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CLEANING OF FUR AND LEATHER GARMENTS

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CLEANING OF FUR AND LEATHER GARMENTS

By M. H. Goldman[1] and C. C. Hubbard[1]

ABSTRACT

The increasing use of fur and leather garments and trimmings has made the necessity for adequate methods for cleaning more urgent. Dry-cleaning plants have been handling a large proportion of these materials either directly or on a wholesale basis for furriers and cold-storage establishments.

A study was made to establish a method for thoroughly cleaning the fur and leather garments, yet retaining the "fat-liquor" content which is essential to the appearance and pliability of the material.

It was found that by modifying the usual dry-cleaning process by the addition of small percentages of paraffin this result could be accomplished. Samples cleaned in the laboratory showed no loss of color, had a good appearance, and retained their pliability.

Trials in cleaning plants of preliminary recommendations permitted the fixing of standard practices.

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I. INTRODUCTION

Fur has been an important factor in clothing mankind from prehistoric ages, when it was used almost exclusively, to the present time. Its utility has depended both on its warmth and its decorative qualities. At the present time large quantities of fur are used in the garment industry, as fur coats, trimmings, and linings. This is

[1] Representing the National Association of Dyers and Cleaners.

equally true in regard to leather, for present styles include gloves, jackets, coats, and numerous leather trimmings.

Used as a garment it is obvious that the fur and leather materials are subjected to a multiplicity of stains and soils just the same as other types of clothing. Methods for cleaning and renovating are thus very desirable, and a number of different ones have been used with varying success.

The dyer and cleaner handling the bulk of the renovation of outer clothing materials has, of course, been called upon to perform this service. The general trend toward better practices or at least of standardization of practice, together with a desire to ascertain the most efficient practical method for cleaning fur and leather, led the National Association of Dyers and Cleaners, through the research associateship at the Bureau of Standards, to undertake a study of this problem.

II. PREPARATION OF FUR AND LEATHER

Leather is formed from animal skin by converting the readily putrescible skin into a more permanent material by processing with vegetable materials, chromium salts, alum salts, or marine oils. This processing, known as tanning, preserves the skin, makes it less subject to decay or putrefaction, and gives it considerable strength and pliability.

The skin of most animals consists of three parts: The outer skin or epidermal layers of which the hair may be considered a part, the middle layer of fibers and connective tissue called the derma, and a third layer of adipose tissue or flesh fibers which connect the true skin to the underlying parts of the body. In preparing skins for tanning it is necessary to remove the epidermal and flesh layers, leaving only the true skin for use in leather making. The preliminary operations also have as their function the swelling and separation of the individual fibers, in order that they may be acted upon by the tanning material and thus prevented from reverting to a hard gelatinous condition when dried.

The methods and materials used may be, and are, purposely manipulated in order to produce leather having the characteristics necessary for a particular use. Thus, hides for use as sole leather are tanned for several months in vegetable tanning materials, in order that the required firmness and water resistance properties may be obtained. As compared with this process, sheepskins for garment leather, where lightness and pliability are desired, may be tanned within 48 hours. Where softness and washable qualities are desired, oil tannages are used, examples of which are chamois and buckskin leathers.

The preparation of fur skins may be considered a special branch of leather making. The outer epidermal layer, including the hair, is not removed in preparing the skins for tanning. Although the hair or fur is the important item, the basis of any fur piece is the tanned skin or leather in which the fur is held. Tanning of fur skins is usually accomplished by treatment with alum and salt from the flesh side accompanied by the use of oils to keep the skin soft. Fur-seal skins are given an oil tannage. Shearlings for garment purposes are tanned with vegetable materials.

Frequently very greasy skins are degreased by treating in gasoline.[2] They are then wrung out and air-dried prior to tanning.[3] Armour [4] mentions the fact that opossum, raccoon, and skunk are very greasy pelts and that all the natural grease is removed from the skins in preparing the leather for the garment maker. It is then necessary to replace the natural oil with prepared grease to some extent in order to make the furs soft and pliable.

After the fur is tanned and dressed it is fashioned into garments. Fur trimmings for garments are often made from clippings occurring in garment making or furs which can not easily be matched. Some furs are dyed to obtain special effects. Leather is frequently dyed, printed, or otherwise decorated.

III. METHODS OF CLEANING FUR AND LEATHER

A preliminary survey showed that fur garments are cleaned at three different types of establishments—the furrier, who extends his services of making and remodeling fur garments to caring for them; the storage concern, which generally advises cleaning previous to storage; and the dry cleaner. It was also noted that many of the garments accepted for cleaning by the first two found their way into the hands of the dry cleaners.

