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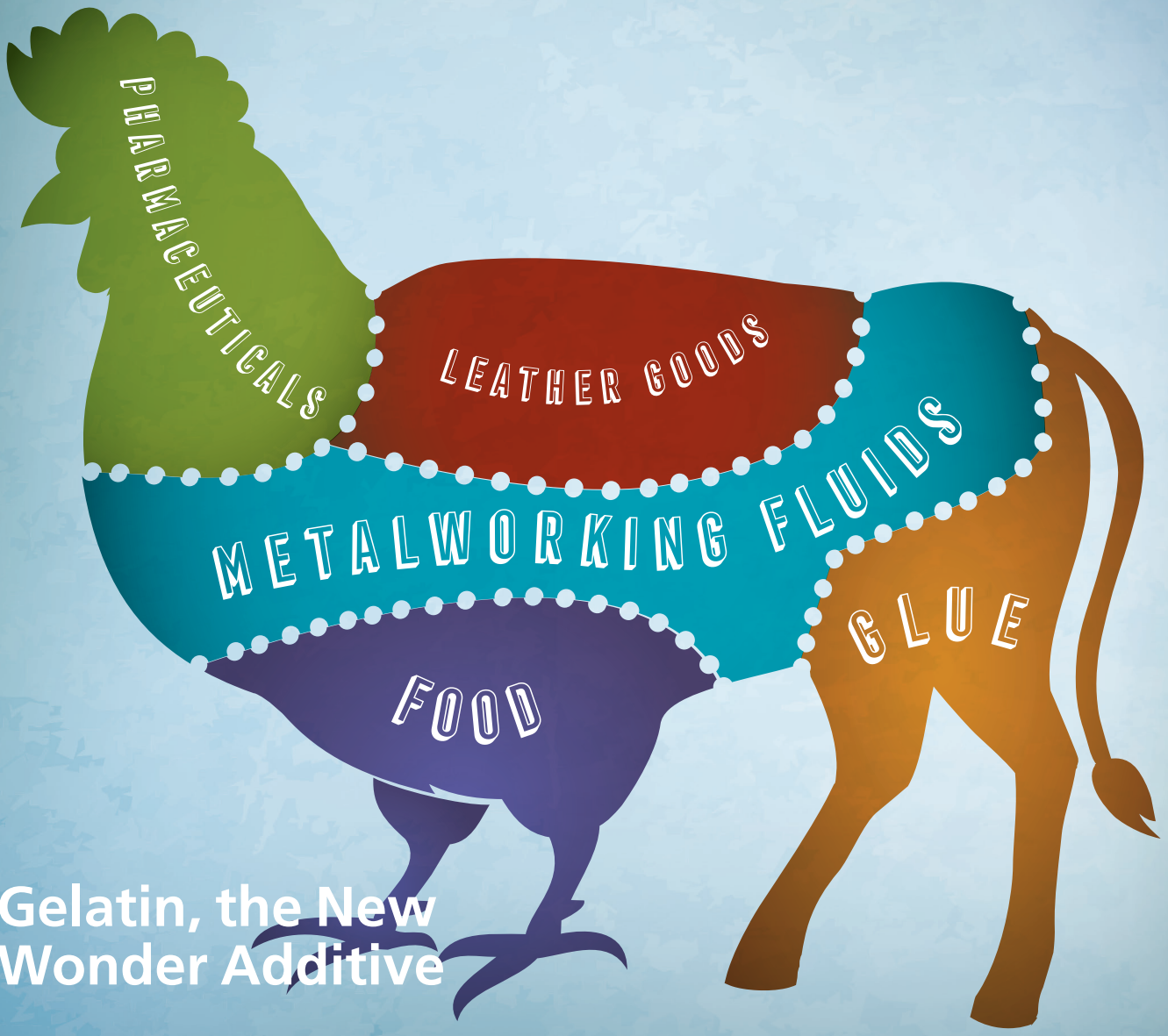


Gelatin, the New Wonder Additive

Gathering Middle East Lube Data

STRETCHING THE SINEWS OF INNOVATION

Derived from the remains of livestock, gelatin has been used for centuries in a wide variety of applications. Now it has found its way into the lubricants industry. Trevor Gauntlett talked to one German company that is promoting this unlikely resource as an additive.

