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MESSER
Gases for Life

Gases for Life

The industrial gases magazine

Supercritical fluid extraction with CO_2 for finest separation and noble substances

Beauty products and stardust

Light bulb production:

From powder to incandescent metal

Cement cooling:

No cracks in the Eierberge Hills

Food freshness:

Naturally for connoisseurs

Dear Readers,

The first issue of our magazine in 2012 sees the introduction of a uniform title. The German version of our magazine will now bear the same name as its English language counterpart: "Gases for Life". This brings both versions into line with our international corporate claim, which is also "Gases for Life".

In terms of the magazine's contents, we will continue to follow the successful line pursued in the previous issues. This means that we will continue to highlight the diversity of industrial gas applications though practical examples that are exciting and accessible even for non-experts.

One of these examples is supercritical fluid extraction with CO_2. This is a controlled process which selectively separates a product's individual substances from one another without adversely affecting their properties. The decaffeination of coffee is a popular example of supercritical fluid extraction, but cosmetics and spices also benefit from this process.

A supercritical fluid extraction product has even been used in space exploration. The product in question is aerogel, a substance that consists almost entirely of pores. No other solid known to us has a lower density. NASA's Stardust probe made use of this property to capture very fine dust particles – such as comet dust – and bring them back to Earth intact.

You can read more about supercritical fluid extraction and other applications in which our "Gases for Life" are used on the following pages. I hope that you enjoy this issue and find it a source of fresh and fascinating insights about gases.

Best wishes

Stefan Messer

Cover photo: Mónika Csere, Marketing Officer at Messer in Hungary, in the supercritical fluid extraction research team's laboratory at Budapest University of Technology.

Good for you and the environment

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Dona Idrizaj, who works at Messer in Austria, uses a smart phone to scan the QR code that opens a website with a safety data sheet on helium. This does not, however, replace the safety data sheets that are supplied with the product.

Austria: Accessing data sheets via QR codes

„Quick Response"

Quick response codes (QR codes) connect print media directly with the mobile internet. These codes can be scanned with a smart phone to get exactly what their name suggests – a quick response. Messer Austria uses QR codes to make operating instructions and safety data sheets even more easily accessible to its customers. For instance, the codes are found on the packaging of the company's balloon gas sets: with a web-enabled mobile phone, customers can access the animated balloon filling instructions on YouTube. There are also numerous Messer safety data sheets which can be accessed via QR codes.

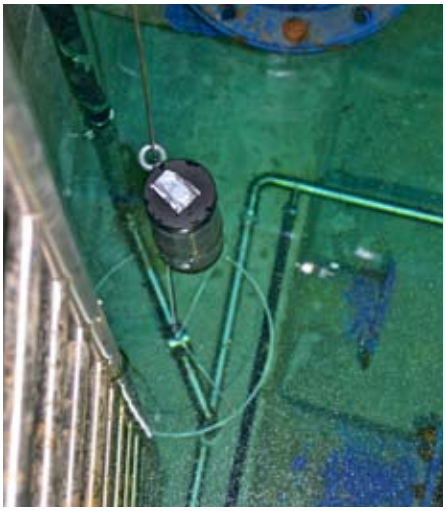
Herbert Herzog, Messer Austria

Slovenia: CO_2 softens drinking water

Gas against lime deposits

The small historic town of Trebnje in Slovenia lies in an idyllic location surrounded by rolling hills. The town's drinking water is actually of good quality, but it has a relatively high lime content. Without treatment of the water, deposits would form in the pipes. A study carried out at utility company Komunala Trebnje showed that the most efficient way of avoiding this is to add carbon dioxide. The gas is a natural component of spring water and is completely safe for normal drinking water supplies. In Trebnje, it is passed through a distribution pipe to a network of perforated pipes in the pump basin. The pH value of the water is then regulated using a control system and a pH probe. Approximately 40 milligrams of CO_2 is added per litre of water.

Dejan Šibila, Messer Slovenija



Clearly visible: CO_2 pipes at the bottom of the pump basin

Austria: Dry ice cleaning for dental products

CO_2 for beaming smiles

A perfect fit and flawless surfaces are an absolute must when it comes to false teeth. That is why Klema Dentalprodukte, a company based in Meiningen, Austria, has been using dry ice blasting to clean its production facilities and sensitive plant components for some time. The conventional cleaning processes used on the high-tech machinery for the manufacture of ceramic and synthetic teeth are gradually being replaced by non-abrasive cleaning with dry ice pellets. The process is similar to sand blasting, but blasting with dry ice pellets causes no wear or damage to the equipment. Furthermore, the cold temperature of the dry ice has an additional cleaning effect, and no residues are left behind apart from the dirt.

Dry ice blasting optimises the manufacture of synthetic teeth.

Herbert Herzog, Messer Austria

Germany: Nitrogen for aluminium profiles

Perfect surfaces

The manufacture of aluminium profiles entails the hot metal being pressed through the die under great pressure, with the friction causing the temperature to rise still further. However, too much heat adversely affects quality and makes the process slower. For this reason, Höfer Metalltechnik GmbH & Co. KG, or

Welding gas mixtures from Messer are used in the assembly of the new Mercedes B-Class in Kecskemét.

Hungary: New plant for Mercedes-Benz compact car

Premium with Messer gases

Mercedes-Benz is enjoying growing demand in the premium compact car segment. The production capacities for the new generation of compact cars from Mercedes-Benz at the German parent plant in Rastatt were insufficient, so in 2008 the Daimler Group made the decision to build an additional plant in Kecskemét, Hungary. The two plants will form a combined production operation; two of the five new compact models, including the new B-Class, will be produced in Hungary. The plant will employ more than 2,500 people and is designed for an annual production capacity of over 100,000 units. Messer in Hungary has been supplying gases to Kecskemét since 2011. Ferroline welding gas mixtures, acetylene, oxygen and nitrogen are used there.

