extremely high biodegradation of oil pollution in process-water. The very short start-up stage and adaptation time make this system operational quickly and easily, and extremely reliable at the same time.

The unique operating mechanism in the related Bioversal® oil-cleaning products is the decisive factor in this breakthrough in the area of cleaning waste water and process water. It results in completely new possibilities and uses in the biological cleaning of process water polluted with contaminants such as oil, fats, motor fuels, PAHs and PCBs.

This system can be supplied as a fully tailormade solution and with a flow rate of 0.3 m^3 to 20 m^3 per hour. The self-contained and compact construction means the system takes up little room. It can be delivered in mobile or permanently-positioned variants.

The absolute precondition for optimal efficiency from the Bioversal® TWIN REACTOR is use of Bioversal® oil-cleaning agents in the cleaning process beforehand. It is only in this way that the unique operating mechanism in these products enables the Bioversal® TWIN REACTOR to realize the results listed overleaf.

Bioversal®
in association with nature
Advanced Bio-Technology Applications



The virtues of Bioversal® show up to best advantage through deployment of the mobile TWIN REACTOR SYSTEM that we use to clean waste water for recycling or discharge.

Load values

Flow rate	1.000 l/hr
Pollution percentage	1.000 mg/l (water)
Output value	< 20 mg/l (water)
Biodegradation	> 98%

Incoming water requirements

Oxygen content	> 3 mg/l
pH value	5.5–8
Temperature	15–38°C
Dimensions (LxWxH)	300 x 140 x 200 cm

Water-based Bioversal® oil-cleaning agents are the new standard for cleaning in the industrial and cleaning-service sectors. These revolutionary agents sharply accelerate the biodegradation of pollution. This unique characteristic makes them powerfully effective, safe and environmentally friendly.
The products themselves are also highly biodegradable, surpassing the highest OECD standard (OECD 301). Following completion of the biodegradation process, only CO_2 and water are left behind. This means that Bioversal® oil-cleaning agents are not harmful to the natural environment. Thanks to their environmentally-friendly composition, they can be discharged without problems into a biological watertreatment plant. They will even speed up biodegradation there.

Bioversal® contains biodegradable and eco-compatible surfactants optimized by the unique BIO-ACTIVATOR, which catalyzes and accelerates the natural self defense and regeneration mechanisms of the Ecosystem. Bioversal® protects, supports and enhances autochthone bacteria in their natural process of microbiological degradation of toxic hydrocarbon complexes during and after Ecological Hazards. The natural residual products CO_2 and H_2O ultimately remain as the end product of the degradation process. Bioversal®'s multifunctional Biotechnology products redefine the term Biodegradability. Not only that our products are environmentally friendly and surpass demanding international enviromental regulations, but the application of our products transforms toxic Hydrocarbons C_n, PAH, BTEX into a feasible and accelerated Biodegradation Job, making NATURE YOUR ALLY.

Bioversal®
in association with nature
Advanced Bio-Technology Applications

Bioversal® is also the designation for a series of high-quality oil-cleaning agents. All these products are composed of environmentally safe biochemical ingredients and accelerate the biodegradation of pollution with the assistance of the microorganisms that occur everywhere in nature. It is exactly because of this environmentally-friendly approach that the cleaning process is so highly effective.

Bioversal International Gesellschaft m.b.H.
Georg-Sigl-Strasse 16
2384 Breitenfurt bei Wien, Austria
Tel: +43 (0)2239 4278 0
Fax: +43 (0)2239 4278 18
info@bioversal.com www.bioversal.com

FIRE ECO HAZARD PREVENTION CONTROL SUPPRESSION

Bioversal® Product Overview

Fire & Eco-Hazard Protection

Bioversal®'s Advanced Biotechnology Products and applications are designed to respond to the highest standards of fire & explosion, eco hazard prevention, control and suppression problematics. Internationally certified and recognized as high performance solutions with integrated bioremediation effectiveness capabilities. For more information, technical specifications & and assistance please contact info@bioversal.com or www.bioversal.com

Bioversal®
in association with nature
Advanced Bio-Technology Applications

Bioversal® Fire & eco-hazard protection products

Article	Size of container	Density	pH-Value conc.	pH-Value 10 g/l	Dilution range	Combating oil-spills on roadsurfaces roadsides	Oil-pollution on sea, lakes, rivers, shores and beaches	Oil-pollution on land and inland-waterways
QF	20 / 210 / 1000 kg	1.02 g/ml	app. 7,5	app. 7	0.5%–6%	YES	YES	YES
pH-neutral multipurpose heavy-middle expansion foam for fire extinguishing, as well as cleaning and elimination of oil-spills and traces in case of accidents and fires. Eliminates oil-skid risks on road surfaces immediately and permanently, 0.5–2 % Wetting Agent, 3%–6% AFFF.								
QF-LF	20 / 210 / 1000 kg	1.02 g/ml			3%	NO*	NO*	NO*
pH-neutral multi-purpose high expansion foam for fire extinguishing, as well as cleaning and elimination of oil-spills and traces in case of accidents and fires. Eliminates oil-skid risks on surfaces immediately and permanently.								
QF-R	20 / 210 / 1000 kg	1.02 g/ml			6%	YES	YES	YES
pH-neutral multi-purpose heavy-middle expansion foam for fire extinguishing systems, which use ready to use Premixes in storage tanks. Product inhibits bad odour due to fouling in fire extinguishers.								
QF-D	20 / 210 / 1000 kg	1.02 g/ml			3%–6%	YES	YES	YES
Fire extinguishing + volatile organic compound mitigation + bad odour elimination, designed for communal and hazardous waste disposal site, pH-neutral multi-purpose agent for fire protection + bad odour inhibition.								
QF AF–20°	20 / 210 / 1000 kg	1.02 g/ml	app. 7		ready2use	NO*	NO*	NO*
pH-neutral; QF based ready to fill fire extinguishing agent for fire extinguisher and static fire extinguishing systems. Application spectrum A/B/F class fires. Environmentally friendly with cleaning and bioremediation effectiveness capabilities.								
QF MX	20 / 210 / 1000 kg	1.02 g/ml	app. 6.5		33 %	NO*	NO*	NO*
pH-neutral; QF based fire extinguishing agent for fire extinguisher and static fire extinguishing systems. Application spectrum A/B/F class fires. Environmentally friendly with cleaning and bioremediation effectiveness capabilities.								
RC	20 / 210 / 1000 kg	1.02 g/ml	app. 7	app. 7	1%–4%	YES	YES	YES
Special, pH-neutral product for ecological cleaning and elimination of oil-spills and residues on road and water surfaces. Eliminates oil-skid risks on road surfaces immediately and permanently.								
HC	20 / 210 / 1000 kg	1.02 g/ml	app. 7.5	app. 7	0.5%–4%		Refined oil 0.5%–3% Crude oil 1%–6%	
pH-neutral oil-cleaning agent for immediate ecological defence, cleaning and elimination of large scale oil-spills at sea, on lakes, rivers, shores and beaches. Suitable for operations using special equipment.								
HC SOILTEQ	20 / 210 / 1000 kg	1.02 g/ml	app. 7.5	app. 7	1%–4%			2%–10%
pH-neutral oil-cleaning agent for immediate ecological defence, cleaning and elimination of oil-spills at sea, on lakes, rivers, shores and beaches. Suitable for soil washing, pump & treat etc.								
HC AQUATEQ	20 / 210 / 1000 kg	1.02 g/ml	app. 7.5	app. 7			0.5%–10%	
pH-neutral product to enhance and accelerate the biological degradation of oil. For use in biological water treatment plants, bioreactors etc.								

