TECHNICAL NOTE

A RAPID TEST FOR RESISTANCE OF GLOVE LEATHERS TO SYNTHETIC PERSPIRATION

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ABSTRACT

This report describes a simple modification of an ASTM-ALCA Test Method that makes it useful for testing light leathers for resistance to synthetic perspiration. Glove and garment leathers can be tested in four hours. In addition, the data indicate clearly that treatment of many chrome-tanned leathers with proper amounts of glutaraldehyde will result in leathers that will resist the effects of this test.

INTRODUCTION

The properties of glutaraldehyde and chrome-glutaraldehyde tanned light leathers were first described about 12 years ago (1, 2). The leathers were reported to be resistant to the effects of a synthetic perspiration test (3, 6) and to the effects of washing in soap and water (1, 5, 6). Later, a report was published on the excellent resistance of chrome-glutaraldehyde tanned glove leather to natural perspiration, as demonstrated by a practical test involving a group of golfers and golf gloves (6). During the last ten years, experimental and practical application of glutaraldehyde as a tanning agent has expanded considerably in this country and abroad. The desirable properties of the leathers reported originally have been confirmed many times over, in publications and in advertised commercial information submitted by many workers and suppliers (4, 7–13). Because of the ever-growing commercial interest, there is now a need for a quick test to identify perspiration-resistant light leathers, especially for gloves. This report describes a simplified adaptation of an ASTM-ALCA perspiration test (14) which was found to be effective in four hours.

EXPERIMENTAL

Leathers and Treatments

A list of the leathers used in these experiments is presented below. The numbers assigned to the leathers correspond to those shown in Table I and Figure 2. Glutaraldehyde retannages were applied to the blue stock in our laboratory.

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1. Commercial, chrome-tanned Nigerian hair-sheep glove leather.
2. Chrome-tanned leather as above, except the blue stock was retanned with 25 percent concentration glutaraldehyde in the amount of five percent of the blue weight of the skin (15).
3. Chrome-tanned leather as above, except that blue stock was retanned with 25 percent concentration glutaraldehyde in the amount of ten percent of the blue weight of the skin (15).
4. Two-bath, chrome-tanned kidskin (commercial blue stock) was retanned with 25 percent concentration glutaraldehyde in the amount of ten percent of the blue weight of the skin (15).
5. Commercial, two-bath, chrome-tanned kidskin leather, unfinished.
6, 7, 8, 9. Pickled Nigerian hair-sheep skins were tanned in the laboratory by a simultaneous tannage comprising a one-bath chrome tanning agent and glutaraldehyde in the amounts shown in Table I.
10. Commercial, two-bath, chrome-tanned kidskin leather, glazed.

The percent chrome listed is dry Tanolin R† based on the drained, pickled weight of the skin; the percent glutaraldehyde is 25 percent grade reagent on the same skin basis. The procedure used was essentially that previously published, except that the skins were not buffered prior to tanning. In these experiments, the pH of the tanning solution was raised gradually, over a period of two hours, from the pickle to 3.9, using one portion of sodium formate, followed by several additions of sodium bicarbonate. The total tanning time was five hours. All the skins, with the exception of those listed in 4, 5, and 10 above, were returned to the tannery for fat-liquoring and processing into leather.

Perspiration Test

The leathers were sampled and subjected to the four-hour perspiration test, using the synthetic perspiration solution specified by the ASTM-ALCA Test Method D2322–69 (14). Essentially, the listed procedure was followed except for the heating time (four hours instead of 48 hours) and the sequence concerned with the Mullen Tester, which was omitted. The test results were judged simply by visual observation and feel of the treated samples after they were removed from the oven and air-dried. At this point, if desired, shrinkage in areas may be determined by the use of rulers to determine the width of the specimen in both directions (16).

The Test Method (14) specifies that each test piece be suspended over water in a rather large bottle. The bottles are then to be placed in a circulating-air oven at the proper temperature. It was found to be space-saving and convenient to use equipment as shown in Fig. 1. The glass container (aquarium‡) is avail-

†Reference to brand or firm name does not constitute endorsement by the U. S. Department of Agriculture over others of a similar nature not mentioned.