Krisztina Lovas, Messer Hungarogáz

The INCAL process increases productivity during aluminium extrusion.

HMT for short, introduced Messer's INCAL process over a decade ago. During the "*IN*erting and *C*ooling of *AL*uminium", the die is cooled with liquid nitrogen. This allows the temperature of the profile surface and the die to be lowered and the extrusion rate to be increased, resulting in an increase in productivity. At the same time, the evaporating nitrogen creates an inert – oxygen-free – atmosphere. This prevents oxidation and improves the surface quality.

Michael Behnke, Messer Industriegase

France: Gases for fire extinguishers

Welding, testing, filling

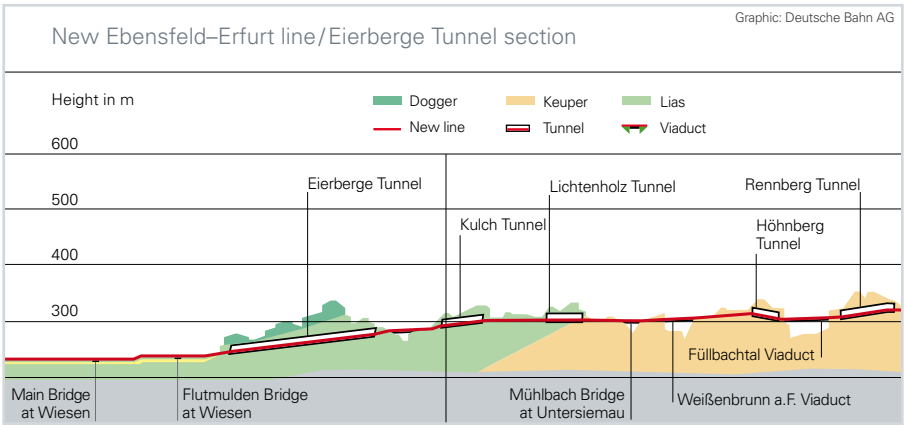
Fire extinguishers are standard equipment in public buildings and on public transport, as well as in offices, factories and, increasingly, private households. Eurofeu produces more than half a million fire extinguishers a year, making it the largest French manufacturer of fire extinguishers. At the end of 2011, the company opened a new production facility in the French town of Chartres. Messer supplies the necessary gases: argon is used in the welding of the fire extinguishers, helium is used to test them for leaks, and carbon dioxide is the extinguishing agent that fills the CO_2 fire extinguishers.

Angélique Renier, Messer France

Eurofeu fire extinguishers use CO_2 from Messer.

No cracks in the Eierberge Hills

In future, ICE trains will travel along the new high-speed rail link between Nuremberg and Erfurt at speeds of up to 300 kilometres an hour. This will cut the journey time from Munich to Berlin to less than four hours. To allow such fast journeys, there will be 25 underground sections where the line passes through hill formations. The stability of the tunnels depends on the quality of the concrete – the most important material in modern tunnel construction. Cooling the building material with liquid nitrogen enables stress cracks to be prevented and optimum properties to be achieved for the structure.



This Deutsche Bahn graphic shows the location of the tunnels for the new ICE line through the Eierberge Hills.

One of the tunnels on the new ICE line is being built near Bad Staffelstein in Franconia. It will extend for 3.8 kilometres under the Eierberge Hills. This construction site alone will devour some 300,000 cubic metres of concrete, the equivalent of 40,000 ready-mix truckloads. As is customary with projects of this magnitude, the required concrete is being produced on site.

This requires the mixing – outside the tunnels – of the three main raw materials as well as other auxiliary materials: aggregates (sand, gravel, rubble or crushed stones), water and cement. The cement itself is also made from a mixture, the ingredients of which are limestone, clay, sand and iron ore, along with other additives. The mixture is sintered at extremely high temperatures in order to completely remove the water bound up in the minerals. When the finished cement then comes into contact with water again, a chemical reaction is triggered. This involves the release of heat energy, which causes the temperature in the drying structure to rise. If the temperature exceeds a critical value, cracks may form as a result of thermal stresses and expansion in the concrete, which poses a serious risk to the stability and durability of the structure.

Particularly during the summer months, therefore, something needs to be done to prevent excessive heat generation when working with concrete. One possible method consists of cooling the fresh concrete before use. Cryogenic gases can be used to adjust the temperature of the fresh concrete to between 10 and 25 degrees Celsius.

The company that has been hired to produce the fresh concrete has – for this project – decided in favour of the new technology for cement cooling in conjunction with water cooling, and against the use of flake ice cooling. At the Eierberge Tunnel, therefore, if the

Further information:
Jens Tauchmann
Manager Application Technology Industry
Messer Group GmbH
Phone: +49 2151 7811-228
jens.tauchmann@messergroup.com

Sven Greiner of "mbk Mobile Betonkonzepte" sets the temperature of the fresh concrete at the optimum level.

temperature of the fresh concrete is too high, the cement is cooled before the concrete is mixed.

Both cooling methods are based on the use of liquid nitrogen. Where large quantities of concrete are involved, a combination of the two methods is often the most efficient way of reliably keeping the temperature of the building material within the desired range. Messer supplies the necessary equipment and gases for both the Cryoment cement cooling process and the water cooling process for the fresh concrete.

Once the concrete has been used on the construction site, the process of setting begins. In this process, stable, needle-shaped crystals form in the concrete mass, which gradually grow and mesh together. As a result, the concrete's raw materials are bonded together firmly, giving the structure its stability and subsequent shape – without any gaps or cracks, thanks to the dual cooling method.