* Waste-water is sewage plant compatible.

Bioversal® in association with nature
Advanced Bio-Technology Applications

Bioversal® is also the designation for a series of high-quality oil-cleaning agents. All these products are composed of environmentally safe biochemical ingredients and accelerate the biodegradation of pollution with the assistance of the microorganisms that occur everywhere in nature. It is exactly because of this environmentally-friendly approach that the cleaning process is so highly effective.

Bioversal International Gesellschaft m.b.H.
Georg-Sigl-Strasse 16
2384 Breitenfurt bei Wien, Austria
Tel: +43 (0)2239 4278 0
Fax: +43 (0)2239 4278 18
info@bioversal.com www.bioversal.com

FIRE ECO HAZARD PREVENTION CONTROL SUPPRESSION

Bioversal® Product Overview

High-performance industrial & manual cleaning

These products are designed to respond to the highest standards of problem solving of the end-user, operational mode of application can vary from case to case. For more information, technical specifications & and assistance please contact info@bioversal.com or www.bioversal.com

Bioversal®
in association with nature
Advanced Bio-Technology Applications

Bioversal® Manual cleaning products

Article	Size of container	Density	pH–Value conc.	pH–Value 10 g/l	Optimal water temperature	Dilution range high pressure equipments	Dilution range manual cleaning
MANTEQ PERFORMANCE	20 / 210 / 1000 kg	1.02 g/ml	app. 7.5	app. 7	40°C–60°C	ready2use	
pH–basic, very powerful water–based ready to use premix/product for cleaning, de–oiling and degreasing dewaxing of any surface or material. Designed for high surface wetting without pressure andtemperature. deoils, degreases, eliminates graffiti carbonized deposits, bitumen and tyres traces on concrete or metallic surfaces, cleans where other products show no effect.							
MANTEQ DYNAMICS	20 / 210 / 1000 kg	1.05 g/ml	app. 8	app. 7.5	40°C–60°C	1%–3%	3%–5%
ph–basic water–based product for intensive cleaning, de–oiling and degreasing of metallic surfaces and solid materials. Designed for high performance cleaning at all pressure and cold water applications. dilution rates for high pressure.							
MANTEQ EXTRA	20 / 210 / 1000 kg	1.03 g/ml	app. 9	app. 8.5	40°C–60°C	1%–3%	3%–5%
Slightly basic pH, MANTEQ with temporary corrosion protection for cleaning, de–oiling and degreasing. For use on oxidizing metallic surfaces and materials. Designed for high performance Ind. Cleaning at all pressure and temperature range for the O&G Industry.							
MANTEQ FORCE	20 / 210 / 1000 kg	1.04 g/ml	app. 13	app. 12	40°C–60°C	1%–3 %	3%–5%
Strongly basic pH, enhanced MANTEQ with temporary corrosion protection for cleaning, de-oiling and degreasing. Specially for strongly adhering contaminants on oxidizing metallic* surfaces or materials. *Do not apply on Al, Mg, Zn, Sn, Pb and alloys of these materials.							
MANTEQ SPECIAL	20 / 210 / 1000 kg	1.02 g/ml	app. 7	app. 7	40°C–60°C	1%–2 %	2%–4%
pH-neutral, water-based product for ecological cleaning and elimination of oil spills and oil residues on road surfaces. MANTEQ SPECIAL can be used manual or with (high-)pressure equipment.							
MANTEQ SUPER	20 / 210 / 1000 kg	1.02 g/ml	app. 7	app. 7	40°C–60°C	1%–3 %	3%–5%
pH-neutral, water-based product for de-oiling, degreasing and cleaning adhering contaminants from various surfaces or materials. Designed for high performance Ind. Cleaning at all pressure and temperature range for the O&G Industry.							
MANTEQ ULTRA	20 / 210 / 1000 kg	1.03 g/ml	app. 12.5	app. 11	40°C–60°C	1%–3 %	3%–5%
Powerful water-based product for de-oiling, degreasing and cleaning strongly adhering contaminants* from various surfaces or materials. Designed for high performance concrete cleaning at all pressure and temperature range for the construction Industry. *Do not apply on Al, Mg, Zn, Sn, Pb and alloys of these materials.							
MANTEQ TOP	20 / 210 / 1000 kg	1.02 g/ml	app. 2	app. 3	20°C–40°C	1%–3 %	3%–5%
Acidic water-based product for cleaning, de-oiling, degreasing and decalcifying various surfaces or materials. Designed for high performance Ind. Cleaning at all pressure and temperature range for the O&G Industry.							
MANTEQ FIT	20 / 210 / 1000 kg	1.02 g/ml	app. 1	app. 2	20°C–40°C	1%–2 %	2%–4%
Powerful acidic, water-based product for intensive decalcifying, de-rusting and de-oiling of various surfaces or materials. Designed for high performance Ind. Cleaning at all pressure and temperature range for the O&G Industry.							