The methods used are varied. Some of them are described briefly as follows:

(*a*) Fuller's-earth Method.—The garment is laid flat on a table and sprinkled with dry fuller's earth. It is then folded together with the fur inside and left to stand for 24 hours or longer. The powder is then beaten out by hand and blown out, after which the fur is glazed with plain water. The garment is then beaten again, using rattan sticks.

(*b*) Damp-salt Method.—Damp salt is rubbed into the fur and beaten out by a fur-beating machine. Sometimes the garments, after the salt treatment, are covered with plaster of Paris and then beaten.

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[2] Rogers, Allen, Practical Tanning, p. 68; 1912.
[3] Farnham, Albert B., Home Manufacture of Furs and Skins, p. 119; 1916.
[4] Armour, Fur Dressing and Dyeing; 1919.

(*c*) The Use of a Finely Divided Solid Plus Gasoline.—Use is made of red-cedar dust, mahogany dust, corn meal, or cornstarch, depending on the type of fur. This is mixed with gasoline, benzine, or carbon tetrachloride. It is then either rubbed on the fur by hand until no dirt or dust appears to soil the mixture or a machine-cleaning method is used. In the latter case four to eight garments are placed in an oscillating drum filled with the requisite amount of the mixture. After a short run the garments are placed on figures and combed and then glazed. The following morning they are again beaten and combed. Sometimes they are ironed.

(*d*) The Dry-cleaning Method.—The dry-cleaning method for both fur and leather consists essentially of placing the garment or garments in a perforated metal cylinder which revolves slowly within a metal shell containing the cleaning solvent (usually a petroleum derivative) and a naphtha-soluble soap. As the cylinder revolves the garments are lifted to about a 45-degree angle and then dropped gently into the solvent. A 10-minute run is used generally. In some instances neat's-foot oil is used instead of, or in addition to, the benzene soap to minimize the loss of original fat or oil content.

There are, of course, many variations of these processes, depending on the type of color and the condition of the fur.

Leather, leather-trimmed, fur-trimmed, and fur-lined garments are treated only by the dry-cleaning method.

Several salient points are worthy of note regarding these methods: (1) Two of the methods use a petroleum solvent; (2) all except the dry-cleaning method employ some solid material, which itself, as well as the dust incident to service, must be beaten or dusted off; (3) by far the largest number of garments are cleaned by the dry-cleaning method; this is especially true when fur-trimmed and fur-lined garments are included.

These points, together with the consideration that dry cleaning seems to be the most logical method because it cleans by actually "washing" the soil and stains from the garment instead of the dusting or absorption and dusting processes used in the other methods, led to the selection of the dry-cleaning process as a basis for this study. Some consideration was also given the fact that fur garments generally have some other textile material used in conjunction with them, as linings and thread, which dry cleaning would adequately clean.

IV. ACKNOWLEDGMENTS

Ac nowledgment is made to R. C. Bowker and E. L. Wallace, of the leather section, and to C. W. Schoffstall, of the textile section, for helpful suggestions in connection with this project.

Manufacturers of fur and leather garments very kindly furnished the samples used in this study. The cooperation of the various dry-

cleaning establishments throughout the country which tried the preliminary recommendations and enabled the fixing of definite standards of practice was also very helpful in this project and is gratefully acknowledged.

V. MATERIALS USED IN THE STUDY

Laboratory apparatus for dry cleaning simulating the regular practice was available. This consisted of glass jars arranged so that material being cleaned could be agitated mechanically by slowly rotating the jars. The 10-minute run used in commercial practice was used.

The samples of leather used consisted of sheepskin dyed in the following hues: 4 different reds, 2 greens, 3 shades of brown, 1 black, and 1 blue. Samples of the following furs were used: Muskrat, wolf, raccoon, caracul, beaver, fox, squirrel, and Hudson seal. These were selected to include the most popular furs and cover, in general, the percentages of fatty content commonly used.

Most of the preliminary work was done on the leather samples, chiefly because it was desired to observe the loss in color or the streakiness of the dyed samples, and because the effect of the treatments on the leather-dressing materials could be better determined.