Jens Tauchmann, Messer Group

In addition to the gases required for the Cryoment process, Messer also supplies all the necessary equipment.

The customer

DB ProjektBau plans and carries out virtually all infrastructure projects throughout Germany for Deutsche Bahn, Germany's national rail carrier. Its work includes modernisation of the existing rail network as well as large-scale projects such as the construction of new and upgraded lines.

The concrete for the Eierberge Tunnel project is being supplied by **mbk Mobile Betonkonzepte**, a concrete logistics and production supplier for tunnel construction and other large-scale projects.

France: Ready-to-cook culinary delights preserved with gases rather than preservatives

Naturally for connoisseurs

„From the vegetable garden to the plate", "Seeds for planting and eating" – these are examples of the neat slogans used by Sophie Monti, the culinary creator and manager of the Lion grocery store in Paris. This exquisite delicatessen, founded in 1895, offers a range of delicacies along with sweet or savoury ready-to-cook dishes, as well as herbal teas from 100% organically grown plants which are untreated and, above all, free from preservatives. In order to ensure an optimum minimum shelf life of one year, the precious ingredients are packaged in a controlled atmosphere. This involves the use of food gases such as carbon dioxide and nitrogen mixtures – both from Messer's "Gourmet" range: a natural, innovative method of preservation designed to preserve flavours and aromas from bygone times and meet the demands of modern-day chefs. Lion's ready-to-cook delicacies are sold in the Lion store itself, which is located in the Montmartre district in the heart of Paris, as well as in delicatessens in all major French cities. Even Harrods in London now sells them. "French Cancan", a rice pudding with white chocolate, raspberries and a hint of roses is particularly delicious. A feast for the eyes and taste buds!

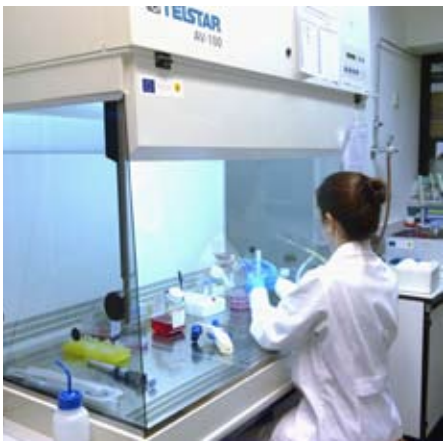
Sophie Monti presents culinary specialities – from high-quality herbal tea to "French Cancan" rice pudding – at her "Lion" delicatessen in Paris.

Angélique Renier, Messer France

Spain: Specialty gases for research and teaching

Cells and culture

When Jaime II, King of Aragon, founded the Estudi General in Lérida (Lleida in Catalan) in the year 1300, he created the third-oldest university in Spain and one of the oldest in the world. Its legacy is the modern Universitat de Lleida. It has been supplied with specialty gases from Messer for teaching and research in medicine and agronomy for two years. In the cell culture laboratory, for example, carbon dioxide is used in the incubators. The cells require a temperature of 37 degrees Celsius and a five per cent CO_2 content in the ambient air so that the cultures can develop as planned. Helium is used as a carrier gas in gas chromatography. Nitrogen, synthetic air and carbon dioxide are supplied for a hypoxic chamber. This is used to investigate processes in cells which receive insufficient oxygen. When hypoxia occurs, the body or individual parts of the body suffer from an acute lack of oxygen. It is triggered by vascular constriction, pulmonary diseases or thromboses, as well as by altitude sickness. Gases can be used to simulate a defined deficiency situation.



Research work in the cell culture laboratory at the Universitat de Lleida

Marion Riedel, Messer Ibérica

China: Krypton/xenon plant commissioned

Noble gases from Xiangtan

In November 2011, Messer's Chinese subsidiary, Hunan Xianggang Messer, commissioned its first plant for the production of krypton and xenon. Noble gases accumulate in liquid oxygen during the process of air separation. However, as they occur only in very small quantities in air, a lot of liquid oxygen is needed in order to obtain significant quantities. The oxygen is supplied by two air separation units, each with a capacity of 40,000 cubic metres per hour, at the Messer location in Xiangtan (Hunan province). Extracting the required gas mixture of 90 per cent krypton and 10 per cent xenon from the air component requires precisely coordinated process steps such as precleaning, pressure build-up, demethanisation and distillation. The new plant can produce 9.4 kilograms of the noble gases per day from 24,000 kilograms of liquid oxygen.

Messer developed the krypton/xenon plant in close cooperation with the plant builder Hangzhou Hangyang, who carried out the construction. The project, which took three years to complete, will serve as a reference for similar projects in the future. The noble gases krypton and xenon are amongst the most valuable products in the portfolio. They are used in the production of light bulbs and gas lasers, among other things. Krypton is also used as an insulating gas filling for double-glazed windows.

Jasmine Yan, Messer China

6 questions for

Dana Köpplová

Dana Köpplová (35), Communications Manager at Messer Technogas in the Czech Republic, has been working for Messer in "Marketing and Communication" since 1999. Dana Köpplová lives in Prague with her two-year-old son Hugo and husband Jaromir.

1. **My biggest professional challenge at Messer so far has been ...**
   winning the "Messer Trade Press Award" for good cooperation with the media and the "Expo Image" award for most effective trade fair for "Welding 2002". My biggest challenge today is combining my career and my role as a mother.
2. **What typifies Messer for me is ...**
   the fact that the company gives employees the opportunity to translate their own ideas into action independently and autonomously.
3. **My strengths ...**
   are a talent for organisation, independence and the ability to communicate internationally.
4. **I have a weakness for ...**
   good food, wine and people who make me laugh.
5. **What fascinates you about gases and gas applications?**
   The boundless possibilities of gas applications. Gases are all around us wherever we go, even though we can't see them.
6. **The most important invention of the last century is ...**
   antibiotics.