Bioversal®
in association with nature
Advanced Bio-Technology Applications

Bioversal® is also the designation for a series of high-quality oil-cleaning agents. All these products are composed of environmentally safe biochemical ingredients and accelerate the biodegradation of pollution with the assistance of the microorganisms that occur everywhere in nature. It is exactly because of this environmentally-friendly approach that the cleaning process is so highly effective.

Bioversal International Gesellschaft m.b.H.
Georg-Sigl-Strasse 16
2384 Breitenfurt bei Wien, Austria
Tel: +43 (0)2239 4278 0
Fax: +43 (0)2239 4278 18
info@bioversal.com www.bioversal.com

FIRE ECO HAZARD PREVENTION CONTROL SUPPRESSION

Bioversal® in the International Press

Oil Pollution? Bioversal® the Green Solution!
Source: Offshore Technology International, Edition 10/2010

FIRE EXTINGUISHING AGENTS AND THE ENVIRONMENT: A multifunctional agent
Source: FIRE & RESCUE, Edition: FOURTH QUARTER 2010

SPILL CONTROL: Slick solutions for oil spills
INDUSTRIAL FIRE JOURNAL, Edition: THIRD QUARTER 2010

POLLUTION CONTAINMENT & CLEANUP, Incident impact
Source: FIRE & RESCUE, FIRST QUARTER 2006

FOCUS ON THE ENVIRONMENT: A MULTIPURPOSE CLEANING AGENT
Source: INDUSTRIAL FIRE JOURNAL, Winter 2012

Bioversal®
in association with nature
Advanced Bio-Technology Applications

Oil Pollution? Bioversal, the Green Solution!

Ioannis Athanasiou, BioVersal International GmbH

Bioversal® in association with nature
Advanced Bio-Technology Applications
www.bioversal.com

Oil Spills released in soil, groundwater and natural water resources are a global problem, which mainly occur during routine activities all along the oil production, transport, storage, processing and distribution life cycle chain. Crude oil released in this way represents an environmental issue of great concern because spills threaten animals, plant life and other marine resources. Natural Biodegradation processes occur when micro organisms like bacteria feed on oil.

OIL SPILLS: SOURCES & MAGNITUDE

According to a 2002 report from the National Academy of Sciences, approximately 210 million gal (790 million l) of oil spills into the oceans each year. Sources include the wells from which oil is extracted and the ships used to transport it, as well as natural oil seepage from geologic formations below the seafloor, as for example in Coal Oil Point along the California Coast,where an estimated 2,000–3,000 gal (7,570–11,350 l) of crude oil is released naturally from the ocean floor every day. While accidental tanker and off-shore oil spills receive the most publicity, they only account for approximately 25% of the crude oil released into the oceans each year by human activity with the remainder largely due to routine oil tanker ship maintenance operations such as loading, discharging, and emptying ballast tanks. According to a 2002 study performed by the National Research Council, a total of 29 million gal (110 million l) of petroleum are released into North American ocean waters each year as a result of human activities or carelessness. However, only a small fraction of that environmental pollution is due to pipeline ruptures or oil tanker spills. Approximately 85% of those spills involve land-based runoffs from cars and trucks, fuel dumping by commercial airplane pilots, and emissions from small boats and crafts.

Bioversal HC®: Mode of Action	Effect	Time scale of Action:
As a Mild Bio-Surfactant:		
Emulsifying and Fragmenting Oil Particles Detaching Oil Particles from Surfaces; Making them Available to Bacteria	Cleaning	Short-term (Minutes)
As a Bacterial Growth Enhancer:		
Attracting Oil-Degrading Bacteria; Stimulating Bacterial Growth	Stimulating	Middle-term (Hours)
As a Product of Bioremediation:		
Enhancing Biodegradation of Hydrocarbons in Oil; Autobiodegradation Low Oxygen Depletion	Bioremediation	Long-term (Days to Weeks)

Bioversal's Mode of Action

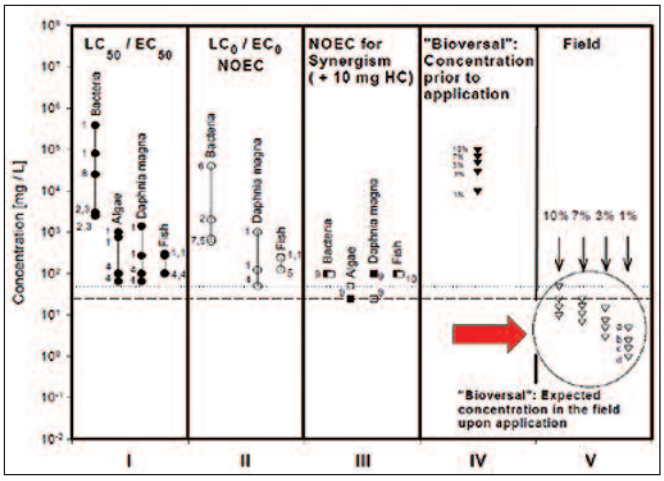
OIL SPILLS: A GLOBAL PROBLEM

The Deepwater Horizon oil Spill in the Gulf of Mexico has only focused our attention to an old problem. Oil spills have occured all over the world. The Cutter Information Corporation tracks oil spills involving at least 10,000 gal (34 tonnes). It reports that spills of that magnitude have occurred in the waters of 112 countries since 1960. Oil spills are also known to happen more often in some parts of the world. Major oil spills from tankers have occurred in the Gulf of Mexico (267 spills); the northeastern United States (140 spills); the Mediterranean Sea (127 spills); the Persian Gulf (108 spills); the North Sea (75 spills); Japan (60 spills); the Baltic Sea (52 spills); the United Kingdom and English Channel (49 spills); Malaysia and Singapore (39 spills); the west coast of France and north and west coasts of Spain (33 spills); and Korea (32 spills).