‡The aquarium only is available from A. H. Thomas, Phila., Pa. 19105. Catalog item 1137-A50, 3/5 gallon capacity, approximate outside dimensions L = 7.5 in., W = 5 in., H = 5 in. (1972 catalog).

able from the supplier with a flat, ground-top surface. The plate glass lid gives a smooth fit on the top. To insure a good seal, masking tape should be used to hold the lid down and to cover the container-lid interface. When thus assembled, there

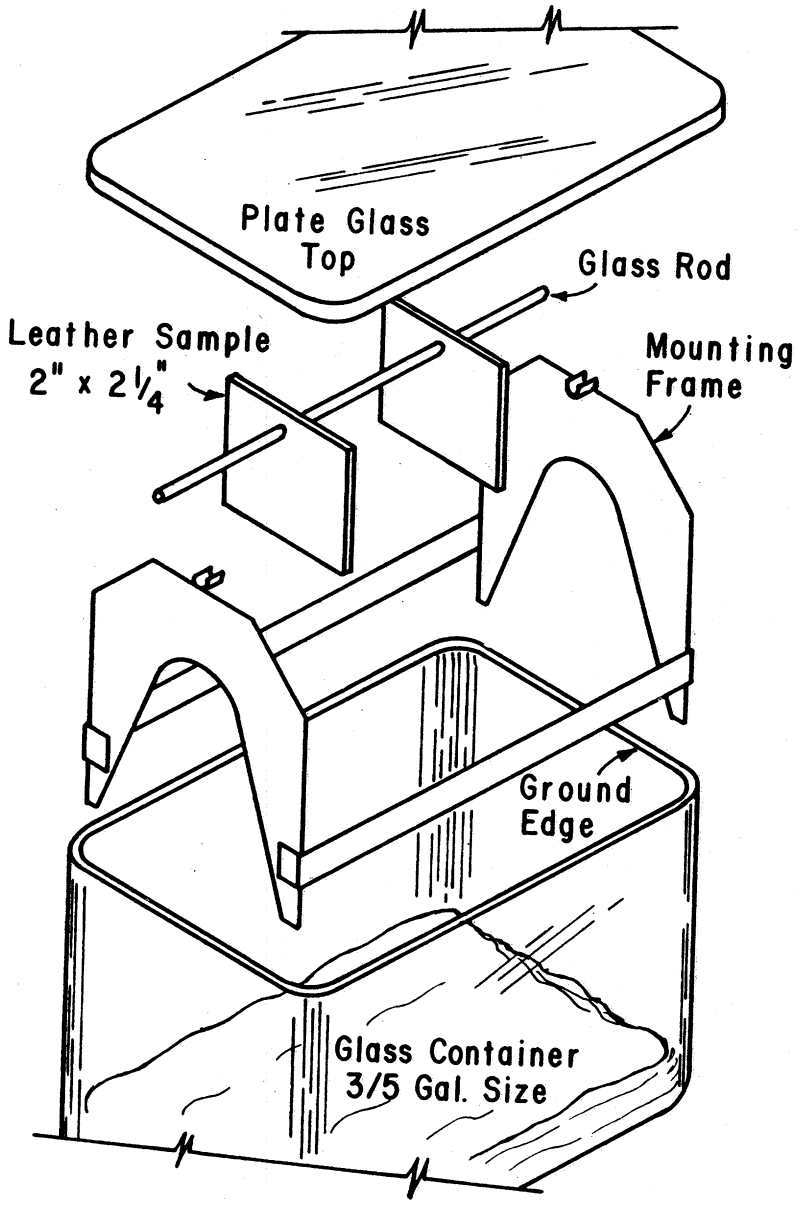

FIGURE 1.—Perspiration test apparatus (see footnote under "Perspiration Test").

is very little water loss, even in heating periods of 48 hours. The container is fitted with a relatively simple rack made of stainless steel sheet. This rack supports a glass rod which can hold at least eight leather specimens. The height of this rack should be calculated so that the mounted leather samples are clear of the glass lid when sealed. During a test, about 100 ml. of water is added to the container before it is sealed and placed in the oven. Most circulating-air ovens can hold four or more such containers.