Beauty products and stardust

It may be named after the Roman goddess of love and beauty, but its surface is far from inviting. The planet Venus is extremely hot, and its surface pressure is akin to that at the bottom of the sea. Under these unpleasant conditions, carbon dioxide, which comprises 96 per cent of the Venusian atmosphere, takes on its "supercritical form", in which it has both gaseous and liquid properties. While this does not help make Venus any more attractive, at least supercritical CO_2 is a substance that is used to enhance beauty here on Earth.

Béla Simándi, professor at Budapest University of Technology: "Herbal extracts retain their properties – aroma, taste and colour – for a very long period of time."

The process is called supercritical fluid extraction, also known as SFE. It offers undreamt-of possibilities for the selective separation of substances without affecting the properties of the materials involved. The method was first used on a large scale for decaffeinating coffee. Coffee is a sensitive plant-derived product with countless constituents, of which only one has to be removed in decaffeination. Solvents which are damaging to health can be ruled out as they would make the product undrinkable. Other available methods would affect the complex aroma too much. The CO_2 used in supercritical fluid extraction, on the other hand, can selectively remove only the caffeine without affecting any of the other components.

If a gas is heated beyond the so-called critical point and subjected to pressure in excess of the critical pressure, it is transformed into the supercritical state. In this state, it is no longer possible to determine whether it is gaseous or liquid, because supercritical fluids have the high density of a liquid and the low viscosity of a gas. The transition to this state entails a sharp increase in solvency by an order of magnitude.

More often than not, CO_2 is used for SFE. The gas reaches its critical point at just 31 degrees Celsius and a pressure of 74 bar. The substance to be processed therefore only needs to be heated to slightly above room temperature – an important advantage of this gas, not just for sensitive plant products. After extraction, it is vaporised entirely and can subsequently be used again as a solvent in a closed-loop system.

Continued on page 12 →

Overview of the advantages of this method

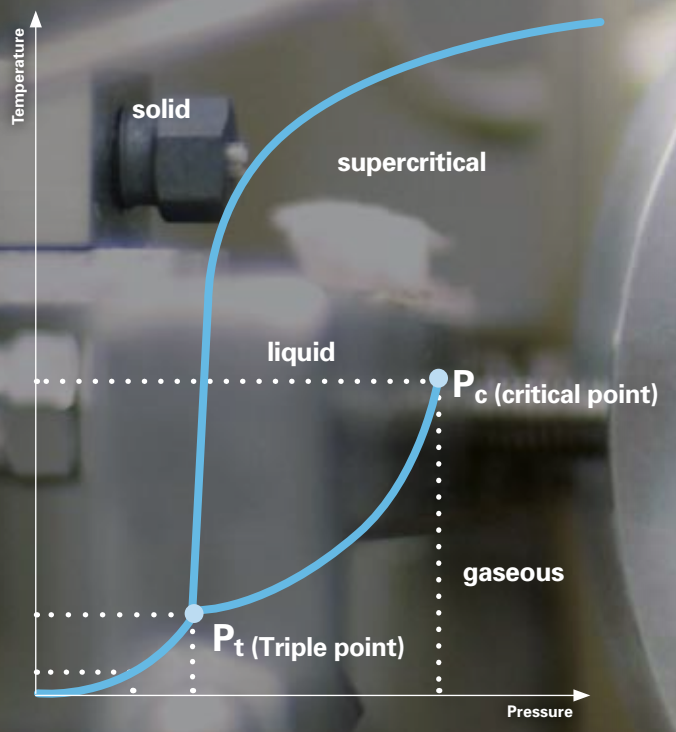
- Safe solvent with no health risks
- Solvent properties can be varied by altering pressure and temperature
- Selective separation even of non-volatile substances possible
- Aroma-preserving separation of natural substances
- Gentle extraction of temperature-sensitive constituents
- CO_2 is inert and does not react with the product
- Non-flammable, non-explosive
- No environmental impact, no emission problems thanks to a closed-loop system

Mónika Csere of Messer in Hungary puts finely ground oregano into an extractor cylinder which forms part of the high-pressure extraction system.

Oregano before and after extraction (on the left, oil; on the right, paste)

Oregano, coriander, lovage root – valuable raw materials, e.g. for cosmetics

Supercritical fluid extraction with carbon dioxide (CO_2)



The phase diagram shows when carbon dioxide is in the solid, liquid, gaseous or supercritical state – depending on pressure and temperature.

Optical cell on phase equilibrium apparatus in which CO_2 can be seen in the liquid and gaseous states.

→ *Continued from page 10*

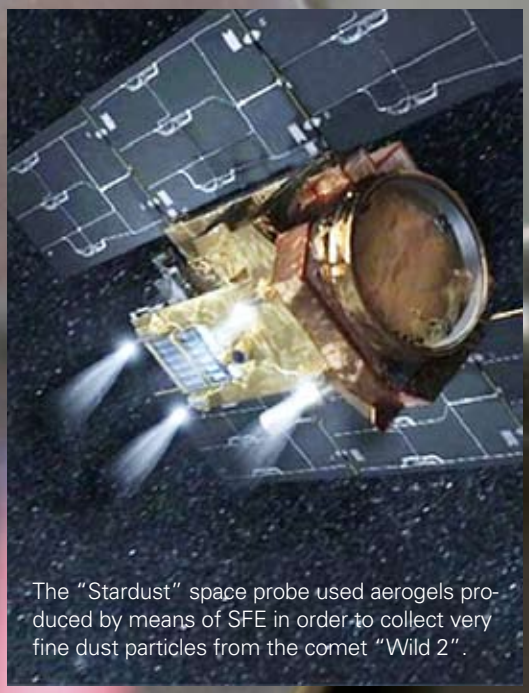
Another advantage of the SFE method is that it can be adjusted with great precision for different substances, explains Professor Béla Simándi, who leads the supercritical fluid extraction research team at Budapest University of Technology. "With medicinal plants and herbs, for example, we can separate essential oils and other oily constituents from one another very easily. We only need to adjust the pressure and temperature to do this. The conventional method would require multiple changes of solvents."