NATURAL MECHANISMS OF OIL BIODEGRADATION

A diversity of naturally occurring Microorganisms in water and soil have the capacity to transform biologically and degrade spilled Hydrocarbons. This biodegradation process relies mainly on aerobic (oxygen related) mechanisms, where a consortium of bacterias uses oxygen to split and transform hydrocarbons in more harmless byproducts. The end result of such sophisticated biochemical reactions can be CO_2 and Water. Environmental conditions and parameters like temperature, pH, oxygen supply, nutrients (Nitrogen, Phosphate), Bioavailability (solubility of Hydrocarbons in water), toxicity levels in water though control

the biodegradation performance and velocity. During this process a series of Microorganisms produce and release Biosurfactants or Biotensids (Rhamnolipids etc.), detergent like biochemical substances which attack in water non soluble oil to form micelles or emulsions. This process makes oil bio-available to a consortium of bacterias. These microorganisms populate microscopic oil drops encapsulated with biosurfactants in the water column. Using docking mechanisms and via their membrane bacterias use the oxygen available in water to metabolize Hydrocarbons in different consecutive steps to CO_2 and H_2O. Sufficient food encourages cell division and the bacterial population grows to accelerate biodegradation of oil. In polluted water oxygen supply is guaranteed by the dissolved oxygen in the water column.



Ecotoxicity Data for Bioversal HC Solutions Undiluted and Upon Dilution as Applied in the field (Prof. Dr. R. Dallinger 2002) Bioversal has been tested repeatedly for its toxicity and Ecotoxicity. It exhibits a remarkably low Toxicity towards Bacteria, Algae, Invertebrates, Fish and Mammals.

Synthetic surfactants are generally used in oil related facilities like Off-Shore platforms to handle a series of important activities.

- Fire extinguishing AFFF foams
- Cleaning and Emulsifying
- Dispersants for accidental Oil Spill treatment

These synthetic detergents or surfactants though, are not biocompatible with the natural biodegradation process of spilled oil , although some of the new generation products present good biodegradable characteristics. Most of these surfactants once mixed with oil and spilled overboard damage this selected biodiversity of oil eating bacterias with the result to inhibit the biodegradation process. Although these products present high performance in dealing with their specific application problematic they do not possess an integrated environmental approach which includes or considers bioremediation effectiveness mechanisms. They are not Biocompatible.

BIOVERSAL'S ADVANCED BIOTECHNOLOGY APLICATIONS

Bioversal has developed in the last 10 years Advanced High Performance Biosurfactants of vegetal origin which enhance the natural self cleaning potential in polluted sites after application. Biodegradation is rapidly activated and natural degradation of spilled Hydrocarbons in water and soil is dramatically accelerated. These eco-friendly and highly biocompatible products offer high performance applications in the field of Fire and Explosion Protection (Bioversal QF), Water and Soil Treatment (Bioversal HC), Industrial Cleaning (Bioversal MANTEQ) and Bioremediation (Bioversal HC Soilteq & Aquateq) with integrated activation of environmental restoration capacities during and after oil spills.

BIOVERSAL'S BIOCOMPATIBLE SURFACTANTS: WHAT DO THEY CONTAIN?

Bioversal's products differ substantially in their biochemical composition from synthetic petrol derived surfactants. They are composed of mild Surfactants of Biological Origin e.g. from Vegetable Sources with long-chained anionic isooctyl Esters and non-ionogenic alkyl-polyglycosides. Natural Buffer Substances and Natural Bioactivators are functioning as Bacterial Attractants and facilitate the docking process and cell membrane contact of microorganisms on encapsulated oil drops. Selective

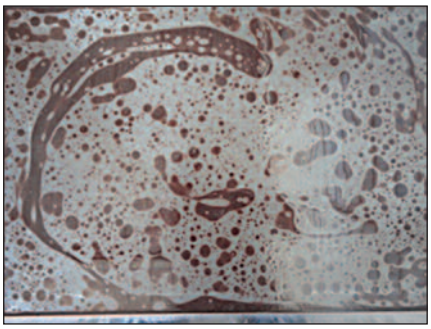
and unique Bacterial Substrates improve the Nitrogen-Carbon ratio (e.g. on a Protein Basis) to assure initial nutrient supply for an enhanced biodegradation process of Oil.

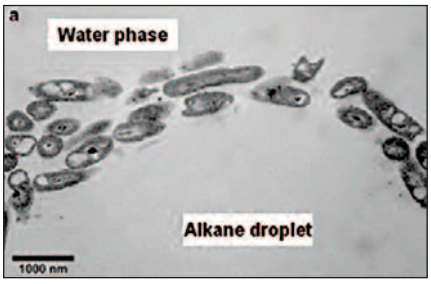
This sophisticated composition of Bioversal products guarantees similar characteristics and mechanisms like naturally produced biosurfactants by oil degrading bacterias. In the same time Bioversal's Biosurfactants are low toxic with 100 times less toxic than conventional synthetic surfactants and highly biodegradable (100% within 4-7 days).

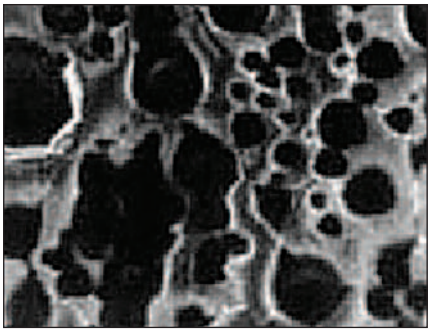
BIOVERSAL'S BIOCOMPATIBLE SURFACTANTS: HOW DO THEY WORK?

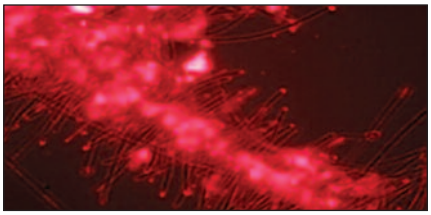
Bioversal's products contain as mentioned above 3 main functional components:

1. mild / weak Surfactants









Attraction of hydrocarbon degrading bacteria on a Bioversal fluorescence-labeled model activator. Bioversal's Bioactivator labeled with Texas Red binds specifically to the glycoside structures of the bacteria and enriches these at the model surface.

2. bacterial substrates on protein basis
3. bioactivator

The mild/weak surfactants guarantee a weak tensidic action to assure sufficient fragmentation and weak emulsification of Oil Particles to make oil available to bacterias. The formation of stable micelles makes oil particles float on the water surface to assure unlimited oxygen supply from the atmosphere, optimum temperatures and light. Emulsification in the water column is held at a minimum in order to avoid oxygen depletion of the water column.

