



# Standard Test Method for Evaluating Degree of Surface Disfigurement of Paint Films by Microbial (Fungal or Algal) Growth or Soil and Dirt Accumulation<sup>1</sup>

This standard is issued under the fixed designation D 3274; 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.

*This standard has been approved for use by agencies of the Department of Defense.*

## 1. Scope

1.1 The photographic reference standards available for use with this test method provide a numerical basis for rating the degree of fungal and algal growth or soil and dirt accumulation on paint films.

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.*

## 2. Referenced Documents

### 2.1 ASTM Standards:

D 4610 Guide for Determining the Presence of and Removing Microbial (Fungal or Algal) Growth on Paint and Related Coatings<sup>2</sup>

### 2.2 ASTM Adjuncts:

Pictorial Photographic Standards<sup>3</sup>

## 3. Terminology

3.1 *Types of Fungal and Algal Growth*—Fungi are heterotrophs capable of reproducing both asexually and sexually. Asexual reproduction takes place either by the fragmentation of the mycelium or by the production of spores. Sexual reproduction can occur by fusion of gametes, penetration of a gamete into a reproductive structure known as a gametangium, or by fusion of gametangia. Some common definitions include:

3.2 *spore*—an asexual reproductive cell capable of developing into a mature fungus without fusion with another cell.

3.2.1 *Discussion*—Spores tend to be spherical in morphology and are observed singly or in clusters. Spores may or may not be associated with fungal mycelia and can range in a wide variety of colors. Although primarily gray or black, some spores are even green in color and have been mistaken as terrestrial algae. Spores of *Aureobasidium pullulans* magnified 100 $\times$  are shown in Fig. 1.

3.3 *hyphae*—thread-like, tubular, fungal filaments that compose the mycelium. Hyphae may appear individually or have spores attached.

3.3.1 *Discussion*—Hyphae of *Aureobasidium pullulans*, magnified 50 $\times$  are shown in Fig. 2.

3.4 *mycelium*—vegetative mass of hyphae forming the body of a fungus.

3.5 *fruiting body*—fungus structure consisting of specialized hyphae where sexual reproduction occurs.

3.6 Amorphous growth typical of an alga such as *Chlorococcum* Sp. appears in Fig. 3 at a magnification of 39 $\times$ . Terrestrial algae can appear green to dark brown in color.

## 4. Significance and Use

4.1 The growth of fungi and algae in and on the surface of paint films represents a major cause of discoloration or disfigurement of painted surfaces. Because of their dark pigmentation, it is frequently difficult to distinguish fungi and algae from soil or dirt particles. The use of magnification of as much as 100 $\times$  affords easy distinguishability among fungal spores, fungal mycelia, algae, and dirt and is recommended in cases where such difficulty is apparent.

4.2 Dirt accumulation observed on specimens can occur more readily with coatings formulated at lower pigment volume concentration or those containing softer resins.

### 4.3 Use of Photographic Standards:<sup>3</sup>

4.3.1 The photographic reference standards that are part of this test method are for illustration purposes and should be used for visual comparisons.

4.3.2 The photographic standards illustrated in Fig. 4 rate the disfigurement of paint films from 0 to 8. A rating of 10 would indicate a film totally absent of disfigurement by particulate matter.

<sup>1</sup> This test method is under the jurisdiction of ASTM Committee D01 on Paint and Related Coatings, Materials, and Applications and is the direct responsibility of Subcommittee D01.28 on Biodeterioration.

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<sup>2</sup> *Annual Book of ASTM Standards*, Vol 06.01.

<sup>3</sup> Available from ASTM International Headquarters (order Adjunct ADJD3274). Copies of the pictorial photographic standards are contained in the publication *Pictorial Standards of Coating Defects*, which may be obtained from the Federation of Societies of Coating Technology, 492 Norristown Rd., Blue Bell, PA 19422.

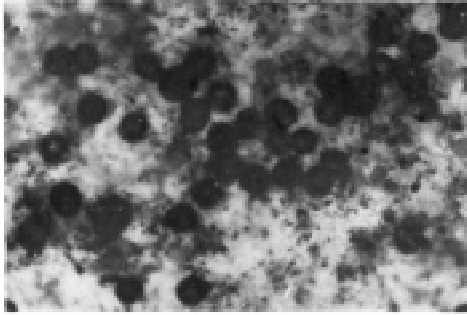


FIG. 1 Spores of *Aureobasidium pullulans*, Magnified 100×

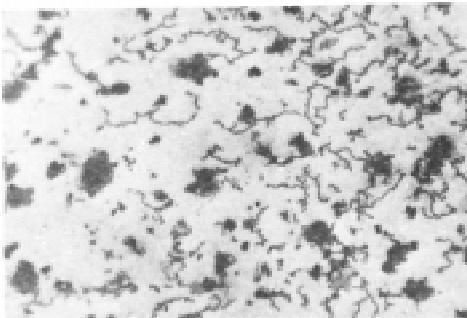


FIG. 2 Hyphae of *Aureobasidium pullulans*, Magnified 50×

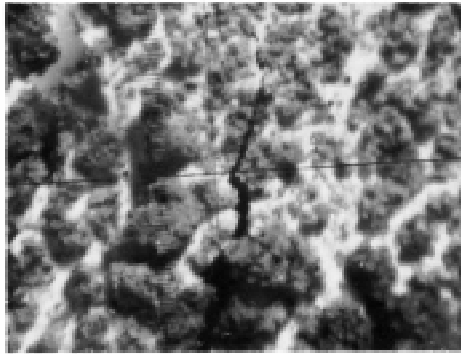


FIG. 3 Amorphous Algal Growth, Magnified 39×

4.3.3 The ratings used in this standard more closely match a nonlinear scale.

## 5. Soil or Dirt Particles

5.1 Soil or dirt particles may range from light brown to black. The particles, viewed at 50× to 100× magnification, are generally amorphous and are frequently translucent. Soil particles on paint magnified 100× are shown in Fig. 5.