The production of liquid herbs and herbal extracts for cosmetics and natural remedies is one of the main areas of the Budapest SFE team's work. "The extracts retain their properties – aroma, taste and colour – for a very long period of time," explains the head of research. "They can be admixed more precisely and evenly and allow consistent results to be achieved, with formulations that are independent of the year of production."

Supercritical fluid extraction even allows enantiomers to be separated. These are substances which, while they have an identical molecular structure, differ only in the mirror-image arrangement of their atoms, such as laevorotatory and dextrorotatory lactic acids. The Budapest research team is the first to have used the SFE method for separating enantiomers, which are also vitally important for the production of medicines. "Generally, only one of the two enantiomers of an active substance is responsible for the curative effect," explains Dr. Edit Székely, a member of the SFE research team. "The other is at best neutral, at worst harmful."

Supercritical fluid extraction is now used in many different fields, for example in the chemical and petrochemical industries, in biotechnology, paper production and environmental protection. It facilitates the regeneration of activated carbon filters, the treatment of waste oil or pharmaceutical wastewater and the decontamination of contaminated soils.

Dr. Edit Székely, a member of the SFE research team, adjusts the settings on the CO_2 reactor in the SFE laboratory.



The "Stardust" space probe used aerogels produced by means of SFE in order to collect very fine dust particles from the comet "Wild 2".

Another area of application is the production of so-called aerogels. In this process, the liquid component of a gel is replaced by a supercritical gas, which subsequently vaporises. This leaves highly porous solids in which up to 99.98 per cent of the volume consists of pores. They have the lowest density we have so far encountered in solids, making them extremely lightweight and very robust at the same time. Their fine structure makes them suitable as a collecting matrix for very fine dust particles, among other things. That is why they were used on board the Stardust space probe to capture comet dust. The dust particles and molecules can be trapped without being thermally destroyed thanks to the gradual deceleration that is made possible by the aerogel. For the first time, therefore, it has been possible to collect cometary material and bring it back to Earth intact.

Editorial Team

Further information:
Thomas Berger
Manager Application Technology Chemistry/Environment
Messer Group GmbH
Phone: +49 2151 7811-229
thomas.berger@messergroup.com

Interview with

Edit Dulovics, Managing Director of CO_2 Supercritical Kft.:

"An excellent solvent for producing very pure and highly concentrated extracts."

Gases for Life: Why do you use supercritical CO_2?

Edit Dulovics: It is an excellent solvent in this form. It enables us to produce very pure and highly concentrated extracts from plant-based raw materials. It is inert, leaves no residues whatsoever and can be used at near room temperature. This means that the treated substances are not adversely affected. Our system allows us to extract water- and alcohol-soluble substances, as well as dry extracts..

Gases for Life: What raw materials do you work with?

Edit Dulovics: So far we have worked with a variety of dried plant-derived substances such as lovage root, sea buckthorn berries, oregano, thyme and a range of medicinal plants. We check the quality of the extracts by means of gas and high-performance liquid chromatography. The extracts contain as many as 200 to 250 different constituents, but generally our search is targeted at only a few important active substances.

Gases for Life: Could you explain the nature of these plant extracts?

Edit Dulovics: They are so extremely concentrated as to make them unsuitable for consumption in undiluted form. For the most part they are oily, waxy or paste-like substances, depending on the raw material and the setting parameters for the process.

Gases for Life: Where are the extracts used?

Edit Dulovics: Mainly in the food, cosmetics and pharmaceutical industries. In diluted form, they are also available directly as herbal remedies in pharmacies and chemist's shops.

Krisztina Lovas, Messer Hungarogáz

CO_2 Supercritical Kft.

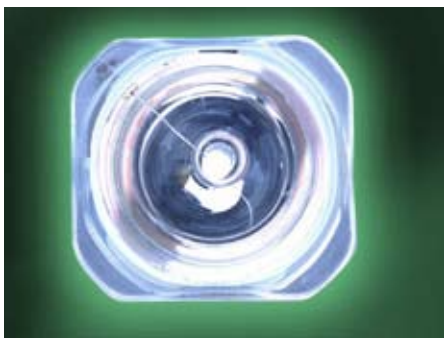
Five years ago, an EU-supported research and development consortium in Hungary started its work in the field of herbal remedies. It has developed three new drugs to date. CO_2 Supercritical Kft. was established for the industrial production of these drugs. Although the company is still in the process of being built up, it is already taking on external orders for its supercritical fluid extraction services. One of the company's long-term aims is the production of plant-based drugs.

Hydrogen, oxygen and argon for light bulb production

From powder to incandescent metal

Osram, the light bulb manufacturer, has had a production facility in Bruntál, Czech Republic, since 2000. The plant initially produced powdered tungsten by reducing tungsten oxide with gaseous hydrogen. Osram then gradually expanded production activities to include the manufacture of fine wires and coils. These are used for light bulb production in the majority of the company's 48 plants.

