



# Standard Terminology Relating to Biotechnology<sup>1</sup>

This standard is issued under the fixed designation E1705; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope\*

1.1 This document is composed of terms, definitions of terms, descriptions of terms, and acronyms used in ASTM documents related to the field of biotechnology. Terms that are adequately defined in a general dictionary are not defined in this terminology standard.

1.2 This standard includes terminology used in biotechnology areas, such as, but not limited to: biological drug products, materials for biotechnology, characterization and identification of biological systems, aseptic sampling, preservation of biological samples, membrane filters, molecular biology, biomass conversion, fuel manufacturing facilities, and fuel analysis.

## 2. Referenced Documents

### 2.1 ASTM Standards:<sup>2</sup>

[E870 Test Methods for Analysis of Wood Fuels](#)

[E1126 Terminology Relating to Biomass Fuels](#) (Withdrawn 2003)<sup>3</sup>

[E1287 Practice for Aseptic Sampling of Biological Materials](#) (Withdrawn 2008)<sup>3</sup>

[E1344 Guide for Evaluation of Fuel Ethanol Manufacturing Facilities](#)

[E1357 Test Method for Determining the Rate of Bioleaching of Iron From Pyrite by \*Thiobacillus Ferrooxidans\*](#) (Withdrawn 2010)<sup>3</sup>

### 2.2 Federal Standards:

[Title 21, Code of Federal Regulations \(CFR\), Parts 210 and 211](#)<sup>4</sup>

## 3. Terminology

### 3.1 Definitions:

<sup>1</sup> This terminology is under the jurisdiction of ASTM Committee E48 on Bioenergy and Industrial Chemicals from Biomass and is the direct responsibility of Subcommittee E48.91 on Terminology.

Current edition approved June 1, 2015. Published June 2015. Originally approved in 1995. Last previous edition approved in 2013 as E1705–13. DOI: 10.1520/E1705-15.

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

<sup>3</sup> The last approved version of this historical standard is referenced on [www.astm.org](http://www.astm.org).

<sup>4</sup> Available from Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098, <http://dodssp.daps.dla.mil>.

**aerobic**—able to live, grow, or take place only where free oxygen is present. **E1126**

**aerobic fermentation**—fermentation processes that require the presence of air. **E1126**

**anaerobic**—living or active in an airless environment. **E1126**

**anaerobic bacteria**—microbes whose metabolisms require the absence of free oxygen. **E1126**

**anaerobic digester**—a chemical reactor in which anaerobic bacteria are used to decompose biomass or organic wastes to produce methane and carbon dioxide. **E1126**

**anaerobic digestion**—degradation of organic matter by microbes in the absence of air (oxygen) to produce methane and carbon dioxide (biogas). **E1126**

**anaerobic fermentation**—fermentation processes conducted in the absence of air. The following anaerobic fermentation processes are significant in obtaining useful forms of energy from biomass: (1) alcoholic fermentation, fermentation processes whereby certain microorganisms convert glucose and other substrates with alcohol as an end product, (2) methane fermentation, generally termed anaerobic digestion (See also **anaerobic digestion**). **E1126**

**anhydrous**—a material that does not contain water either absorbed on its surface or as water of crystallization; a water-free product. **E1126**

**aseptic sampling**—sampling process in which no extraneous microorganisms or substances are introduced into the sample or its original bulk material as a result of the sampling system and activity. **E1287**

**ash**—inorganic residue remaining after combustion, determined by definite prescribed methods. **E1126**

**ash fusion temperature**—melting point of ash, usually expressed in degrees Fahrenheit. Variations include oxidizing atmosphere or reducing atmosphere, initial softening, or final fluid temperature. Some specifications include two intermediate points between initial softening and final fluid. **E1126**

