Tower Oil
& Technology Co.

WHY BIODEGRADABLE?

Why is biodegradability of a lubricant important? The significance of this question is realized by the fact that media publicity surrounding various crude oil spills have sensitized a lot of people. Even small amounts of an oil-based lubricant are easily visible on a lake or pond. Since a portion of lubricants used is not recoverable, lubricants can reach the natural environment by many routes. Biodegradability becomes a concern if a lubricant is expected to enter the natural environment directly or via a POTW (Publicly Owned Treatment Works) after or during its normal use. This does not include major spillage, misuse, or failure of the user to dispose of the used lubricant properly.

According to ASTM (American Society for Testing and Materials), biodegradation is the process of chemical breakdown or transformation of a material caused by organisms or their enzymes. Biodegradability means that a material has the proven capability to decompose into nontoxic soil, water, carbon dioxide or methane within three years in the particular environment into which this material is being disposed. Biodegradation can take place as *anaerobic* or *aerobic*. *Anaerobic* biodegradation takes place in the absence of oxygen. It commonly occurs in waterlogged or compacted soil, sediment, deep lakes or oceans, and some parts of sewage treatment plants. Although *anaerobic* environments are important in nature, they are not an issue in the final disposition of many lubricants. *Aerobic* biodegradation requires oxygen. All environments exposed to open air are *aerobic*. *Aerobic* biodegradation is generally faster than *anaerobic*. Most biodegradation tests mimic fresh-water (aquatic) *aerobic* environments.

The *aerobic* biodegradation process consists of lubricant (containing carbon, hydrogen, oxygen, phosphorus, sulfur, nitrogen and other elements) plus oxygen plus microorganism (bugs/inoculum) in a water environment. This results in conversion to carbon dioxide, water and microorganisms. Primary biodegradation demonstrates the ability of the tested material to degrade readily and it is commonly measured by determining the extent of disappearance of a physical or chemical property. Ultimate biodegradation has occurred when the lubricant is completely degraded into soil, water, carbon dioxide or methane. It can be estimated by measurement of carbon dioxide production, oxygen consumption (depletion), or loss of dissolved organic carbon. If primary biodegradation does not occur, ultimate biodegradation cannot occur. If primary biodegradation occurs, ultimate biodegradation is possible, but not guaranteed.

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Factors that influence biodegradation are the specific lubricant properties (hydrocarbon structure, composition, concentration, viscosity, additives present, freshness, toxicity) and system conditions to which lubricant may be exposed (*aerobic*/*anaerobic* microorganisms, nutrient concentrations, oxygen supply, humidity, temperature, pH). Current thinking is that a majority of oil-based lubricants in the marketplace are, at best, only slightly biodegradable. Water-based "synthetic" lubricants have the advantage of better biodegradability than oil-based compositions. Seed and vegetable oil based products are generally biodegradable. Although suppliers may claim their products are "biodegradable", it is in the best interests of the end user of such products to check with local municipalities before discharging them into sewers. As environmental concerns increase, biodegradability will become a higher priority as a desirable lubricant property.

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