



# Standard Practice for Evaluating an Effluent for Flavor Impairment to Fish Flesh<sup>1</sup>

This standard is issued under the fixed designation D 3696; 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 (ε) indicates an editorial change since the last revision or reapproval.

## 1. Scope \*

1.1 This practice describes procedures for determining the potential of an effluent to cause flavor impairment of fish flesh. Fish can be exposed to effluent either caged at contaminated sites adjacent to a discharge, or to dilutions of an effluent in a laboratory. Depending upon the uptake rate of the chemicals from the discharge into the flesh, 1 day to several weeks might be required before an off flavor is detectable. However, an exposure of 10 days is usually adequate. This practice is applicable to fish in either fresh or salt water.

1.2 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.* Specific hazard statements are given in Section 7.

## 2. Referenced Documents

### 2.1 ASTM Standards:

- D 1125 Test Methods for Electrical Conductivity and Resistivity of Water<sup>2</sup>
- D 1126 Test Method for Hardness in Water<sup>2</sup>
- D 1129 Terminology Relating to Water<sup>2</sup>
- D 1192 Specification for Equipment for Sampling Water and Steam<sup>2</sup>
- D 1252 Test Method for Chemical Oxygen Demand (Dichromate Oxygen Demand) of Water<sup>3</sup>
- D 1293 Test Methods for pH of Water<sup>2</sup>
- D 1888 Test Methods for Particulate and Dissolved Matter, Solids, or Residue in Water<sup>2</sup>
- D 2579 Test Methods for Total and Organic Carbon in Water<sup>3</sup>
- D 3250 Test Method for Total Oxygen Demand in Water<sup>3</sup>
- D 3370 Practices for Sampling Water<sup>2</sup>
- E 729 Guide for Conducting Acute Toxicity Tests with Fishes, Macroinvertebrates, and Amphibians<sup>4</sup>
- E 943 Terminology Relating to Biological Effects and Environmental Fate<sup>4</sup>

<sup>1</sup> This practice is under the jurisdiction of ASTM Committee E47 on Biological Effects and Environmental Fate and is the direct responsibility of Subcommittee E47.01 on Aquatic Toxicology.

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<sup>2</sup> Annual Book of ASTM Standards, Vol 11.01.

<sup>3</sup> Annual Book of ASTM Standards, Vol 11.02.

<sup>4</sup> Annual Book of ASTM Standards, Vol 11.05.

E 1192 Guide for Conducting Acute Toxicity Tests on Aqueous Effluents with Fishes, Macroinvertebrates, and Amphibians<sup>4</sup>

E 1810 Practice for Evaluating Effects of Contaminants on Odor and Taste of Exposed Fish<sup>4</sup>

## 3. Terminology

3.1 *Definitions*—For definitions of terms used in this practice, refer to E 943.

3.2 *Description of Terms Specific to This Standard:*

3.3 *flavor impairment*—a detectable flavor deterioration between a test and control sample. Flavor tainting, off flavor, and undesirable flavor are considered synonyms.

3.4 The words “must,” “should,” “may,” “can,” and “might” have very specific meanings in this practice. “Must” is used to express an absolute requirement, that is, to state that the test ought to be designed to satisfy the specified condition, unless the purpose of the test requires a different design. “Must” is only used in connection with factors that directly relate to the acceptability of the test. “Should” is used to state that the specified condition is recommended and ought to be met if possible. Although violation of one “should” is rarely a serious matter, violation of several will often render the results questionable. Terms such as “is desirable,” “is often desirable,” and “might be desirable” are used in connection with less important factors. “May” is used to mean “is (are) allowed to,” “can” is used to mean “is (are) able to,” and “might” is used to mean “could possibly.” Thus the classic distinction between “may” and “can” is preserved, and “might” is never used as a synonym for either “may” or “can.”

## 4. Summary of Practice

4.1 Fish are exposed to an effluent or dilutions of an effluent either in the field or in the laboratory. After an exposure sufficient to allow tainting, fish are removed and fillets are evaluated for flavor impairment using the practice described in E 1810. Fillets are those portions of a fish exclusive of scales, bones, head and fins that are normally consumed. Only live fish should be used for the taste test.

## 5. Significance and Use

5.1 This methodology, although subjective, can detect contamination of a fishery resource. Varying results may be obtained depending on the selection of fish and the sensitivity of participants in the taste panel. Nevertheless, enforcement agencies usually consider water that produces an undesirable

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

flavor to fish flesh to violate water quality standards.

## 6. Apparatus

### 6.1 Field Study:

6.1.1 *Cages*—Cages should be large enough to allow free swimming of the fish. The wire mesh or holes used to provide water circulation into and out of the cage should be small enough to retain small minnows, yet large enough to allow free passage of stream drift organisms. A 5-mm screen has proven satisfactory. See Fig. 1 for a typical fish exposure cage.

6.1.2 *Nets*—Nets used to capture and handle test animals should be pocketed to retain fish. Use soft nets to prevent abrasion of the test fish during handling. Thoroughly wash new nets to remove any textile finish.

