

Glossary

Frederick J. Passman, Ph.D.¹

RECOGNIZING THAT MANY OF this Manual's readers may be unfamiliar with microbiological and filtration terms used in Chapters 1, 2, and 3, this glossary has been compiled as a quick reference. Additional definitions may be found in the *Terminology* section of each of the ASTM standards compiled in this Manual. In particular, Guide D 6469 *Microbial Contamination in Liquid Fuels and Fuel Systems* provides definitions for 30 terms relevant to the discussion of microbial contamination.

Where possible, the definitions provided in this glossary were drawn from the ASTM Dictionary of Engineering, Science, and Technology. The source standard and responsible committee are listed after each definition. Several definitions are drawn from other sources. When this was done, the source was identified after the definition. Finally, the author conjured or embellished definitions for a few terms, or added as *discussion*. These definitions are identified with the author's initials: FJP.

alga (pl. *algae*), *n.*—any of a group of chiefly aquatic mono cellular plants with chlorophyll often masked by a brown or red pigment. **D 6161, D19**

antimicrobial pesticide, *n.*—chemical additive registered under 40CFR152, for use to inhibit growth, proliferation or both of microorganisms. (Synonyms: biocide, microbicide) **E 2169, E35**

anoxic, *adj.*—oxygen free. **D 6469, D02**

bacterium (pl. *bacteria*), *n.*—a simple, single cell microorganism characterized by the absence of defined intracellular membranes that define all higher life forms.

Discussion—All bacteria are members of the biologically diverse kingdoms: *Prokaryota* and *Archaeobacteriota* (recently assigned kingdom status as the Archaea). Individual taxa (phyla, families, genera, species and strains) within these kingdoms are able to thrive in environments ranging from sub-zero temperatures such as in frozen foods and polar ice, to superheated waters in deep-sea thermal vents, and over the pH range < 2.0 to > 13.0. Potential food sources range from single carbon molecules (carbon dioxide and methane) to large hydrocarbons and complex polymers, including plastics. Oxygen requirements range from obligate anaerobes, which die on contact with oxygen, to obligate aerobes, which die if oxygen pressure falls below a minimum threshold which is species specific. **D 6469, D02**

Beta-ratio (β_x where x = particle size), *n.*—the ratio of number of particles of known size ($> x \mu\text{m}$) entering a filter to the number of those particles passing through that filter.

Discussion—for example if 500 particles $\geq 10 \mu\text{m}$ diameter are filtered and 50 pass through the filter, $\beta_{10\mu\text{m}} = 10$. Filter performance, in terms of particle retention, increases as the beta-ratio increases.

FJP adapted from *Filtration Technology*, Parker Filtration, Cleveland OH, 1997, pp. 1–284.

biocide, *n.*—a poisonous substance that can kill living organisms. **D 6469, D02**

biodeteriogen, *n.*—an organism capable of causing biodeterioration.

<http://www.rocmaquina.es/ingles/Publications/technic/biodeterioration.htm>

biodeterioration, *n.*—the loss of commercial value and/or performance characteristics of a product (fuel) or material (fuel system) through biological processes. **D 6469, D02**

biofilm, *n.*—a film or layer of microorganisms, biopolymers, water, and entrained organic and inorganic debris that forms as a result of microbial growth and proliferation and proliferation at phase interfaces (liquid-liquid, liquid-solid, liquid-gas, etc.). (synonym: *skinnogen layer*) **D 6469, D02**

biomass, *n.*—density of biological material per unit sample volume, area or mass (g biomass / g (or / mL or / cm²) sample). **D 6469, D02**

biosurfactant, *n.*—a biologically produced molecule that acts as a soap or detergent. **D 6469, D02**

Discussion—These materials may produce and stabilize emulsions of water in fuel. **FJP**

coalesce, *n.*—a filter element designed to cause water droplets to coalesce.

coalescence, *n.*—the merging of two or more liquid particles to form a single (larger) liquid particle. **E 1620, E29**

consortium (pl. *consortia*), *n.*—microbial community comprised of two or more than one species that exhibits properties not shown by individual community members.

Discussion—Consortia often mediate cause or create biodeterioration processes that individual taxa cannot. **D 6469, D02**

depth filter, *n.*—filtration medium comprised of either fibers (for example: spun glass) or particles (for example: activated carbon or clay) designed to entrap contaminants both within the matrix and on the surface of the medium.

¹ President, Biodeterioration Control Associates, Inc., PO Box 3659, Princeton, NJ 08543-3659.

Discussion—As particles are trapped within a depth filter's matrix, they improve its performance until such time as the particle load impedes fluid flow and the benefits of filtration efficiency are offset by the disadvantages of flow restriction.

FJP adapted from: http://www.pall.com/catalogs/oem_health/concepts.asp

Filter water separator (FWS), *n.*—a device used in fuel distribution systems for removal of solids (usually down to 1 μm) and water (usually down to < 15 ppm) from fuel.

Discussion—Typically the device will consist of several coalescer elements and a separator element. API / IP 1581

fuel polishing, *n.*—a process to clean fuel in which filtration, centrifugation or both are used to clarify fuel by removing water, particulates, or both. **FJP**

fungus (pl. **fungi**), *n.*—single cell (yeasts) or filamentous (molds) microorganisms that share the property of having the true intracellular membranes (organelles) that characterize all higher life forms (*Eukaryotes*). **D 6469, D02**

metabolite, *n.*—a chemical substance produced by any of the many complex chemical and physical processes involved in the maintenance of life. **D 6469, D02**

microbially influenced corrosion (MIC), *n.*—corrosion that is initiated or enhanced by the action of microorganisms in the local environment. **D 6469, D02**

Discussion—MIC can cause pitting corrosion in steel tanks and pipes.

microbicide, *n.*—see antimicrobial pesticide.

nominal pore size (NPS), *n.*—the minimum size particle that the medium is designed to trap as a percentage of effi-

ciency for that size (for example, the NPS for filter that retains a minimum of 95% of all particles $\geq 5.0 \mu\text{m}$ is 95% at 5.0 μm).

Discussion—In common usage, only the pore dimension is stated. In the example given above, the filter would be described simply as a 5 micron NPS filter.

FJP adapted from *Filtration Technology*, Parker Filtration, Cleveland OH, 284 pp., 1997

porosity, *n.*—the ratio of the volume of air or void contained within the boundaries of a material to the total volume (solid matter plus air or void) expressed as a percentage. **D 123, D13**

Discussion—Porosity (n) = $V_{\text{void}} \div V_{\text{total}}$ where V_{void} is the volume occupied by fluids (fuel, air and water) and V_{total} is the total volume of the filter.

rag layer, *n.*—in inhomogeneous invert emulsion of fuel in water that may develop as a layer between two phases, such as water and fuel.

Discussion—the rag layer may be comprised of bubbles ranging from < 5 μm to > 1 mm which may be visible, along with entrained sediments. The blend of entrained oil and sediment particles typically gives the rag layer a dirty appearance. (Synonyms: invert emulsion layer; Lacy emulsion layer). **GCH & FJP**

sediment load, *n.*—a general term that refers to material in suspension or in transport, or both; it is not synonymous with either discharge or concentration. **D 4410, D19**

suspended solids (SS), *n.*—solid organic and inorganic particles that are held in suspension in a liquid. **D 6161, D19**