Throughout the study, naphtha complying with Stoddard's[5] specifications was used, since this is the type most commonly utilized by dry-cleaning plants. The common types of benzine soap were also used. These soaps are soluble in naphtha, thus permitting better penetration and also acting as emulsifying agents in the removal of the stains. They are made by partial saponification of oleic acid, to the extent of 70 to 90 per cent, with sodium hydroxide, thus leaving 10 to 30 per cent of the oleic acid present in the free state. The water-soluble soap present—that is, the sodium oleate—is ordinarily insoluble in naphtha, but it is soluble in oleic acid, which in turn is soluble in naphtha.

The excess of oleic acid present in the benzine soap performs a very valuable function in the cleaning of fur and leather, for it tends to prevent the naphtha from dissolving the fatty contents of the leather. Oleic acid is a fatty acid and in a general way is similar in nature to the fatty dressing of the leather. There is thus a tendency toward equalizing the dissolving effect of the naphtha.

As stated previously, neat's-foot oil is sometimes used instead of benzine soaps to minimize the loss of fatty content. However, there may be a tendency toward matting of the fur due to the greasy character of the neat's-foot oil when present in excess.

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[5] Stoddard's specifications for solvent obtainable on request from this bureau or consult B. S. Tech. Paper No. 322.

VI. EXPERIMENTAL RESULTS

Samples of alum-tanned leather were first degreased with ethyl ether, then placed in water. When dried they were hard and stiff. Chrome-tanned and vegetable-tanned leather similarly treated were only slightly hardened, and it was possible to soften them again by moistening and restoring the fat content by applying sulphonated castor oil. The alum-tanned samples, however, could not be restored by this treatment, probably because the tanning materials are soluble in water. They could no doubt be softened and restored by retanning. Austin [6] states that skins, during alum tanning, absorb about 6 per cent of their weight from the alum-tannage solution, of which amount three-fourths may be extracted or lost by soaking in water, leaving a hard stiff leather.

Oil-tanned leather samples were treated repeatedly with gasoline and benzol, then immersed in water. When dried they retained their original softness and pliability.

It was also observed that when vegetable and alum tanned leather were exposed to high temperatures when wet they became hard and brittle. This was not so marked when dried before exposure.

An analysis was made of the furs to determine the nature of the tannage. The results are shown in Table 1. Chromium and iron were found in only small quantities. Their presence evidently resulted from the use of their salts during the dyeing rather than the tanning process; thus it is assumed that the furs were all tanned with alum.

TABLE 1.—*Analysis of tannage and dye residues*

Kind of fur	Tanning and dyeing materials present
Muskrat	Aluminum and chromium
Wolf	Do.
Raccoon	Do.
Caracul	Aluminum and iron.
Beaver	Aluminum and chromium.
Fox	Aluminum, chromium, and iron.
Squirrel	Aluminum and chromium.
Hudson seal	Aluminum, chromium, and iron.

A preliminary test was made to establish approximately the amount of the fatty contents dissolved by a naphtha treatment alone. The fatty contents of several fur specimens were obtained by ethyl-ether extraction. Additional specimens were then treated with naphtha and ether extractions made. It was found that the first naphtha treatment caused a loss in fatty content of about 50 per cent; a second treatment removed 10 to 14 per cent; no appreciable loss occurred in the third or later treatments.

[6] Austin, W. E., Fur Dressing and Fur Dyeing, p. 66; 1922.

The "bleeding" of coloring matter from the dyed-leather materials was observed when they were subjected to the laboratory dry-cleaning process. It was found that this was directly due to the removal of the fatty content, evidently because the dressing materials held some of the dye.

These preliminary experiments showed that the dyed-leather problem might be studied along the following lines: (*a*) Prevent the loss of the fatty content, which in turn would eliminate the bleeding of the color; (*b*) prevent or minimize the bleeding action even though the fatty content were removed. In the latter case a "refat-liquoring" of the material would be necessary. The fur problem was not complicated by the dye bleeding, for although furs are sometimes dyed it is the hair rather than the leather which is dyed, so it was presumed that either procedure would also be applicable to it.

In order to eliminate the "bleeding" of the color, it was necessary to find some means of "fixing" the color or coagulating the fatty content, which in turn would serve to hold the color intact. An analogous situation occurs in cotton dyeing, where in using certain direct blacks it is necessary to aftertreat the material to eliminate a deficiency in the dye fastness to washing of the coloring matter.

For the aftertreatment in the case of these blacks, formaldehyde and acetic acid are generally used. Sometimes some bichromate of potassium is added.