The bacterial substrates deliver enough nitrogen, important constituents for bacterial growth and cell division.

What makes Bioversal unique world wide though is the presence of a Bioactivator of vegetal origin. Its main function is to be a target for Bacterial Cell Wall Receptors, like a sophisticated docking device which attracts bacterias and enhances its adhesion on coated oil particles.

As a result of these combined mechanisms (1,2,3) Bioversal stimulates and enhances bacterial growth on a natural way and accelerates biodegradation of hydrocarbons without having any negative ecological impact making Nature Your Ally.

Contact Information

Ioannis Athanasiou
BSc., MSc. Eng.,MBA
Technical Director, International Business development
Bioversal International GmbH
Georg Sigl Str. 16
A-2384 Breitenfurt bei Wien
+43/69917142099
Ioannis.athanasiou@bioversal.com
www.bioversal.com

A multifunctional agent

There are some products in the market that claim to be both environmentally friendly and effective against class A and class B fires. But how many products are there in the market that can do this, and also clean up after hydrocarbon spills or even stimulate their natural biodegradation process in soil and groundwater? Jose Sanchez de Muniain talks to Ioannis Athanasiou, Technical Director of the Viennese company Bioversal.

Fire brigades in Austria have used Bioversal in practice for cleaning up accidental oil spills in the river Danube (above incident took place in May 2005).

Bioversal QF is what is known as a miscelle encapsulator agent (MEA), a technology that is increasingly being used and recognised by the NFPA as a useful technology worthy of its own classification norm, fulfilling NFPA 18 as well as NFPA 11 requirements.

Conventional AFFF foams primarily work by creating a surface foam blanket that isolates the oxygen from the combustible, knocking down the oxygen parameter from the fire tetrahedron. Ioannis explains that miscelle encapsulator agents work on all four parameters simultaneously. Firstly, they knock down the surface tension: "Normal water tension is 72 mN/m– if you add Bioversal it goes down to 10-15 mN/m." In effect, this enhances the cooling efficiency of water by changing the shape of water droplets on the surface in the same way as traditional wetting agents. The subsequent vapourisation of the water absorbs heat and thereby cools down the fire.

This is in addition to the foaming action of Bioversal QF, which – as with traditional AFFFs – cuts off the oxygen supply from the fuel.

Thirdly, the extinguishing agent encapsulates the fuel and thereby neutralises it so it can no longer burn.

But that is not all. Ioannis adds that the encapsulation process is so strong that it also captures and traps any combustible gas compounds that are released by the burning fuel, preventing any further explosions. The NFPA recognises these aspects as being beneficial in coalbunker fires and explosions.

Bioversal QF's extinguishing capabilities are now proven for both class A and class B fires. Ioannis points out that it is used in Italy, Germany, Austria and Turkey for class A fires – especially wildland fires.

It has also passed EN 1568-3 Level 1A standard (Specification for low expansion foam concentrates for surface application to water-immiscible liquids). Unlike UL 162, this European standard is not pass or fail and 1A is the highest grade. In addition, it has been tested according to UL 168 level – although not by UL, clarifies Ioannis, and the company is intending to enter the US market in 2011 for which this certification will be officially sought. "We have also tested to the French equivalent of LASTFIRE, called GESIP, for refinery fires. Moreover, we have ICAO level B certification as well as GOST for the Russian market."

Extinguishing capabilities aside, Bioversal QF is used by fire brigades in Europe as an effective detergent for cleaning up oil spills. "Here in Austria it is used during road traffic collisions –both for extinguishing the fire as well as to clean up the oil and preventing further accidents as a result of skidding on roads."

Crucially, Bioversal QF has the same bioremediative properties as the company's flagship oil spill clean up product, Bioversal HC. Bioremediation can be defined as any process that uses microorganisms to return the environment altered by contaminants to its original condition. Bioversal QF is highly biodegradable in less than seven days with a low BOD (biological oxygen demand), and due to its bioremediative capacities fire brigades in Austria have used it in practice for cleaning up accidental oil spills in the river Danube.

Indeed, Bioversal is currently in talks with the US Navy for potential tests and applications on aircraft carriers, where not only is there a continuous danger of fire and explosion, but also slipping on mixtures of jet fuel, hydraulic oils and seawater.

Predictably, Bioversal QF scores excellently in toxicity tests. The conventional test for toxicity is LC50 (lethal concentration 50%), where progressively higher amounts of product are applied to different selective species being more or less sensitive to altering degrees of toxicity until 50% of the tested species show mortality effects. These test procedures and requirements though can differ from country to country. In these tests Bioversal QF shows remarkably low toxicity ratios.

Ioannis points out that currently there is much emphasis on the term "biodegradable" in the "green" market, and that this is causing some confusion. "Scientifically speaking, it is not right to assume that a product that is 100% biodegradable is automatically good for the environment. Everything is biodegradable, but what is important too is whether it is biocompatible."

He qualifies biocompatibility as the effect a surfactant of biological or synthetic origin has on the biodegradation process of fuels. "You could have a surfactant that is biodegradable in 30 days – but what if it inhibits or even kills the bacteria that are responsible for the biodegradation of hydrocarbons?"

It is this biocompatibility that makes Bioversal QF a unique product, says Ioannis.

The company is close to achieving EPA approval for use for oil spills in the US: "If we get it then we will be truly unique world-wide and offshore platforms will be happily able to buy our product both to extinguish a fire and also treat an oil spill on the ocean."

Slick solution for oil spills

With at least 250,000 gallons of "anti-freeze-like" synthetic dispersants having been pumped into the Gulf of Mexico to mitigate the Deepwater Horizon catastrophe, and serious concerns raised about the effect of this type of technology on the marine food chain, has the time come to look at alternatives? Jose Maria Sanchez de Muniain speaks with a company that has a multi-purpose, eco-friendly "bio-agent" with bioremediative capacities that turns the slick into marine food.

At the time of going to press the decision had been taken by the US Coast Guard to halt the use of dispersants in deep water because the effects these chemicals were having on deep water marine life were unknown.

