

WHITEPAPER

BREAKING DOWN THE FACTS ON FOOD-GRADE AND BIODEGRADABLE LUBRICANTS

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ABSTRACT

Machinery across the food and beverage industry requires food-grade high-performance lubricants to help maintain uptime of its manufacturing plants and deliver profit. Growing pressure to be more environmentally friendly is leading some companies to explore alternative solutions that are food-safe, non-toxic and biodegradable.



INTRODUCTION

Did you know that most biodegradable packaging may still contain hazardous and even toxic materials? Over the past few years, numerous studies have shown that many of these biodegradable materials aren't as green as we think them to be. While they do break down faster in soil, we're discovering that up to 30 per cent of the material can still be non-degradable.

Thanks to green marketing, many people now hear the word "biodegradable" and equate this with being good for the environment. However, biodegradability only describes one of the material's properties – how it decomposes and breaks down in soil and water over a specific time. If the material is unsafe to begin with, then breaking it down won't make it less toxic for landfills or waterways.

When considering biodegradability, it's worth keeping toxicity in mind as well. This is especially true for the food and beverage industry, where food safety is critical and microbial growth is frowned upon. For lubrication across production lines, bottling, filling and capping equipment, biodegradability can be an antagonistic feature, especially when food hygiene and security come into question. For meats, dairy and other similar products, any chance for microbial introduction through degradation should be reduced or eliminated.

As lubricants for the food and beverage industry are already food-grade, they have a crucial advantage in being non-toxic. But there is a difference between being food-grade and food-safe.



The three levels of food-grade lubricants

The U.S. Department of Agriculture (USDA) first developed three designations for food-grade lubricants. The National Sanitation Foundation (NSF) later adopted these and has since built on them to become the gold standard.

- **H1 lubricants** – these are food-grade lubricants where incidental food contact can occur. They are tasteless, odourless, non-reactive and safe for human consumption in small amounts. If there is any question of contact with food, H1 lubricants are the default requirement for food safety compliance.
- **H2 lubricants** – these are food grade lubricants where there is no possibility of contact, and these products are food grade, but not necessarily food safe. However, these lubricants must meet toxicology requirements and not contain carcinogens, mutagens, heavy metals or other toxic substances.
- **H3 lubricants** – these are food grade lubricants that are used to clean and prevent rust on production equipment such as conveyors, belts, hooks and trolleys. They are usually edible oils such as corn, sunflower, soybean or cottonseed oil.

What does biodegradability signify?

According to the standards and terminology for lubrication, biodegradability is the ability to decompose purely by encountering naturally occurring bacteria within soil and water. The breakdown happens because the bacteria react with hydrocarbons within the base oil and turn them into water, CO₂ and trace minerals that harmlessly dissipate into their surroundings.

A variety of laboratory tests are used to measure two forms of biodegradability: primary (biotransformation) and ultimate (mineralisation). These test results are determined after the product has been allowed to break down for a total of 28 days as standard.



A second 10-day window within the 28 days is recorded once the material reaches 10 per cent conversion to further classify the performance of the material. These results provide four definitions for biodegradability:

- **Non-biodegradable:** None or a negligible breakdown of the product over 28 days.
- **Inherently biodegradable:** Breaks down anything from 20-60 per cent – either primary or ultimate degradation over 28 days.
- **Ultimately biodegradable:** Breaks down at 60 to 70 per cent or more, **longer than** the 10-day window, but less than the total of 28 days.
- **Readily biodegradable:** Breaks down at 60 to 70 per cent or more **within 10 days** from when the material is at 10 per cent, but less than the total of 28 days.



Supply chain pressures for more efficient and environmentally friendly lubrication

As food and beverage companies worldwide push to become more environmentally friendly, there is rising interest in alternate solutions for industry materials and options for safer industry waste. These companies need to provide their shareholders with progress on Environmental, Social and Governance (ESG) targets and are turning to their supply chains and industrial partners for solutions.

As such, there has been an increasing uptake of interest around food-safe and biodegradable lubricants, for their performance in the food and beverage industry. Lubrication plays a critical role to keep parts moving across production lines with a high degree of efficiency. This means balancing performance and efficiency on the one hand with material safety and properties on the other.

It is important to note that biodegradable oils are still considered industrial waste after use. They still need to be treated and handled correctly, although

it is easier to do this with bio-based over non-bio-based oils.

Rather than focus on its disposal, food and beverage manufacturing plants should pay closer attention to the potential discharge of oil during normal use. This means possible leakage, spills and accidental discharge. Consideration must be given for how the material is collected, where it goes, how the area is cleaned and what chemicals are required. These considerations are where bio-based fluids can take a lead role.

Sustainable alternatives are driving lubrication innovation

Just as the ISO 9000 family of standards are used to improve quality systems in production, the ISO 14000 standards are helping organisations to improve their environmental systems.