## 6. Procedure

6.1 Compare each specimen with the photographic standards associated with this test method to determine which most closely matches the degree of disfigurement on the specimen. When the degree is intermediate between two adjacent standards select the intermediate odd number as the disfigurement rating.

6.2 The density of fungal or algal growth as well as dirt accumulation may vary over the painted surface being evaluated. This variation may be the result of the location of the surface (that is, under an eave of a house *versus* an exposed area), nonuniformity of the substrate, film thickness or other factors. Note such variation when reporting the rating assigned to specimen under test. In examining test specimens for fungal, algal, or dirt disfigurement, make sure that the possibility of failure due to the wood substrate is recognized and reported.

6.3 When microbial disfigurement is detected (or established), distinguish between algal and fungal growth. For the latter, estimate whether spores or mycelia predominate (see Guide D 4610).

NOTE 1—Applying sodium hypochlorite to coatings is optional, however, the invasiveness of this technique may contaminate test substrates that could inhibit future fungal/algal growth.

6.4 If fungal or algal growth is only observed on dirt or soil particles that have accumulated on the specimen, disregard the assignment of a rating. In this case the organism is not actually utilizing the coating as a food source. Make sure that special mention as to this observance is noted as agreed upon between all parties involved with the testing.

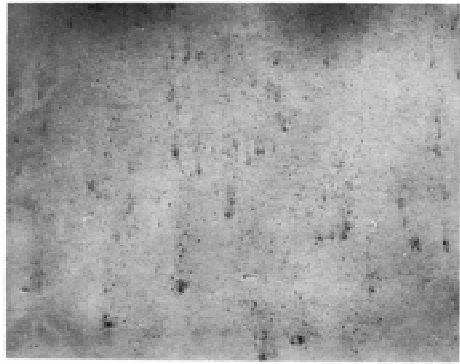
## 7. Report

7.1 Report the numerical disfigurement rating as defined in 4.3.2 and the predominant type, that is, fungi, algae, or soil.

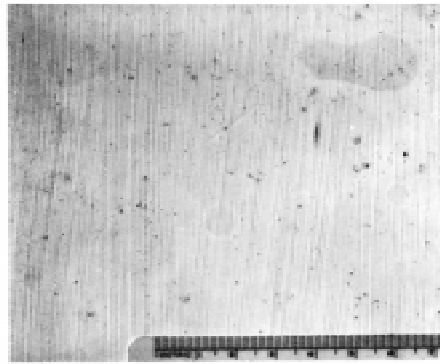
7.2 Make a notation as to the uniformity of the failure noticed on the specimen.

## 8. Keywords

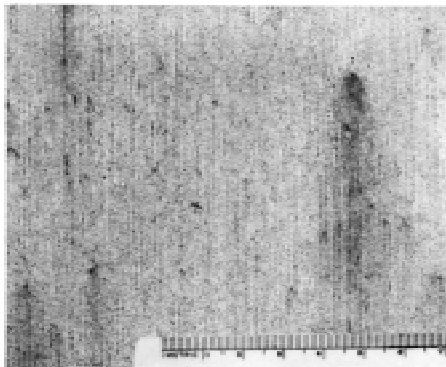
8.1 algal; disfigurement; fungal; photographic standard



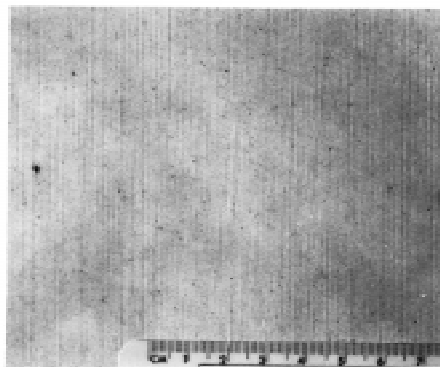
Rating-4



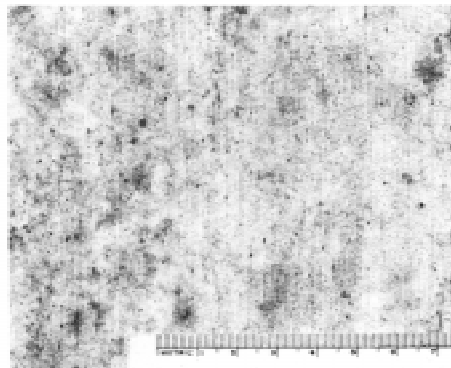
Rating-8



Rating-2

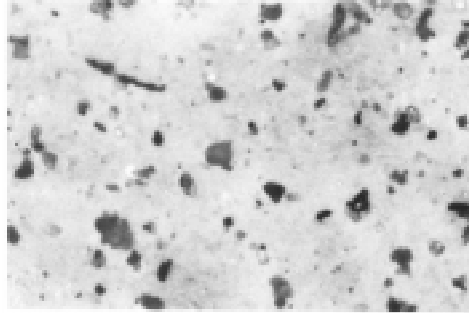


Rating-6



Rating-0

FIG. 4 Disfigurement Ratings



**FIG. 5 Soil Particles on Paint, Magnified 100×**

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