DISCUSSION AND RESULTS

A variety of "synthetic perspiration" solutions (1, 4, 7, 10) have been used in tests on glutaraldehyde and glutaraldehyde-chrome tanned leather. In essentially all cases, the properly treated leathers were quite resistant to the test procedures, especially when compared to the effects of these solutions on many leathers tanned with chrome alone. Glutaraldehyde-chrome shoe-upper leathers have been found to be readily resistant to the effects of the ASTM-ALCA test for

TABLE I

EFFECT OF TEST SOLUTION* ON LEATHER SAMPLES

Leather sample† No. and Tannage‡	Shrinkage Temp. (°C.**)	% Cr_2O_3 (M.F.B.)††	Solution Effect*** (4 hrs. at 70°C.)
1. Chrome only (commercial)	98 (90)	3.50	(−)
2. Chrome +5% glutaraldehyde retan	102 (94)	3.53	(+)
3. Chrome +10% glutaraldehyde retan	100 (95)	3.32	(+)
4. Chrome kid +10% glutaraldehyde retan	(86)	2.8 ± 0.2‡‡	(+)
5. Chrome kid (com'l. unfinished)	(88)	2.8 ± 0.2‡‡	(−)
10. Chrome kid (com'l. glazed)	(88)	2.8 ± 0.2‡‡	(−)
Simultaneous Tannages			
6. 6% Tanolin R; 5% glutaraldehyde	96 (90)	2.47	(−)
7. 6% Tanolin R; 7.5% glutaraldehyde	103 (92)	2.47	(+)
8. 8% Tanolin R; 5% glutaraldehyde	103 (94)	2.78	(+)
9. 6% Tanolin R; 10% glutaraldehyde	98 (93)	2.67	(+)

*Solution specified in ASTM-ALCA Perspiration Test D 2322–64T.

†Glove and garment leathers (Nigerian hair-sheep) except as noted.

‡% shown is based on drained wet weight of skins. Glutaraldehyde is 25% commercial solution. Tanolin R is a one-bath chrome tanning agent — 23.5% Cr_2O_3. 34/37% Basicity (Diamond Shamrock Chemical Co.).

**All shrink temperatures determined in water; those above 100°C. were determined under pressure. Values shown are for freshly tanned wet skins, and, in parentheses, for finished dry leather.

††M.F.B. = moisture-free basis.

‡‡Data supplied by tanner.

***(−) = Sample shrunken to much less than original size, also stiff and brittle. (+) = very little or no shrinkage; sample remains soft and flexible.