The effectiveness of formaldehyde in this case suggested the possibility of its use in arresting the "bleeding" of the color in cleaning leather. Formaldehyde, however, besides having an objectionable odor is not soluble or miscible in naphtha; but it is quite probable that, as the aldehyde group is quite reactive, it is this radical which performs the service. Benzaldehyde, a chemical commonly used in the cleaning industry for special spotting purposes, is capable of being used with naphtha and is reactive.

Accordingly, tests were made with benzaldehyde and it was found that in most instances when used in naphtha it would coagulate at least partially the fatty content of the dyed leather and prevent to a large extent the "bleeding" of the color. In a few cases, however, "bleeding," though lessened, still occurred.

Various ingredients were then added to the benzaldehyde in order to remedy this difficulty, with varying degrees of success. These included oleic acid, neat's-foot oil, coconut oil, sulphonated castor oil, sulphonated cod oil, olive oil, cacao butter, and paraffin. It was found that the benzaldehyde-paraffin mixture gave the best results in regard to retention of the pliability of the leathers.

Means for more positively fixing the color were still needed. Formic and acetic acids are used in acid dyeing of leathers for "setting" the dye so it was decided to try these. However, using

these acids with benzine soap, a reaction which forms sodium formate or sodium acetate will occur. In order not to impair the efficiency of the soap, these last two compounds were used separately with the benzine soap and naphtha. It was found that sodium formate was effective, and this in conjunction with benzaldehyde and paraffin used in the naphtha gave encouraging results in both retention of color and pliability of the leather. However, there was one serious objection to this treatment: If the material happened to have been stained with something that might also be coagulated by the benzaldehyde the difficulty of removing the stain would be increased, if not insurmountable.

This led to tests to determine the minimum amount of benzaldehyde which could be used. The benzaldehyde, therefore, was decreased and the paraffin increased until the extreme case was reached in which no benzaldehyde was used. In this last case surprisingly good results were obtained. Further experiments were made, using paraffin-naphtha mixtures without including sodium formate, and here also indications were noted that the latter could be eliminated. Accordingly, trial runs were made, using naphtha with percentages of paraffin varying from 1 to 5, to determine the best amount of paraffin to use. It was found that 1¼ per cent by weight produced the best results on the dyed leather and 2½ per cent the best on furs. Paraffin having a melting point of 45° C. was used.

A stock liquor was made up, using 1 part paraffin by weight to 5 parts of naphtha. For the leather-cleaning tests this bath was diluted to 1 part paraffin to 80 naphtha; for the fur-cleaning 1 to 40 was used.

Specimens of each of the dyed leathers were cleaned separately without apparent loss of color evident either in the bath or from the specimens. Then all the shades were cleaned in one batch for 30 minutes without noticeable change in color. This test was far more severe than these materials would receive in the cleaning plant.

Two specimens of each of the furs were subjected to naphtha cleaning and two to naphtha and paraffin for 10-minute runs, after which they were extracted in a centrifuge and dried in an air current. The appearance of the latter two samples was good, the fur was not matted, no greasiness was felt, and the pelts were soft and pliable.

All four specimens, together with two untreated specimens, were then extracted with ethyl ether in a söxhlet extractor so that the "fat contents" remaining in the fur might be obtained.

All the fat-free specimens were next subjected to the cleaning process, using paraffin and naphtha in 1 to 40 proportion. Appearance was satisfactory. Again, all specimens were extracted with ether to determine how much paraffin had been absorbed by the fat-free skins.

The results of the ether-extract determinations are shown in Table 2.

TABLE 2.—*Ether-extract ("fatty content") determination*

Type	A	B	C	D
Beaver	2.09	1.29	1.92	1.41
Fox	2.64	1.60	2.90	1.70
Squirrel	2.93	1.91	3.45	1.82
Hudson seal	4.12	3.23	3.76	1.33
Caracul	4.46	1.78	4.68	1.88
Wolf	5.38	1.35	4.42	1.42
Muskrat	9.75	2.22	7.97	2.12
Raccoon	9.84	2.53	5.85	1.27

A = total fatty content as shown by complete extraction with ethyl ether.
B = Fatty content after dry cleaning with naphtha alone.
C = "Fatty content" after dry cleaning with naphtha-paraffin mixture.
D = "Fatty content" of specimens which were dry cleaned with the naphtha-paraffin mixture after the original fatty content was extracted with ethyl ether.
New specimens were used in each case except D. All results are averages of two determinations. All percentages are based on the weight of the fur conditioned at 65 per cent relative humidity and 70° F.