One alternative technology that (up to now) hadn't been used in the Gulf of Mexico was Bioversal HC, owned by Bioversal International in Vienna (Austria). Although the company's technology is widely used in Europe, it has not managed to find an opening in the USA because, believes the company, of the strong influence exerted by the competing chemical lobby therein. In contrast to synthetic substances, Bioversal is composed of biochemical ingredients of botanic origin.

Ioannis Athanasiou, Technical Director & International Business Development for Bioversal, spoke exclusively to *IFJ* about how the product works. "Actual dispersant science is a 40-year-old conventional approach based on a trade-off, decision-making process. It accepts eco-toxicological impact when applied in order to avoid spills contaminating natural coasts infrastructures, but this is no longer coherent with state-of-the-art environmental engineering and microbiology scientific knowledge.

"Current requirements and standards of synthetic dispersants follow visions, objectives and tactics that handle oil spills in a very different way to the Bioversal HC approach. Oil spills nowadays are treated like chemotherapy and cancer-cells – killing and weakening the immune-system of nature. Our approach is completely different, we treat and enhance the immune system so that the immune system can cure itself."

What Bioversal HC does is first of all disperse the hydrocarbons on the surface of a spill, and then encapsulates them so that volatile organic compounds (VOC) cannot escape into the atmosphere – the aim is to keep the oil on the surface where oxygen supply is unlimited and light is available – and heat (bacterial biodegradation processes have their maximum performance at 25-30°C). "This way a biodiversity of micro-organisms degrade the oil and take the oxygen required to do so from the air – as opposed to the sea. The end result from the aerobic biodegradation process is carbon dioxide and water, as well as biomass."

Bioversal contains special "biotensides" that don't inhibit bacterial growth due to eco-toxicological interactions, as well as a bio-activator, which stimulates the mechanisms of the whole aerobic biodegradation process. The result is that bacteria experience a population growth spurt, thus naturally accelerating the biodegradation process of the hydrocarbon in a natural way.

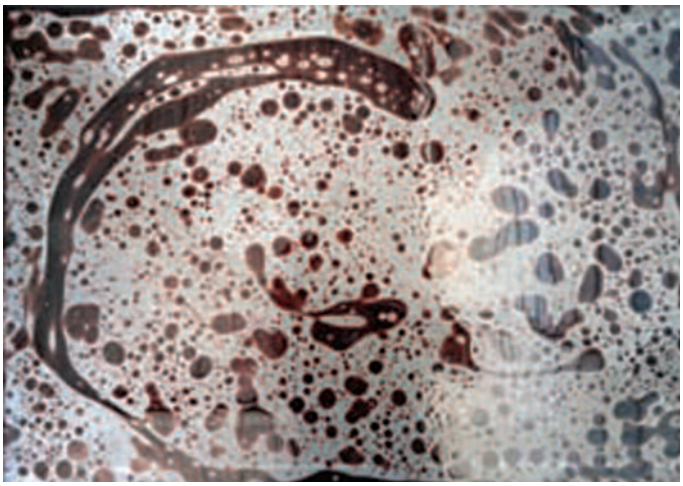
So would Bioversal HC have been the solution for a massive slick like that in the Gulf of Mexico? Athanasiou believes it could have been useful in some crucial applications. "After a few hours oil has a tendency to sink somewhat, so even when you spray synthetic dispersant the effect is small because the oil has to be mixed with the dispersant, typically with high pressure nozzles that create the turbulence to mix it in. We have tested it and if you do not get to the slick before the oil starts sinking, it is not easy.

"Where it can be extremely helpful is in wetting the coast infrastructure because once stones, plants etc are sprayed with Bioversal HC, the oil cannot stick to them while wet. The product is completely non-toxic, and it has been successfully applied to clean the oil-contaminated plumage of birds – even oral administration brings no negative effects whatsoever."

Due to the fact that the product is so revolutionary, no relevant standards exist for it and as a result Bioversal International has had to create its own standard just to be able to classify the product. This was recognised recently by the Legislature of Italy, where biocompatible surfactants (termed "tesioattivi pseudonaturali") have been approved as a separate class of remediative products for applications in marine oil spill remediation within Italian territories.

Speaking at the recent First Adriatic Oil Spill Conference in Opatija, Croatia in May this year, the molecular physiologist and ecotoxicologist Reinhard Dallinger (Institute of Zoology, University of Innsbruck, Austria) spoke about the use of such products during oil spills: "In such critical situations, modern biocompatible surfactants may help to stimulate and enhance the natural process of hydrocarbon biodegradation that is brought about by inherent microbial communities… The use of 'Bioversal' as a modern and novel means to combat mineral oil contaminations

Spill being tackled with Bioversal in County Roscommon, Connacht (Ireland). Bioversal is typically applied to water with high pressure nozzles to ensure a good mix with any oil that has sunk beneath the top surface of the water.



Bioversal HC disperses hydrocarbons on the surface of the spill, then encapsulates them and keeps them on the surface of the water. The end result is carbon dioxide, water, and biomass.

hence appears to be ecologically compatible and expedient."

Josef Buchta, President of the Austrian Fire Service Association, has in the past spoken positively on the use Bioversal HC in Lower Austria during extensive flooding of the river Danube in 2002, where the product was used on a large scale to deal with oil. Similarly, it was used in the municipality of Dürnkrut (Austria) in March/April 2006 following a dam failure resulting in large quantities of oil flowing from ruptured tanks. In that particular incident the product was applied with special 10-litre hand-spraying devices which work with high pressure technology from the firefighting trucks.

Other applications – emergency response

In Austria, Germany, Italy, and Switzerland, municipal fire brigades are using Bioversal HC to neutralise environmental damage that can arise from hydrocarbon (diesel, petrol, biofuel, oil, animal fats) leaks. "After absorbents have been used to clear spillages, fire brigades in these countries are permitted to apply Bioversal on the surface of the ground. The big issue here is that while most of the oil may have been removed with absorbents, some will remain on the ground – and it could be flushed out by rain and even cause a further accident. Once Bioversal HC has been applied, nature takes its course and breaks it down in around 14 days, depending on variables such as temperature."