In Bruntál, wire is produced from tungsten and molybdenum and processed to make tungsten coils. This coil is the actual luminous element and therefore contributes significantly to the quality of the bulb. That is why quality and innovation are particular priorities here. High-purity hydrogen and nitrogen are required for the production process. Since September 2004, the Osram plant in Bruntál has also been producing special bulbs for medical applications, as well as for the television and entertainment industry. This also involves the use of oxygen and argon. The noble gas is used as a fill gas for light bulbs and video projectors.



The plant in Bruntál also produces special bulbs for medical applications and the entertainment industry – with the help of various gases.

In 2008, Osram outsourced production of the tungsten powder to the American company Global Tungsten & Powders Corp based in Towanda. Last year, Global Tungsten decided to build additional furnaces in Bruntál in order to secure production capacity for tungsten powder. Messer Technogas provided support for the start-up of these furnaces, which, of course, also require hydrogen for tungsten production.

In 2011, Osram itself commenced production – in its Display/Optics division – of special quartz glass bulbs for large light sources. Very powerful oxygen/hydrogen burners are used to form these glass bulbs. Due to the increases in capacity at both companies, Messer Technogas is supplying Osram and Global Tungsten Powders with a total of two million cubic metres of hydrogen for the four on-site hydrogen tanks.

Vit Tuček, Messer Technogas

Further information:
Vit Tuček
Sales Manager of Application Technology
Messer Technogas, spol.s.r.o.
Phone: +420 241008211
vit.tucek@messergroup.com

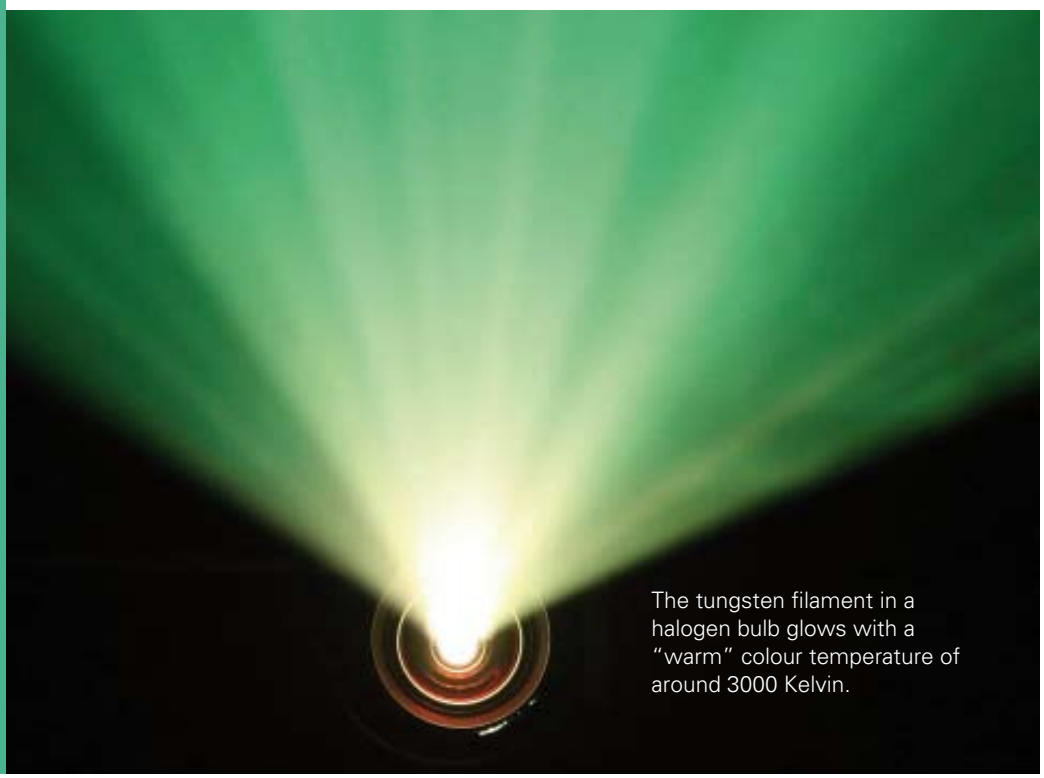
Tungsten – a classic illuminant

At 3,422 degrees Celsius, tungsten has the highest melting point of any metal, making it extremely heat-resistant. At the same time, it is not as good at conducting electricity as copper and aluminium, the typical conducting metals. Thus, a thin tungsten filament heats up until it is incandescent – without melting – while the thicker conducting-metal supply cables barely get warm.

For this reason, from the beginning of last century, light bulb filaments were predominantly made of tungsten, which has not, in principle, changed to this day. Apart from the classic light bulb, which is increasingly being replaced by more energy-efficient light sources, tungsten filaments are also found in halogen bulbs. Furthermore, the metal is used as an electrode in gas discharge lamps and electron tubes.

Tungsten only occurs naturally in various chemical compounds. When processing the ore, the first step is to separate tungsten oxide from these compounds. In order to obtain the pure metal from this oxide, the latter is reduced to a powder and heated in reducing furnaces. The atmosphere in these furnaces consists of hydrogen, which combines with the oxygen in the oxide powder. This leaves pure tungsten and steam. Excess hydrogen is returned to the furnaces. The metal is sintered in a protective atmosphere consisting of argon and hydrogen. The subsequent drawing process produces the wire for the tungsten filaments.

Hydrogen tanks on the factory premises in Bruntál



The tungsten filament in a halogen bulb glows with a "warm" colour temperature of around 3000 Kelvin.

A simulation at Messer's headquarters in Bad Soden explains the principle of crust freezing.

