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Standard Terminology Relating to Biodegradability and Ecotoxicity of Lubricants[1]

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1. Scope

1.1 This terminology covers definitions relating to biodegradability and ecotoxicity of lubricants.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D5864 Test Method for Determining Aerobic Aquatic Biodegradation of Lubricants or Their Components

D6139 Test Method for Determining the Aerobic Aquatic Biodegradation of Lubricants or Their Components Using the Gledhill Shake Flask

3. Terminology

activated sludge, *n*—the precipitated solid matter, consisting mainly of bacteria and other aquatic microrganisms, that is produced at a domestic wastewater treatment plant; activated sludge is used primarily in secondary sewage treatment to microbially oxidize dissolved organic matter in the effluent. **D6139**

acute ecotoxicity, *n*—the propensity of a test material to produce adverse behavioral, biochemical, or physiological effects in non-human organisms or populations in a short period, usually not constituting a substantial portion of the life span.

acute ecotoxicity test, *n*—a comparative ecotoxicity test in which a representative subpopulation of organisms is exposed to different treat rates of a test material and is observed for a short period, usually not constituting a substantial portion of their life span.

aerobic, *adj*—(*1*) taking place in the presence of oxygen; (*2*) living or active in the presence of oxygen. **D6139**

biodegradation, *n*—the process of chemical break-down or transformation of a substance caused by organisms or their enzymes. **D5864**

biomass, *n*—any material, excluding fossil fuels, which is or was, a living organism or component of a living organism.

blank, *n*—*in biodegradability testing*, a test system containing all system components with the exception of the test material.

chronic ecotoxicity test, *n*—a comparative ecotoxicity test in which a representative subpopulation of organisms is exposed to different treat rates of a test material and is observed for a period of time which constitutes a major portion of their life span.

ecotoxicity, *n*—the propensity of a test material to produce adverse behavioral, biochemical, or physiological effects in non-human organisms or populations.

effect load XX (ELXX), *n*—a statistically or graphically estimated loading rate of test material that is expected to cause one or more specified effects in XX % of a representative subpopulation of organisms under specified conditions.

DISCUSSION—This terminology should be used instead of the standard ECXX when the test material is not completely soluble at the test treat rates.

environmental compartment, *n*—a subdivision of the environment based on physical or chemical properties, or both.

DISCUSSION—Examples of environmental compartments are aerobic fresh water, aerobic marine, aerobic soil, and anaerobic media. The results of test procedures may be applied to environmental compartments, but the test systems do not constitute an environmental compartment.

fresh water environment, *n*—the aerobic, aqueous compartment, characteristically with a salinity of less than five parts per thousand.

good laboratory practices (GLP), *n*—guidelines for the management of laboratory experiments which are published by regulatory agencies or other recognized groups, and are concerned with the organizational process and the conditions under which laboratory studies are planned, performed, monitored, recorded, and reported.

DISCUSSION—The major GLPs used are USEPA-TSCA, USFDA, OECD, and to some extent, the MITI version from Japan, for submissions in Japan.

inhibition load XX (ILXX), *n*—a statistically or graphically estimated loading rate of test material that is expected to

[1] This terminology is under the jurisdiction of ASTM Committee D02 on Petroleum Products and Lubricants and is the direct responsibility of D02.12 on Environmental Standards for Lubricants.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

cause a XX % inhibition of a biological process (such as growth or reproduction) of a representative subpopulation of organisms under specified conditions and is expressed as an analog as opposed to digital measure.

DISCUSSION—An example of a digital measure would be alive/dead. This terminology (ILXX) should be used instead of the standard ICXX when the test material is not completely soluble at the test treat rates.

inoculum, *n*—living spores, bacteria, single celled organisms, or other live materials that are introduced into a test medium.

lethal load XX (LLXX), *n*—a statistically or graphically estimated loading rate of test material that is expected to be lethal to XX % of a subpopulation of organisms under specified conditions.

DISCUSSION—This terminology should be used for lubricants instead of the standard LCXX to designate that the material is not completely soluble at the test treat rates.

loading rate, *n*—the ratio of test material to aqueous medium used in the preparation of WAF, WSF, or mechanical dispersion and in the interpretation of the results of a toxicity study with a poorly water-soluble lubricant or lubricant component.

mechanical dispersion, *n*—a low energy aqueous medium produced by continuous stirring of the test solution and containing both dissolved and undissolved components of the test material.

microbial degradation, *n*—synonym for biodegradation.

mixed liquor, *n*—*in sewage treatment*, the contents of an aeration tank including the activated sludge mixed with primary effluent or the raw wastewater and return sludge.

pre-adaptation, *n*—the incubation of an inoculum in the presence of the test material which is done prior to the initiation of the test and under conditions similar to the test conditions. D6139

primary biodegradation, *n*—degradation of the test material by microorganisms resulting in a change in the test material's physical or chemical properties, or both.

primary biodegradation test, *n*—a test that monitors the disappearance of a test material by measuring some physical attribute of the material.

DISCUSSION—The extent to which the results of a primary biodegradation test correspond to the biological conversion of the test material will depend on the attribute which is being measured. An example of a measurement of a physical attribute is infrared (IR) measurement of the C-H bond of a methylene carbon at 2930 cm^{-1} for the CEC (Coordinating European Council) biodegradation test.

salt water, *n*—the aerobic, aqueous compartment, characteristically with a salinity equal to or greater than five parts per thousand.

sonication, *n*—the act of subjecting a material to the shearing forces of high-frequency sound waves.

DISCUSSION—Sonication of a two-phase liquid system may result in the dispersal of one phase as fine droplets in the other phase.

supernatant, *n*—the liquid above settled solids.

terrestrial (or soil) environment, *n*—the aerobic environmental compartment which is found in and on natural soils.

theoretical CO_2 (carbon dioxide), *n*—the amount of carbon dioxide which could hypothetically be produced from the complete biological oxidation of all the carbon in a material.

DISCUSSION—The appropriate abbreviation is $ThCO_2$.

theoretical O_2(oxygen), *n*—the amount of oxygen that is theoretically required to oxidize a material.

DISCUSSION—The appropriate abbreviation is ThO_2.

toxicity, *n*—the propensity of a test material to produce adverse behavioral, biochemical, or physiological effects in a living organism.

ultimate biodegradation, *n*—degradation achieved when the test material is totally utilized by microorganisms, resulting in the production of carbon dioxide (and possibly methane, in the case of anerobic biodegradation), water, inorganic compounds, and new microbial cellular constituents (biomass or secretions, or both).

ultimate biodegradation test, *n*—a test which estimates the extent to which the carbon in a material is converted to carbon dioxide or methane, either directly by measuring the production of carbon dioxide O_2 or methane, or indirectly by measuring the consumption of oxygen.

DISCUSSION—The measurement of new biomass is usually not attempted.

water accommodated fraction (WAF), *n*—the predominantly aqueous portion of a mixture of water and a material poorly soluble in water which separates in a specified period of time after the mixture has undergone a specified degree of mixing and which includes water, dissolved components, and dispersed droplets of the poorly water soluble material.

DISCUSSION—The composition of the WAF depends on the ratio of poorly soluble material to water in the original mixture as well as on the details of the mixing procedure.

water soluble fraction (WSF), *n*—the filtrate or centrifugate of the water accommodated fraction which includes all parts of the WAF except the dispersed droplets of the poorly soluble material.

wppm, *abbr.*—an abbreviation for part per million by weight.