Interestingly, different variations of the Bioversal product are also used as extinguishing materials without losing the same bioremediative effect as Bioversal HC. Bioversal QF, for example, is EN-1568-3 Level 1A, GOST, ICAO level B (3%) approved for ARFF usage in airports. It has also been successfully tested at TNO Netherlands according to UL-162 requirements (UL Standard for Safety for Foam Equipment and Liquid Concentrates). "Our fire extinguishing agent fulfils environmental requirements that simply don't exist at the moment. As well as having a high performance as a fire extinguishing agent, it cleans up the oil by first encapsulating it and then neutralising it as a combustible. This means that any foam water will also transform into something highly biodegradable."

So is Bioversal a miracle product? Athanasiou doesn't like that term. "No, such miracle products do not exist. This is a scientific product with all the relevant certification. Our aim is to communicate the concept behind the product. So whatever the primary mission is, to clean oil or extinguish fires, or even doing industrial cleaning in refineries, what is important to realise is that once that primary mission is completed, there is no new contamination problem to deal with."

What issues have emerged from the Buncefield depot fire which generated around 30m litres of contaminated runoff? Aidan Turnbull sought the opinions of Gary McDowall, Franz Kitzwögerer and Colin Chiverton about possible fire service solutions.

Pollution containment and cleanup

The major fire at the Buncefield fuel storage site, which burned for three days from the 11th to the 13th December 2005, is known to have produced approximately 30 million litres of contaminated firewater. One of those concerned about the fate of the runoff is Gary McDowall of Foamclean Limited.

"All of this firewater contains fluorosurfactant and many other contaminants, and will require treatment," he says.

Gary's company, Foamclean Limited, provides products and services designed to resolve issues with the disposal of firefighting foam. Using a patented and tested system, Foamclean Limited removes the chemicals from the solution that make a fire fighting foam an effective extinguishing agent. The process employed removes the environmentally damaging fluorosurfactants and other agents, rendering the treated solution harmless and clean.

Foamclean Limited uses the 'Perfluoro Filtration Extraction Cleaning and Treatment' process known as perfFECTTM. This is a patented process for cleaning fluorinated solutions, such as AFFF foam. The process works by passing the solution through a carefully-designed carbon matrix in such a way that it extracts the fluorosurfactants, rendering the treated foam solution free of any contaminants known to have a detrimental impact on the environment.

Should we depend on foam agents?

"Safe disposal of firefighting foam and, in some cases, foam concentrates has never raised more questions than it does currently," reports Gary. From the well-documented withdrawal by 3M from fluorosurfactant manufacture using perfluorooctanyl sulphonate (PFOS) chemistry in May 2000 to the present day, dealing with foam as a waste product has become a fundamental environmental issue.

There are those who would argue that there should be a reduction in our dependency on foam products because of their potential detrimental impact on the environment, comments Gary.

"Foam manufacturers have developed fluorosurfactant free foams (FSFF) that have no long-term detrimental environmental impact. There are numerous areas of application for this type of product, in particular with the UK fire & rescue services. However, the main issues relate to foams containing fluorosurfactants."

30 million litres of contaminated wastewater was left behind after the Buncefield fire.

PRODUCT PROFILE

CONTAINING WASTE RUNOFF

How do you ensure that contaminated material is collected for proper off-site disposal? UK-based Professional Protection Systems, known for supplying bespoke decontamination solutions to emergency services in 60 countries has developed a range of waste water bladder tanks with capacities from 100 to 6,000 litres which can be filled via a range of wastewater pumps, including units with floor level suction that will remove wastewater and solids up to 6mm in diameter down to a 1mm depth.
To further reduce the spread of contaminant PPS have developed raised plastic flooring (made from recycled product) to keep contaminant from legs and feet, or boots, and the company also offers a decon basin or boot bath with a disposable liner, the contents of which can then be pumped into a bladder. More information? Visit: www.ppsgb.com

The UK Ground Water Regulations 1998 describe specific groups of substances which fall into two lists, List I and List II. Those detailed in List I include organohalogen compounds and should be prevented from entering groundwater. All Aqueous Film Forming Foam (AFFF) formulations contain fluorosurfactants which are organohalogens and fall within List I of the Regulations.

Gary concludes: "Any substance that is found to be persistent, bioaccumulative or toxic (PBT) must be prevented from entering groundwater. All fluorosurfactants are known to be environmentally very persistent (vP) with a halflife of the order of a decade or more. Some fluorosurfactant breakdown products, for example, PFOS, also bioaccumlate and are toxic. The lithium salt of PFOS is even an insecticide."

Should brigades use safer foams?

Franz Kitzwögerer of BIOVERSAL looks to the example of Austria's fire services as the way forward. He comments: "In Austria more than half the fire brigades have opted to use alternative firefighting foam extinguishing agents rather than create problems for the local environment. These products do not carry any hazardous markings for transport and the products do not carry any hazardous labelling whatsoever.

"BIOVERSAL QF corresponds with the highest standards in the world against fires and fulfils not only the EN-standards but also international standards, i.e. ICAO, GOST etc."

BIOVERSAL works like this - the product encapsulates particles of the hydrocarbon when foaming which means there is a high portion of water which cools in a very effective and efficient way, making three-dimensional fires easier to control.

"Next, BIOVERSAL QF prepares the hydrocarbons for a rapid biological breakdown during the extinguishing process. This so far, has been unequalled anywhere in the world," says Mr Kitzwögerer.

Left behind in the firewater is a dirty mixture of water, PFOS, polyaromatic hydrocarbons and MTBE. No-one knows what will happen to it.

The BIOVERSAL range of products contain special natural substances which can fight fires and oil pollution but are completely harmless to the environment. These organisms are based on highly-degradable surfactants. They stimulate the micro-organisms to multiply substantially, thus bringing about a rapid biological degradation process.

In September 2002, approximately 5,000 litres of commercial heating oil spilled into Lake Goldegg in Austria, affecting tourism, drinking water quality and some commercial operations supplying mud packs to health farms. This whole area is very environmentally sensitive and BIOVERSAL was the only product that met the criteria for use in such an important area. In April 2003 - after treatment - the water was passed as fit for drinking by the local authority in Salzburg. This was an incredible achievement considering the previous level of contamination.