**bagasse**—residue remaining after extraction of a sugar-containing juice from plants like sugar cane. **E1126**

\*A Summary of Changes section appears at the end of this standard

- bioconversion**—a general term describing the use of biological systems to transform one compound into another. Examples are digestion of organic wastes or sewage by microorganisms to produce methane. **E1126**
- biofuel**—biomass-derived fuel. **E1126**
- biomass**, *n*—substance wholly comprised of living or recently living (non-fossil) material.  
 DISCUSSION—Sometimes referred to as renewable organic material, examples of biomass include whole, or parts of, plants, trees, aquatic organisms, animals, algae, and microorganisms.  
 DISCUSSION—When considered as an energy source, biomass may be further subdivided into: (1) primary biomass—rapidly growing plant material that may be used directly or after a conversion process for the production of energy, and (2) secondary biomass—biomass residues remaining after the production of fibre, food, or other products of agriculture, or biomass by-products from animal husbandry or food preparation that are modified physically rather than chemically. Examples include waste materials from agriculture, forestry industries, and some municipal operations (manure, saw dust, sewage, etc.) from which energy may be produced.
- biomass fuel**—fuel derived from biomass. **E1126**
- corn stover**—the stalks of the maize plant. **E1126**
- current good manufacturing practices (CGMP)**—current regulations published by the United States Food and Drug Administration (FDA) regarding manufacturing, processing, packaging and storing of drug and biological products. **E1287**
- dead leg**—any inactive, trapped or stagnant zone of a biological fluid that is to be sampled aseptically where this liquid zone would not be representative of the bulk fluid that is to be sampled. This “dead leg” zone could deviate from the bulk system in oxygen content, nutrients levels, material composition, temperature, bacterial contamination, and other process variables that would prevent any sample drawn through this system from representing the bulk fluid quality to be tested. **E1287**
- denatured fuel ethanol**—fuel ethanol to which chemicals (denaturants) have been added to make the ethanol unfit for human consumption in accordance with the regulations of the Bureau of Alcohol, Tobacco, and Firearms of the U.S. Treasury Department. **E1126**
- densified particulate biomass fuels**—a fuel made by mechanical compression of biomass to increase the bulk density and to press the fuel into a specific shape, such as pellets and briquettes. The fuel can have a maximum volume of 16.39 cm<sup>3</sup> (1 in.<sup>3</sup>) such that the largest dimension is 7.62 cm (3 in.). **E1126**
- digester**—a bioreactor in which anaerobic bacteria are used to decompose biomass or organic wastes into methane and carbon dioxide. **E1126**
- distillate**—the overhead product of distillation such as ethanol liquid from the top of a beer still. **E1344**
- dry basis moisture content**—of biomass fuels, the ratio of the weight of the water in a sample to the weight of the dry material. It is expressed as a percent. **E1126**
- ethanol (ethyl alcohol, grain alcohol)**—CH<sub>3</sub>CH<sub>2</sub>OH; can be produced chemically from ethylene or biologically from the fermentation of various sugars from carbohydrates found in agricultural crops and cellulosic residues from crops or wood. **E1126**
- fermentation**—decomposition of organic compounds, by microorganisms, to fuels and chemicals such as alcohols, acids, and energy-rich gases. **E1126**
- fermentation fuel**—a fuel produced by fermentation of biomass. **E1126**
- fixed carbon**—carbon remaining after heating in a prescribed manner to decompose thermally unstable components and to distill volatiles. **E1126**
- fuel alcohol**—ethyl, methyl, or higher alcohols with impurities (including water but excluding denaturants) produced for use as a fuel alone or as an addition to other fuels, such as gasoline. **E1126**
- fuel ethanol**—ethanol with impurities (including water but excluding denaturants). **E1126**
- fuel ethanol manufacturing facility**—a manufacturing facility of any size designed to produce fuel ethanol by a fermentation process. **E1126**
- furfural**—an aldehyde derivative of certain biomass conversion processes, used as a solvent. **E1126**
- fusel oil**—a clear, colorless, poisonous, liquid mixture of alcohols obtained as a by-product of grain fermentation; generally amyl, isoamyl, propyl, isopropyl, butyl, and isobutyl alcohols and acetic and lactic acids. **E1126**
- gasification**—any chemical or heat process used to convert a feedstock to a gaseous fuel. **E1126**
- gasifier**—a device that converts solid fuel to gas. Generally refers to thermochemical processes. Major types are moving bed (fixed bed), entrained bed, and fluidized bed. **E1126**
- herbaceous plants**—nonwoody species of vegetation, usually of low lignin content such as grasses. **E1126**
- hogged fuel**—ground wood fuel that is usually a by-product of a wood products manufacturing process. **E1126**
- landfill gas**—biogas produced from the natural degradation of the organic material in landfills. **E1126**
- lignin**—the noncarbohydrate, polyphenolic, structural constituent of wood and some other plant tissues that encrusts the cell walls and cements the cells together. **E1126**
- methanogenic bacteria**—microorganisms capable of producing methane. **E1126**
- methanol (methyl alcohol, wood alcohol)**—an alcohol, CH<sub>3</sub>OH, formed by catalytically combining carbon monoxide (CO) with hydrogen (H<sub>2</sub>) in a 1:2 ratio, under high temperature and pressure. Commercially, it is often manufactured by steam reforming natural gas. It is also formed in the destructive distillation of wood. **E1126**