These results are also shown in Figures 1 and 2. It is to be noted that the "fatty content" after cleaning was in every case, except the raccoon, very close to the original fatty content. The two cases of high fatty content showed the largest loss, but even in these cases it will be noted that a considerable amount remained. Figure 2 shows all the results on a percentage basis, the original fatty content taken as a basis of 100 per cent. The results based on this comparison show, in addition to the above, that the dry-cleaning method without the use of paraffin removes a considerable amount of the fatty content and that using the paraffin-naphtha method on fat-free furs a considerable amount of the fatty content is retained, or replaced with paraffin.

A few experiments were also made using the "fat-free" skins. It was found that, although they were somewhat pliable after the ether extraction, when dried after being wetted they were quite hard and brittle. However, if instead of applying water alone, water containing a water-soluble oil of the sulphonated castor-oil type was applied, their pliability was completely restored.

VII. APPLICATION OF THE METHODS IN THE CLEANING PLANT

When the laboratory experiments were concluded, recommendations regarding these methods were placed in the hands of a large number of cleaning plants for trial in a preliminary report issued in August, 1926. Very gratifying reports have been received regarding it. Some variations were found to be desirable. For instance, in most cleaning plants the cleaning machines are connected with a naphtha-purification system. The use of the paraffin in the naphtha in the cleaning liquor was not, therefore, desirable because it might interfere with the purification of the naphtha and because the remaining paraffin was lost each time. A modification of the method was

developed in which the leather or fur material was cleaned first and then dipped in a paraffin stock bath in a separate vessel. Appearance and pliability were entirely satisfactory.

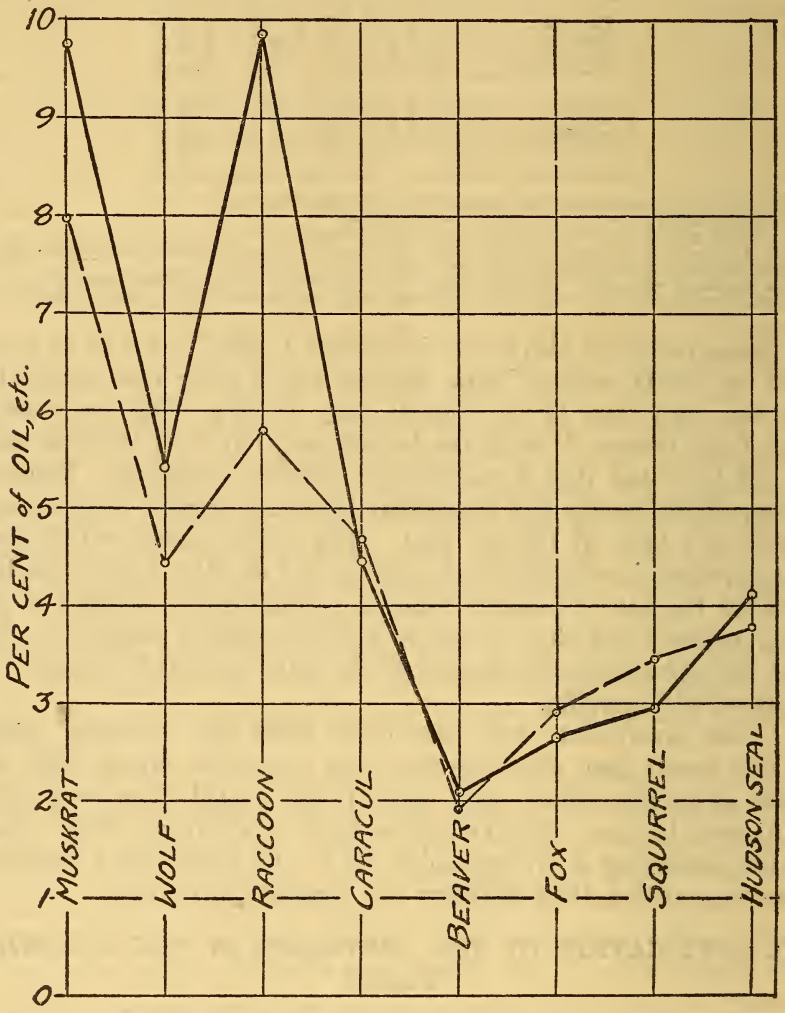

FIG. 1.—*Ether-extract ("fatty content") determinations*

The points on the solid line indicate the amount of fatty content in the original specimens as shown by complete extraction with ethyl ether. The points on the broken line indicate the "fatty content" in specimens after using the paraffin-naphtha cleaning method on new specimens.