UK Environment Agency's view

Colin Chiverton, head of the team dealing with the foam at Buncefield for the Environment Agency commented:

"All the contaminated firewater has now been removed from the Buncefield site and is being securely stored at a number of sites around the country. It is the oil company's responsibility to come forward with options for the safe disposal of the firewater.

"We worked closely with the fire services from the earliest stages of the incident to plan a response that would minimise the environmental impact and risks to underground and surface waters drawn for public supply. This covered arrangements for sourcing water, for containing firewater, and the use of foam. Measures were put in place to contain foam on site as well as contaminated firewater.

"We aim to protect the environment and human health from exposure to PFOS. We will use our available powers to prevent, and where this is not possible, to minimise the emissions of PFOS to the environment, however the use of such 'PFOS foams' is not currently illegal. Defra did bring forward proposals to phase out the use of PFOS in firefighting foams but the European Commission proposed a Directive on PFOS last December.

"This does not restrict the use of PFOS in firefighting foam and discussions on this will now need to be pursued at EU level."

MULTIPURPOSE CLEANING AGENT

A UNIQUE FIRE FIGHTING TECHNOLOGY THAT CAN ALSO BE USED FOR CLEANING UP HYDROCARBON SPILLS IS FINDING A NEW APPLICATION IN REFINERIES AND TANK STORAGE FARMS. JOSE MARIA SANCHEZ DE MUNIAIN SPEAKS WITH BIOVERSAL'S TECHNICAL DIRECTOR IOANNIS ATHANASIOU.

The extinguishing and bioremediation characteristics of Vienna-based Bioversal's products have been covered in *Industrial Fire Journal* in previous editions.

To recap, Bioversal QF is a micelle encapsulator agent that works on multiple firefighting levels. Firstly, it reduces the surface tension of water, altering the shape of water droplets on the surface from round to flat, which in turn increases the cooling efficiency.

Secondly, QF has similar foaming properties to traditional AFFF foam, which means the blanket of product cuts off the oxygen supply from the burning fuel.

Thirdly, QF encapsulates both the fuel and its gases so not only can the fuel not burn, but the gases cannot explode. This last application has made it particularly useful in the mining industry, where it is used to encapsulate coal dust whilst also penetrating deep into the combustible to cool it down.

Firefighting capability aside, Bioversal technology has an important side effect: it actually encourages the natural regeneration of a hydrocarbon-polluted area.

When QF comes into contact with an oily surface for instance, it simultaneously enlarges it and encapsulates the oil particles, which reduces the adhesive properties. The enlarged surface area aids in the biological breakdown of the oil – encouraged by Bioversal's vegetable active substance (activator), which creates the best possible living conditions for the micro-organisms naturally present in the environment.

Spills in refineries

For many years Bioversal QF has been used by fire brigades in Europe to clean up oil spills. In Austria, it is used both to extinguish fires and to clean oil spills on roads, to prevent further accidents as a result of cars skidding on hydrocarbon residues: it has even been used to clean up accidental oil spills in the river Danube.

Interestingly, explains Ioannis Athanasiou, Bioversal is finding new application niches in the oil industry. Recently, it was used to clean up oil-polluted soil in a refinery in Kazakhstan. 'They are utilising the product in their fire extinguishing equipment as a tool to clean up oil spills. Moreover, due to the high temperatures in Kazakhstan there are high concentrations of volatile gases – Bioversal encapsulates these gases and thus reduces the risk of explosion.'

Once Bioversal has been applied to the oil, it encapsulates the oil and within a matter of a couple of hours the encapsulated oil rises to the surface, from which it can then be skimmed. 'Once skimmed the residual oil still present in the waste water can be easily treated by biological waste water plants, because the bio-activator in Bioversal stimulates bacteria to simply eat it all up.'

Storage tanks – cleaning and maintenance

Storage tank cleaning as per ANSI/API Standard 2015 (Requirements for Safe Entry and Cleaning of Petroleum Storage Tanks) is a complex and expensive process that typically needs to be carried out on a five-yearly basis and is usually carried out by third-party contractors.

Increasingly Bioversal is attracting interest from cleaning contractors and petrochem companies. 'I made a calculation for a 22m diameter storage tank and I estimated that it could be cleaned with 400 litres of Bioversal product, using standard equipment. We have a major petrochem company in Belgium that does precisely this, as well as a tank storage farm in Slovenia. A company in Croatia uses around 2 tonnes a year to clean their pipes. They flush 3% Bioversal and water solution into the pipe and let it run in cycles for two or three hours. After the water has been flushed out, maintenance such as welding can be carried out safely.

'The application is innovative and makes sense – it provides a higher standard of environmental protection, increases safety via effective explosion and fire protection, combined with high performance cleaning results – and it costs less.'

Before and after: Bioversal QF was recently used to clean up oil-polluted soil in a refinery in Kazakhstan.

BIOVERSAL QF – FIRE FIGHTING CERTIFICATIONS

- DIN 14272-2
- UL-162
- EN 1568-3
- GESIP approved and listed as AFFF Fire Protection Agent
- ICAO level B






FIRE ECO HAZARD PREVENTION CONTROL SUPPRESSION

Whatever your primary mission is:

- **Fire & Explosion Protection**
- **Oil Spill Eco Hazard**
- **Oil Spill Eco Cleaning**
- **Soil/Groundwater Bioremediation**
- **Watertreatment**
- **Industrial Cleaning**


Bioversal's Advanced Bio-Technology Products and Applications surpass any existing environmental requirements, hence setting new standards. Its low eco-toxicological impact on natural self-cleaning mechanisms and its bioremediative capacities accelerate dramatically biodegradation of spilled hydrocarbons on soil and water, enhancing the natural attenuation process.

Protecting your most valuable ressources & assets

NATURE and ENVIRONMENT included!

Bioversal®
in association with nature
Advanced Bio-Technology Applications
www.bioversal.com

Bioversal International Gesellschaft m.b.H.
Georg-Sigl-Str. 16
2384 Breitenfurt bei Wien, Austria
Tel: +43 (0)2239 4278 0
Fax: +43 (0)2239 4278 18
info@bioversal.com
www.bioversal.com

Bioversal®
in association with nature
Advanced Bio-Technology Applications