- moisture content**—the amount of water contained in the biomass, expressed as either a percentage of the mass of the oven-dry biomass or of the wet biomass, moisture content, dry basis. **E1126**
- municipal solid wastes (MSW)**—the refuse materials collected from urban areas in the form of organic matter, glass, plastics, waste paper, etc., not including human wastes. **E1126**
- particulate wood fuel**—any wood fuel with a maximum particle volume of 16.39 cm<sup>3</sup> (1 in.<sup>3</sup>) such that the largest dimension is 7.62 cm (3 in.). **E1126**
- pathogenic**—disease causing. **E1287**
- pelletized biomass fuel*—see **densified particulate biomass fuels**. **E1126**
- proximate analysis**—the determination, by prescribed methods, of moisture, volatile matter, fixed carbon (by difference), and ash. The term **proximate analysis** does not include determinations of chemical elements or determinations other than those named. **E1126**
- proximate analysis**—an assay of the moisture, ash, volatile matter, and fixed carbon as determined by prescribed test methods. Other constituents such as sulfur and phosphorus are not included. **E870**
- pyrolysis**—the breaking apart of complex molecules by heating (over the range from 392° to 932° (200° to 500°C)) in the absence of oxygen, producing solid, liquid, and gaseous fuels. **E1126**
- quad**—one quadrillion (10<sup>15</sup>) Btu. **E1126**
- refuse-derived fuel (RDF)**—fuel processed from industrial waste, municipal waste, garbage, or sewage sludge. **E1126**
- refuse derived fuel 3 (RDF-3)**—as defined by Committee E-38 on Resource Recovery, RDF-3 is a shredded fuel derived from municipal solid waste (MSW) that has been processed to remove metal, glass, and other inorganics. The material has a particle size such that 95 % weight passes through a 2 in. square mesh screen. **E1126**
- renewable energy resources**—sources of energy that are regenerative or virtually inexhaustible, such as solar, wind, ocean, biomass, municipal wastes, and hydropower energy. Geothermal energy is sometimes also included in the term. **E1126**
- sterile**—free of any living organism. **E1287**
- stover**—the dried stalks and leaves of a crop remaining after the grain has been harvested. **E1126**
- syngas**—the synthetic gas resulting from incomplete combustion or pyrolysis of organic material to primarily carbon monoxide and hydrogen. (See also **synthesis gas**.) **E1126**
- synthesis gas**—mixtures of gas in suitable proportions for the production of synthetic products without adding further reactants, such as carbon monoxide and hydrogen, for synthesis of methanol. **E1126**
- total weight basis moisture content**—of biomass fuels, the ratio of the weight of the water in a sample to the weight of the wet material. It is expressed as a percent (also called wet basis moisture content). **E1126**
- ultimate analysis**—the determination of carbon and hydrogen in the material, as found in the gaseous products of its complete combustion, the determination of sulfur, nitrogen, and ash in the material as a whole, and the calculation of oxygen by difference. **E870**
- ultimate analysis**—the determination of the elemental composition of the organic portion of carbonaceous materials as well as the total ash and moisture. Determined by prescribed methods. **E1126**
- vacuum distillation**—the separation of two or more liquids under reduced vapor pressure; reduces the boiling points of liquids being separate. **E1126**
- validation**—the quality assurance evaluation of an item of equipment or overall process wherein the equipment or process, or both, is challenged to perform under the “worst case” conditions of process variables and applicable micro-organism contamination to meet preestablished acceptance criteria. **E1287**
- volatile matter**—those products, exclusive of moisture, given off by a material as gas or vapor, determined by definite prescribed methods that may vary according to the nature of the material. **E1126**
- wet-basis moisture content**—the moisture content expressed as the ratio of the weight of water in the fuel to the total weight of the fuel. **E1126**
- wet basis moisture content*—see **total weight basis moisture content**. **E1126**
- wood fuel**—fuel derived from biomass composed of woody trees or shrubs. **E1126**

### 3.2 Definitions of Terms Specific to This Standard:

- soluble iron**—the determination of “soluble iron” used in this test method corresponds operationally to the “complexed and dissolved” iron determination described by Vuorinen et al.<sup>5</sup> in their study of the species of iron released from pyrite oxidation by *T. ferrooxidans*. They found that values of complexed and dissolved iron corresponded closely with “total iron” as determined after hot sulfuric acid digestion of samples, particularly at 1 to 2 % pulp density. **E1357**

<sup>5</sup> Vuorinen, A., Hiltunen, P., Hsu, J.C., and Tuovinen, O.H., “Solubilization and Speciation of Iron During Pyrite Oxidation by *Thiobacillus ferrooxidans*,” *Geomicrobiology Journal*, Vol 3, 1983, pp. 95–120.

**SUMMARY OF CHANGES**

Committee E48 has identified the location of selected changes to this standard since the last issue (E1705–13) that may impact the use of this standard. (Approved June 1, 2015.)

(1) Revised the definition of “biomass.”

*ASTM International takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.*

*This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, at the address shown below.*

*This standard is copyrighted by ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, United States. Individual reprints (single or multiple copies) of this standard may be obtained by contacting ASTM at the above address or at 610-832-9585 (phone), 610-832-9555 (fax), or [service@astm.org](mailto:service@astm.org) (e-mail); or through the ASTM website ([www.astm.org](http://www.astm.org)). Permission rights to photocopy the standard may also be secured from the Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923, Tel: (978) 646-2600; <http://www.copyright.com/>*