Germany: Crust-freezing of food products

Rapid chilling for culinary delights

Why does the cherry sit proudly on top of the cream gateau rather than sink into it? And why is the chocolate coating inside an ice cream cone so smooth and even? The answer lies in the targeted use of cryogenic cooling, which chills the product extremely rapidly and thus hardens its surface. This keeps the cherry on top of the cream and ensures that the liquid chocolate coating that is applied to the inside of the cone solidifies into a wafer-thin layer.

Apart from enhancing gateaux and ice cream cones, the rapid chilling of surfaces by means of cryogenic cooling is also suitable for processing sausage and meat products or producing neatly sliced bread. The frozen surface stabilises the product and facilitates better and faster slicing. Crust freezing is performed in cabinet freezers, tunnel freezers, immersion freezers or a snow horn, with nitrogen or carbon dioxide being used as the cryogenic coolant. Which of these methods is the best one in a particular situation depends on the product and the production process. The principle of the crust freezing process is demonstrated very clearly at Messer's headquarters in Bad Soden: a tunnel freezer model simulates surface hardening to prevent the cherries from sinking into the gateau and to ensure neatly sliced white bread.

Diana Buss, Messer Group

France: Individual freezing of gourmet fish

Fresh fish at any time

Overfishing is threatening fish stocks in our seas, with catches during reproductive periods posing a particularly serious threat. The only way to counter this is through sustainable fishing that complies with protective catch quotas and respects the reproductive periods of different fish species. This means, though, that not every fish species will be available fresh from the sea all year round. Nevertheless, consumers need not go without fresh quality seafood at any time as modern freezing methods allow the freshness to be preserved without any loss of quality. This means that fish consumption is no longer limited to the catch of the day, while closed seasons can be observed without limiting consumer choice.

Yvon Prigent Pinchon hails from a long line of Breton fishermen and runs the company "Côtes et Poissons". He specialises in selling fresh fish to gourmet restaurants and is committed to sustainable fishing. With Messer's support, "Côtes et Poissons" has developed a

Modern freezing methods keep fish fresh. "Côtes et Poissons" uses a 30-point procedure that extends from the fish market to the kitchen.

30-point procedure that extends from the fish market to the kitchen and ensures maximum product quality. This means that, at any time, their demanding customers can be supplied with gourmet fish products whose sensory qualities match those of freshly caught fish.

The important thing when freezing the fish is the rate of cooling. If it takes too long, large ice crystals form in the frozen product, which damage the cells and result in the loss of vitamins, nutrients and flavouring substances. That is why Messer's Cryogen-Rapid freezing units use liquid nitrogen or carbon dioxide to freeze food products in a very short time.

The fish is filleted at "Côtes et Poissons" immediately after auction. The fillets are then individually frozen and vacuum-packed, without any liquid separation and with a minimum storage life of twelve months. "Cryogenic nitrogen and the Cryogen-Rapid tunnel freezer are crucial components in our procedure," explains the company's manager. "Thanks to the rapid reduction in temperature, product quality is perfectly preserved. The easy operation of the tunnel freezer always allows us to make very precise and, moreover, reproducible adjustments to the process to suit different fish species and sizes."

Angélique Renier, Messer France

Neutralisation with CO_2 in civil engineering projects

Not aggressive, not corrosive, not expensive

In civil engineering projects, the use of fresh concrete in water-bearing layers is associated with the generation of alkaline wastewater. This needs to be neutralised before it is discharged into sewerage systems or surface waters. Neutralisation with carbon dioxide, an environmentally friendly and economical solution for such projects, is being used in the expansion of Prague's metro system.

In 2010, the construction of the metro link to Praha-Ruzyně international airport saw the start of one of the Czech capital's biggest civil engineering projects. Large quantities of fresh concrete are used in this project, resulting in a correspondingly large volume of alkaline wastewater. In cooperation with the building contractors, Metrostav, HochTief and Subterra, Messer has installed systems that neutralise the wastewater with the aid of CO_2.

Neutralisation traditionally involves the use of aggressive mineral acids such as hydrochloric or sulphuric acid. Carbon dioxide has a number of advantages over these: no corrosive or polluting salts are produced when using the inert gas for neutralisation. The neutralisation process is more precise and there is no risk of acidification. The operating and investment costs are lower as there is no need for the expensive storage of acid or the safety measures that would be necessary when handling these hazardous substances. Other sectors in which alkaline wastewater needs to be neutralised also benefit from these advantages.

"Wastewater neutralisation with carbon dioxide has helped solve our wastewater problem very quickly, with minimal investment costs and excellent results," emphasises Miroslav Cejnar, an engineer at Metrostav. "The installation will, for the most part, be dismantled by Messer after completion of the construction work. This means that we will not have to think about what to do with the reservoirs, pumps and other equipment that the use of mineral acids usually involves. Our consortium partners, HochTief and Subterra, have now also adopted this solution."

Dr. Antonín Kroupa, Messer Technogas

Miroslav Cejnar, a Metrostav engineer, and Dr. Antonín Kroupa of Messer Technogas

Messer know-how was in demand for the expansion of Prague's metro system.

Carbon dioxide – Origin of biomass

Carbon dioxide is a media star. No other gas has ever had so much written about it. However, it owes this honour to its reputation as a global villain, because among the general public it is primarily known as a "greenhouse gas". By contrast, there are hardly any reports about its many useful properties: for example, the fact that it is CO_2 which allows plant growth in the first place, making it an essential prerequisite for the development of complex life forms.

Besides water, plants primarily contain carbon compounds. They get the carbon they need for their roots, stems, leaves and fruit from the CO_2 in the atmosphere. Plants, in turn, form the basic food source for the animal kingdom as a whole, including humans.