A common call from Western governments to industry, and from senior management to staff, is for more innovation. But what is innovation? Among many definitions applicable to lubricants, it can result in new processes, products or applications of an existing product.

An example of a new application has been gradually entering the metalworking fluids market in recent years. Gelita – based in Eberbach, Germany – has introduced a water soluble, label-free, non-irritating, friction-reducing extreme pressure additive that is compliant with the European Union's Registration, Evaluation, Authorization and Restriction of Chemicals regulation and reduces energy consumption and waste production both during operation and cleaning of parts. Not only is the product itself innovative, by most people's criteria, but the process by which it has arrived in the market is also novel.

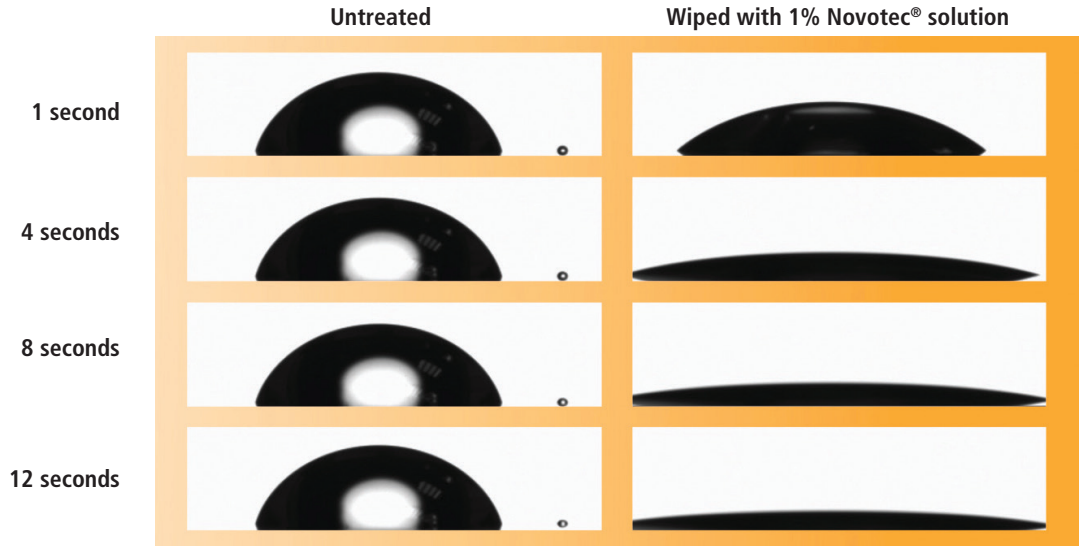
Culture of Innovation

Gelatin and collagen are byproducts of the meat industry and are derived from bones, tendons and skin tissue. They usually find applications in food, pharmaceuticals and personal care. What is interesting is how they went from baking, pharmaceutical coatings, photographic prints and food supplements to metalworking fluids for milling, turning and grinding.

Ten years ago, Gelita's Head of Global Product Management for Photo/Technical Matthias Reihmann was a laboratory scientist when the and other researchers made the key discovery that transferred the product's applicability to lubrication.

"We worked with a well-known automotive supplier on heat-resistant ceramic coatings for casting molds. The ceramic coating should be particularly resistant to thermal shock, so we coated metal sheets with different ceramics, heated them to 300 degrees Celsius and then threw them into water. Each time, of course, it hissed violently. But by chance, a colleague had put a glass containing dissolved protein next to our glass for rinsing,

Figure 1: Wetting Behavior of a Water Droplet on a Steel Surface (Cross-sectional view)



Source: Gelita

and we accidentally threw the metal sheets into the wrong one. Instead of a hissing noise, there was just a quiet 'pluff'," he told *Lubes'n'Greases*. This was an unexpected development.

"We investigated further and found that our proteins bind effectively to metal and form water-attracting films," recalled Reihmann.

Thanks to the automotive supplier, further development was performed on real machines, but it took more than five years to show that the protein layers were present and effective in real applications. Novotec was the name eventually given to the company's range of so-called functional proteins for industrial lubrication applications.