When it comes to applying these standards to lubrication, this translates to extending the life of lubricants, the methods of recycling or disposal of

lubricants in a controlled manner for environmental best practice and adopting more environmentally friendly alternatives where possible to replace petroleum-based lubricants.

A.W. Chesterton Company, a world leader in sealing and lubrication solutions for the food and beverage industry for over 130 years, uses ISO 14000 to help focus its research and development into new types and applications of lubrication for the food and beverage industry.

Put simply, the ISO 14000 standards are there with the intention to do no harm to workers, the environment and to make things last as long as they can, reducing the need to replace, or produce more before it is needed. This approach lies at the heart of circular economy thinking.

Five questions you need to ask to save costs and get it right

While the total costs for lubrication represent just a sliver of the overall operational plant costs, estimates suggest around one per cent, the cost of getting lubrication wrong is significantly worse.

Industrial and scientific experts agree that the primary cause of industrial equipment wear and failure is a lack of the right lubrication. In 2014, Ken Bannister's "State of the Lubrication Nation" suggested that it is the cause around 70 per cent of the time. The report also calculated U.S. losses from lubrication issues to be one trillion dollars annually. Estimates do vary, but it's clear that the number of lube-related machine failures is far too high.

One thing is clear, consistent lubrication is critical to extending the life of a mechanical system. Not every lubricant is the same however, as there are many types of preparation and production which require very specific properties from a lubricant.

There are five key questions you should ask to decide whether you have the correct lubricant:

1. Is it the right technology for the application?
2. How much lubrication is the correct amount?
3. How often should the lubrication be reapplied?
4. Is it supported by the right delivery and training?
5. How can we monitor and adjust if needed?

Finding the right lubricant is about weighing up these operational parameters alongside the key performance indicators for each lubricant. The right lubricant must minimise or eliminate the impact of operational variables on the equipment and mechanisms.

This is where A.W. Chesterton Company comes into play. While the major oil companies provide competitive products through scale and volume, Chesterton® draws on its industry experience to provide high-performance use-case lubricants for select industries. With extensive customer experience in the food and beverage industry, the Chesterton team bring a unique understanding of plant operations, as well as the expertise to improve equipment efficiencies and uptime.

Plant operators choose 650 AML for operational reliability and worker safety

As an example, increasingly at food and beverage plants around the world, customers are choosing to switch from using USP white oil to Chesterton 650 Advanced Machinery Lubricant (650 AML) for its properties. It is food safe, has excellent water absorption and displacement properties, has detergency, is odourless and is also readily biodegradable.

CASE STUDIES

Enhancing filling operations with 650 AML

At a food processing plant in Philadelphia in the U.S., serving containers on a filling line for pre-packaged sauces and creams were causing issues at start-up. Moisture would build up inside and around the pneumatic cylinder control valves and cause delivery problems, particularly after a three-day holiday. The customer was using USP white oil as an NSF H1 lubricant, however despite being food safe, its water elimination properties were not displacing water from the pneumatic systems.

The customer saw immediate benefits after switching out USP white oil for Chesterton 650 AML, which is NSF H1 certified and has excellent water elimination properties. Aside from solving the problem of sticky valves at start-up, maintenance personnel noticed that water no longer accumulated within the cylinders. The actuators and solenoid valves also looked and worked like they were brand new. With 650 AML being an irritation free product, it also improved the worker environment so much, that the factory made the choice to switch from USP white oil to 650 AML right throughout the plant.



High speed filling line



Chesterton 650AML added into the in-line oiler

Improving the reliability of pneumatic equipment

Also in Philadelphia, operators at a meat processing plant were having issues with USP white oil as the lubricant for a sausage casing machine that used pneumatics to clip and seal sausages. After six weeks of using the oil, a sticky residue would cover the solenoid surface and cause a malfunction. Plant operators were looking for a way to reduce the time spent cycling and cleaning the residue from the machine.

The team were recommended to switch to 650 AML, as it has excellent detergency and cleans the surface while it operates, while its excellent thermal stability slows down the formation of residue and varnish. Following the switch, the operators were able to more than double the operational time between a cycle without issue. In addition, workers noted that the system was not as noisy as it had been before the switch.



CONCLUSION

In a competitive landscape like the food and beverage industry, where high speed filling lines and unique food production applications need to consistently deliver peak performance, having the right lubrication can make all the difference. Plant operators should check to make sure they have a superior lubricant with the right chemical and physical properties to maintain their uptime and their profitability.

Want to know more?

Visit [Chesterton](#) to discover more about industrial lubricant solutions for the food and beverage industry, or send your enquiry to: enquiries_apac@chesterton.com and speak to one of our experts to discover the right lubrication solution for your business.