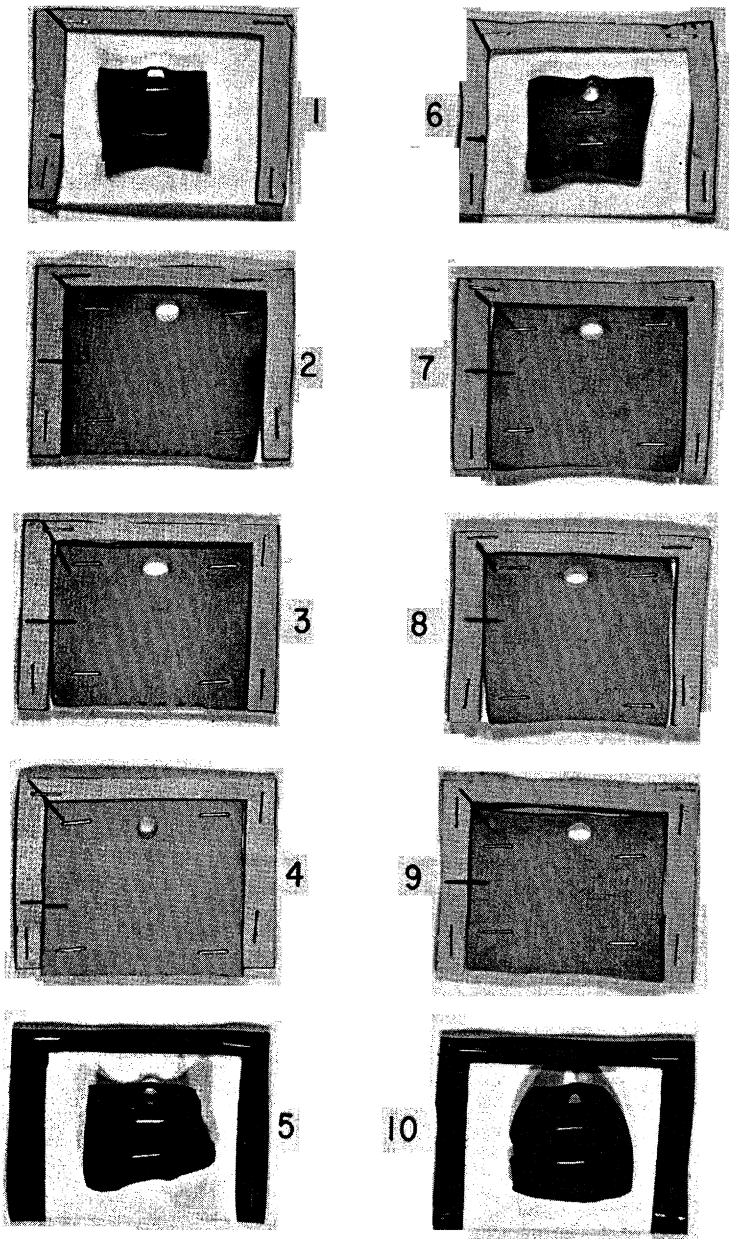

FIGURE 2.—Leather specimens showing test results after treatment with synthetic perspiration solution for four hours. (solution specified in Ref. 14). Specimens are numbered as listed under "Experimental" and described therein.

white shoe-upper leather (14). The effect of this test is measured by the leather's resistance to grain crack (Mullen Test) after treatment. The effects on flexibility and dimension of these heavier leather samples have not been evaluated as criteria of deterioration in this test method (14). In the case of low-chrome glove leather, however, the changes in dimension and flexibility due to the treatment with synthetic perspiration solutions are usually quite obvious, without real need for mechanical evaluation. This is shown by the samples pictured in Figure 2. Samples 1, 5, and 10 were tanned with chrome tanning agents and no glutaraldehyde. These samples, after the test, were both shrunken and brittle. Sample 6, though shrunken, remained soft and flexible. This sample had been treated with some glutaraldehyde (Table I). All the samples shown in Figure 2 that did not shrink were relatively soft and flexible after the test; all had been retanned with glutaraldehyde. As is shown by results on the variety of leathers tested (Table I), it appears that this synthetic perspiration solution treatment can classify such light leathers in the four-hour test described. Also, the data indicate that, at the chrome level of these samples, treatment with sufficient glutaraldehyde enables the leather to pass the test. Fully chrome-tanned cattlehide glove leathers, with shrink temperatures at or above the boiling point of water, are likely to pass this test with no glutaraldehyde treatment. It would seem, however, that the test would allow for a "good guess" that leather which is not fully chrome-tanned and which shrinks below the boiling point of water, but passes the perspiration test, was treated with glutaraldehyde during its tannage. This would have to be an assumption, of course, until a more specific test is devised for glutaraldehyde in finished leather.

An analytical procedure is available for determining glutaraldehyde in leather before it is finished. However, the procedure requires expert laboratory technique and special equipment (17). The analysis cannot tolerate interference from aromatic type materials used in processing leather, such as vegetable tannins, syntans, resins, dyes, and certain finishes (17).

Since a fast, practical test for finished leathers is needed at this time, the test described in this paper should be of value to users of glove leathers, etc., who require perspiration resistance in their products.

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