### 6.1.3 Chest Waders or Hip Boots.

6.1.4 *Boat*—Depending upon the nature of the study, especially when large rivers, lakes or estuaries are being investigated, a boat is necessary. The type of boat necessary must be matched to the type and size of the water body.

### 6.1.5 Life Preservers

6.1.6 *Holding Cages or Tankage*—Fish should be held in cages or pens placed at clean sites in the river or in aquaria of appropriate size for the fish for at least 10 days before testing. The grams of fish per liter volume of cage, pen, or aquarium should not be so high that it affects the results of the test. Therefore, the loading should be limited to ensure that (1) the concentrations of dissolved oxygen and test material do not fall below acceptable levels, (2) concentrations of metabolic products do not exceed acceptable levels, and (3) the test organisms are not stressed because of aggression or crowding. Suggested loadings for aquaria found in E 729 based on temperature regime should be applied to both cages and aquaria unless data are provided to justify some other loading.

### 6.2 Laboratory Study:

6.2.1 *Flow-Through System*—Many metering systems can be used. Guides E 729 and E 1192 describe suitable systems that are or can be modified for effluents.

6.2.2 *Compressed Air* (oil-free)—A low-pressure high-volume air blower system is ideal for providing air to support life in laboratory aquaria.

6.2.3 *Exposure Aquaria*—Aquaria should be large enough to provide an adequate volume of water and sufficient space for the fish being exposed.

6.2.3.1 Aquaria and other equipment that will contact stock solutions, test solutions, or any water into which test organisms will be placed should not contain substances that can be leached or dissolved by aqueous solutions in amounts that adversely affect test organisms. In addition, aquaria that contact test solutions should be chosen to minimize sorption of test materials from water. Glass, Type 316 stainless steel, nylon, and fluorocarbon plastics should be used whenever possible to minimize dissolution, leaching, and sorption, except that stainless steel should not be used in tests on metals in salt water. Concrete and rigid plastics may be used for holding and conditioning tanks and in the water-supply system, but they should be soaked, preferably in flowing dilution water, for a week or more before use (E 729). Brass, copper, lead, galvanized metal, cast-iron pipe, and natural rubber should not contact test solutions before or during the exposure. Items made of neoprene rubber and other materials not mentioned above should not be used unless it has been shown that either (a) unfed individuals of a sensitive aquatic species do not show more signs of stress, such as discoloration, unusual behavior, or death, when held for at least 96 h in static dilution water in which the item is soaking than when held in static dilution water that does not contain the item, or (b) their use will not adversely affect survival, growth or reproduction of a sensitive species.

### 6.3 Equipment Required for Taste Evaluation:

6.3.1 See ASTM E 1810.

## 7. Hazards

7.1 Follow local water safety laws and practices in field studies. Check with local enforcement agencies, since these laws vary from one area to another. When wading in water, wear boots or chest high waders. Wear a life vest or preserver when wading in deep water or in a boat.

7.2 Do not wash fish that are being cleaned in the field with effluent or the dilution water (river, lake, etc.). Use paper towels to wipe the fish clean. Do not taste fish that are dead in the exposure tank or show any signs of toxic effects, because they might be toxic to the taster or possible tissue deterioration might influence the test results.

7.3 Minimize personal contact with the effluent or dilutions of the effluent because it is always possible that some hazardous material, bacterial, or viral pathogen might be present. Thoroughly clean hands, clothing, and equipment after contact.

7.4 Chemical and microbiological analysis of effluent should be undertaken before exposing fish. Chemical analytes should include metals, volatile and semi-volatile organic compounds, pesticides, and any other chemicals known or believed to be present in the exposure medium. Use appropriate safety equipment when handling effluent and fish.

7.5 When sampling, preparing and performing odor and flavor evaluations, follow all safety precautions described in E 1810.

## 8. Field and Dilution Water

8.1 At a minimum, water quality for field or laboratory water in which fish are exposed for any flavor impairment tests must allow fish to survive with no obvious internal or external lesions forming. For field or dilution water used in laboratory

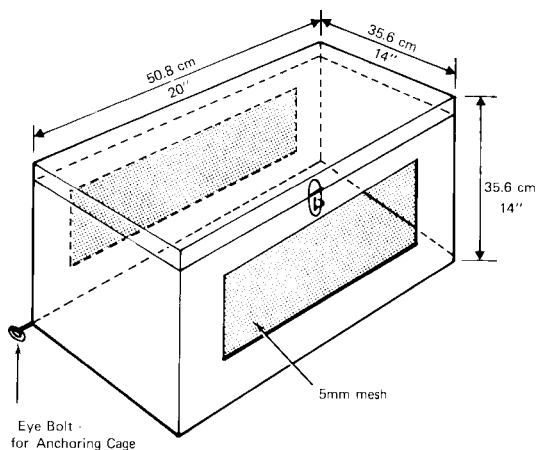


FIG. 1 Fish Cage