Profile: Carbon Dioxide [CO_2]

Element symbol	CO_2
Occurrence	The greatest proportion of carbon dioxide is dissolved in the water of the world's oceans and rivers in the form of CO_2, hydrogen carbonate or carbonate ions. Only around two per cent of all CO_2 on earth is present in the atmosphere, the CO_2 content of which is approximately 0.04 per cent by volume.
Sublimation point	-78,5 °C (changes directly to gaseous state at normal pressure)
Triple point	-56.57 °C at 5.18 bar
Chemical properties	Colourless and odourless, non-flammable, inert, but very water-soluble. Reacts with basic metal oxides or hydroxides to form carbonates and hydrogen carbonates.
Production	Predominantly as a by-product of biochemical or chemical processes. Among other things, it is generated during ammonia synthesis, ethylene oxide production, hydrogen reforming and other industrial processes such as alcoholic fermentation (bioethanol production or breweries). Natural CO_2 sources are predominantly found in areas of volcanic origin.
Uses	Carbonation of soft drinks, drinking water treatment, wastewater neutralisation, greenhouse fertilisation, cooling agent, cleaning agent (as dry ice), refrigerant, e.g. for catering or transport refrigeration (dry ice), firefighting



Over hundreds of millions of years, this biomass has also given rise to the huge reserves of coal, oil and gas which man is burning at an increasing rate, thus releasing the CO_2 again. That is why the carbon dioxide content of the atmosphere is rising, and its insulating effect is contributing to global warming.

In industrial use, a proportion of these CO_2 waste gases are captured and recycled in a useful way. The best-known of these uses is the enrichment of soft drinks, which owe their sparkle to this important gas.

As dry ice, it is used for chilling and freezing. In the treatment of drinking water and the neutralisation of wastewater, it plays an increasingly important and extremely eco-friendly role. Unlike the aggressive acids that are normally used, it does not leave any problematic residues.

When used in greenhouses, carbon dioxide is turned into biomass again as plants use the gas as a source of carbon, which they need for their growth, while the oxygen is released into the atmosphere.

Editorial Team

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Corporate Communications
Gahlingspfad 31
47803 Krefeld, Germany

Editorial Team:

Diana Buss – Editor-in-chief
Tel.: +49 2151 7811-251
diana.buss@messergroup.com

Benjamin Auweiler, Corporate Office
benjamin.auweiler@messergroup.com

Angela Bockstegers, Corporate Office
angela.bockstegers@messergroup.com

Thomas Böckler, Application Technology
thomas.boeckler@messergroup.com

Dr. Christoph Erdmann,
Production & Engineering
christoph.erdmann@messergroup.com

Tim Evison, Corporate Office
tim.evison@messergroup.com

Dr. Bernd Hildebrandt, Application Technology
bernd.hildebrandt@messergroup.com

Michael Holy, Region Central Europe
michael.holy@messergroup.com

Monika Lammertz, Application Technology
monika.lammertz@messergroup.com

Krisztina Lovas, Region Southeast Europe
krisztina.lovas@messer.hu

Dr. Joachim Münzel, Patents & Trademarks
joachim.muenzel@messergroup.com

Angélique Renier, Region Western Europe
arenier@messer.fr

Marlen Schäfer, Corporate Office
marlen.schaefer@messergroup.com

Nicole Urweider, ASCO Carbon Dioxide LTD
urweider@ascoco2.com

Concept and Realisation:

Agentur Brinkmann GmbH
Mevissenstraße 64a
47803 Krefeld, Germany

Text and Editing:

klartext: von pekker!
Römerstraße 15
79423 Heitersheim, Germany

Cover photo:

Mózes Zimányi
Budapest, Hungary

Translation:

Context GmbH
Elisenstraße 4–10
50667 Köln, Germany

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The Gases for Life editorial team

We are ...

From left to right: Dirk Kampffmeyer, Dr. Joachim Münzel, Dr. Christoph Erdmann, Michael Wolters, Zsolt Pekker, Monika Lammertz, Marlen Schäfer, Diana Buss, Benjamin Auweiler, Angela Bockstegers, Krisztina Lovas, Nicole Urweider and Angélique Renier

(not pictured: Michael Holy, Thomas Böckler, Tim Evison and Dr. Bernd Hildebrandt)

Competition

Delicious!

In this issue of the magazine, instead of culinary delights from the country featured in our cover story, readers have the chance to win a gourmet hamper full of specialities that are produced using Gases for Life.

For your chance to win these special delicacies, all you need to do is answer our questions relating to this issue of Gases for Life. The letters in the coloured boxes will give you the answer.

Congratulations!

The winner of the last competition was Manuela Merth, Pernegg, Austria. The correct answer was "MONALISA".

Which Spanish university does Messer supply with specialty gases for research and teaching?

			1		3						6

							2

Please send it by email with the subject line "Gases for Life competition" to: diana.buss@messergroup.com. The deadline is 7 May 2012.

What is the commonly used abbreviation for "supercritical fluid extraction"?

		5

Which Parisian delicatessen uses „Gourmet" gases from Messer?

	4		

Answer:

1	2	3	4	5	6	
						Y

Have fun and (with a bit of luck) enjoy the delicacies!
Your Gases for Life team

So dangerous, yet so safe!

What's an action film without explosions? Ideally, there should be shots of the hero flying through the air – and then getting back up unscathed. To make it look dangerous without actually endangering the actors (much), nitrogen under high pressure is used to simulate the force of explosions during the shoot. Messer supplies this gas to locations in Hungary, including for films such as "World War Z" and "Asterix and Obelix", as well as the television series "The Borgias".

For more on this and many other gas applications, go to:

www.Gases for Life.de