Reihmann described the discovery as the "Novotec effect" and cited it as an example of success due to Gelita's interdisciplinary teamwork, drawing together scientists, engineers, marketers and product managers.

What is the "Novotec effect"?

Reihmann and his colleagues found that certain functional proteins adhere to a broad range of surfaces, such as metal or glass. Once on the surface, the proteins form stable, hydrophilic (water-loving) layers through interaction with each other and the surface. The water attracted to the protein network provides a new form of surface protection, which is used today in cleaners, metalworking fluids and release agents for die casting, for example.

This effect can be monitored by imaging and measuring water droplets on surfaces. (See Figure 1.) The better the material wets the surface, the lower the contact angle and better the spread of the droplet. It has been suggested by Mitjan Kalin of the Laboratory of Tribology and Interface Nanotechnology in Ljubliana, Slovenia, that there is a correlation between the good spreading of a liquid droplet on a solid surface and lower friction.

Applications

Novotec CR800 enhances cooling release agents for casting light metals. By binding cooling water to hot surfaces, it reduces the familiar effect where water droplets appear to bounce across a hot surface. Called the Leidenfrost effect, this is due to steam forming an insulating layer around the liquid droplet. Field trials showed a potential for 30 percent savings of water, waste water and release agent, while production time could be decreased by 20 percent.

When used to wash trucks and rail vehicles, an ultra-thin protein-water layer repels dirt and can therefore be easily cleaned. One user, Luxembourg National Railway Company, reported a 30 percent reduction of washing time, a 90 percent reduction of fresh water consumption and an overall cost reduction of 50 percent when using Gelita's Novotec CB800 biological cleaning product.

The company's cooling lubrication product marketed for metalworking applications, Novotec CL800, contains similar proteins that also adsorb on metal surfaces. The protein-water layer enhances the performance of metalworking fluids by providing greater cooling and lubrication, while facilitating subsequent cleaning.

One of the biggest challenges when formulating semi-synthetic oils is balancing the need to cool the part with water and carry surface-active additives to the surface in mineral

Figure 2: Test Cylinders After Reichert Wear Test

Fluid used:	Water	5% standard MWF	5% Novotec® CL800

Source: Gelita

oil, which is more thermally insulating. The adsorbed proteins provide lubricity while water can migrate into and out of the protein-water layer, carrying heat away from the contact.

Gelita studied heat transfer in collaboration with Theodor-Frey-Schule, a vocational college also located in Eberbach. AlSi12 aluminum alloy pistons were machined on a metalworking lathe. After relatively high-speed machining, there were no visible residues of oxidation byproducts or metal debris on surfaces of pistons, which were lubricated with either 2 percent Novotec CL800 solution or a typical fully formulated, 5 percent mineral oil emulsion. (See Figure 2.)

This was also true for the protein solution after slower machining, but when the mineral oil emulsion was used, residues welded to surfaces. These observations support Gelita's claim that water-miscible metalworking fluids formulated with its product can cool more effectively than those formulated with oil.

Field trials with cwTec GmbH, a metalworking company from Hage, Germany, resulted in the company switching all production from mineral-oil-based products to one of Gelita's protein-containing cooling lubricants. The company operates some 30 turning, milling, surface and cylindrical grinding machines for brass, aluminum, titanium and all types of plastics, as well as hard, soft and corrosion-resistant steels. Founder and CEO Christoph Wenk said that the switch was "a completely satisfying decision."

After machining, the parts and workpieces were very clean and dry, as were the chips, which confirmed very low coolant loss. The staff benefitted because the machines and tools were now much cleaner or easier and faster to clean than before, while harmful chemicals previously present in the air were below the detection limit during a recent audit. Even the less frequently used machines require less maintenance, as the durability of the protein-containing cooling lubricant is very high.

A Bright Future?

Gelita's Reihmann is enthusiastic about the prospects for the Novotec range of products. It is rare that a product comes to market with better health, environmental and performance attributes than many of the incumbent products. However, there are currently no standard performance tests that demonstrate the benefits of Novotec, such as improved cooling and easy cleaning of surfaces. He sees the next phase of the journey to be developing test methods that demonstrate the advantages of the Novotec products to a wider audience. □

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