

R68-84

TESTING CELLULOSE-CONTAINING PLASTICS FOR RESISTANCE TO FUNGI

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The widely used ASTM (1963) mixed culture petri dish method for the determination of the susceptibility of plastics and plastic-like materials to mold growth makes use of a combination of species of fungi. The mixture contains *Aspergillus niger* ATCC 9642, *A. flavus* ATCC 9643, *A. versicolor* ATCC 11730, *Penicillium funiculosum* ATCC 9644, *Trichoderma* sp. ATCC 9645, and *Pullularia pullulans* ATCC 9348.

The original reasons for the choice of these particular organisms have been lost in history, but it is probable that their choice was largely on empirical grounds rather than on research designed to discover the best organisms for the tests. There are, in fact, few data to rationalize the use of any of the organisms in the mixture over equally serviceable organisms, and probably some of them never, or rarely, contribute to the efficacy of the mixture.

Conversely, work in these laboratories has shown that the mixture is deficient in at least one major capability, namely the ability to detect reliably the susceptibility of a cellulose-containing plastic material to cellulose decomposition, cellulose frequently being a component of plastic formulations or laminated with synthetic materials. The absence of a dependable cellulose utilizing organism in the mixture has been a fault which has led to erroneous evaluations of the resistance of some materials to mold growth. This note demonstrates one such case.

A routine test of a sample of a recently introduced synthetic, laminated polymeric material, widely used for better grade shoes, indicated that it was not subject to mold growth. When tested according to ASTM (1963) Designation D-1924-63, the results showed that there was a trace of transient superficial growth of fungus on the surface of the material after one week incubation but that this was not noticeable at the end of the three week test. The material was considered to have passed the test.

Repetition of the test some time later, this time

with the addition of spores of the strongly cellulolytic fungus *Chaetomium globosum*, QM 459 (=ATCC 6205) to the inoculum produced the opposite result. In this second test the material supported various amounts of growth as shown in Figures 1 and 2. After one week of incubation, the lower side showed light growth and fruiting heads of *Chaetomium globosum*, and this increased to the state shown in Figure 1 by the end of the third week. The cut edge of the piece, however, supported heavy growth of the fungus as shown in Figures 1 and 2. No other fungus grew on the material. The upper surface of the material was free of growth.

The significance of these findings in the reliability of the present ASTM test is obvious. Since there is always the possibility that cellulose may be part of some plastic materials, either as a component of the formulation or as a laminate (as in this case) the susceptibility of the material may depend on this ingredient alone. Although the ASTM mixture does already contain known cellulose decomposers, notably *Trichoderma*, experience has shown that this organism is highly unpredictable in its behaviour in the mixture and cannot be relied on to detect the presence of cellulose.

Modification of the ASTM method to include the more reliable *Chaetomium globosum* seems to be needed so that this fungus may seek out any susceptible cellulosic constituents which may be present.

References :

American Society for Testing and Materials (1963), 1916 Race St., Philadelphia, Pennsylvania, 19103; Recommended Practice for Determining Resistance of Plastics to Fungi. ASTM Designation D-1924-63.

Abstract :

The inclusion of *Chaetomium globosum* in the fungus test mixture in ASTM Designation D-1924-63, "Determining Resistance of Plastics to Fungi," is recommended to detect cellulosic constituents of formulations.

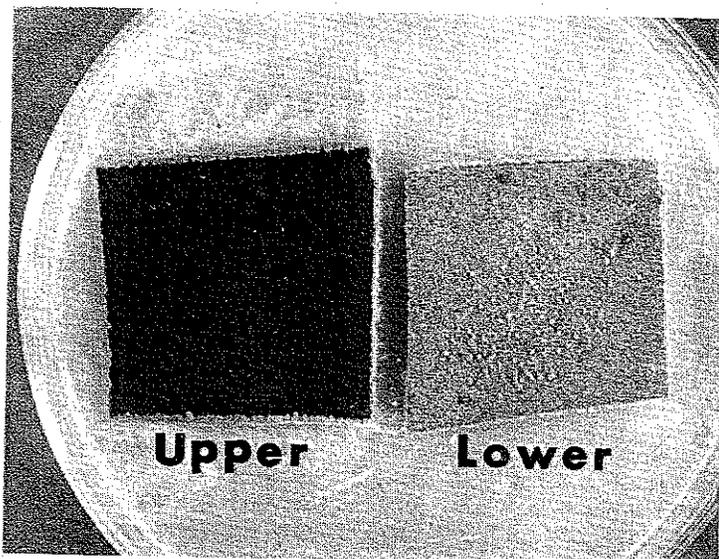


Figure 1.—
Appearance of material after 3 weeks in mixed culture petri dish test, using ASTM D-1924-63 organisms plus *Chaetomium globosum* QM 459 (=ATCC 6205).
Left: upper surface. Right: lower surface.

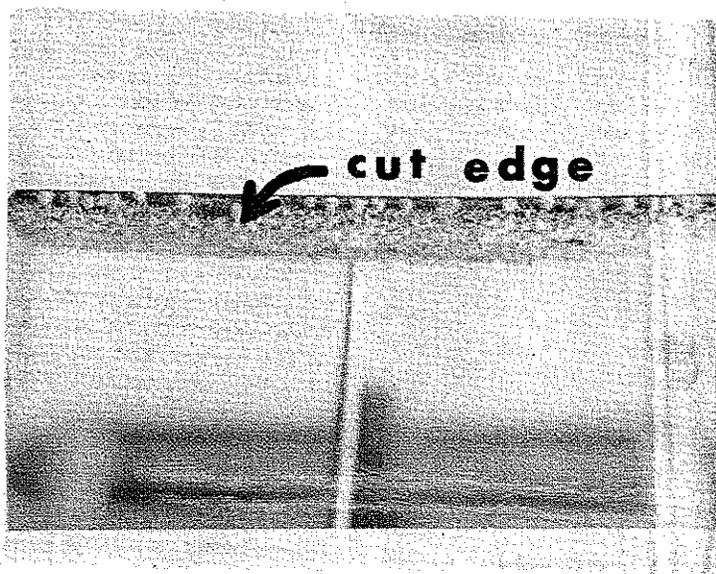


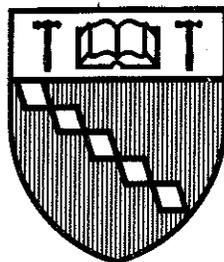
Figure 2.—
Appearance of cut edge of material after 1 week incubation in mixed culture petri dish test, showing fruiting heads (perithecia) of *Chaetomium globosum* along the edge. Actual length of piece approx. $1\frac{1}{2}$ ".

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