Some further laboratory experiments on this variation are shown in Table 3.

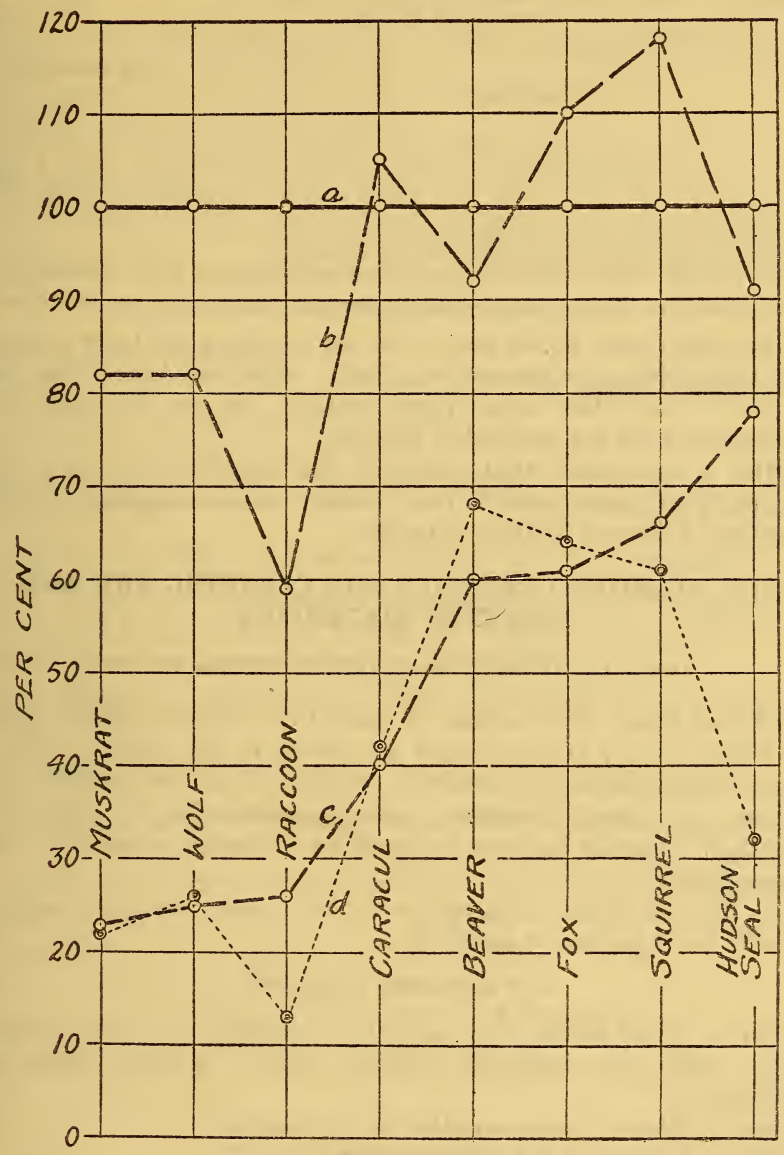

FIG. 2.—*Ether-extract ("fatty content") determinations on a percentage basis*

The points on line (*a*) indicate the amount of fatty content in the original samples taken as a basis of 100 per cent. The points on line (*b*) indicate the "fatty content" after using the paraffin-naphtha cleaning method on new specimens. The points on line (*c*) indicate the "fatty content" after using the dry-cleaning process on new specimens. The points on line (*d*) indicate the "fatty content" of specimens which have been completely extracted, then subjected to the paraffin-naphtha cleaning process.

Percentages shown in (*b*), (*c*), (*d*) are based on (*a*) as 100 per cent.

TABLE 3.—*Tests of furs showing "pick-up" in the paraffin-naphtha bath following dry cleaning*

Kind of fur	"Fatty content"		
	A	B	C
Fox	2.40	2.26	2.44
Muskrat	7.80	3.65	5.45

A=total fatty content as shown by complete extraction with ether.
B=fatty content after dry cleaning with naphtha and benzine soap.
C="fatty content" after dry cleaning with naphtha and benzine soap, then giving a paraffin-naphtha bath.
New specimens were used in each case; the figure given for muskrat under (C) is an average of 12 tests.

The results show in the case of the fur having a low fatty content that about the same amount remained. Some was lost in the case of the fur with the higher fatty content, but the pliability and appearance were not noticeably affected.

After a six-months' trial, review of the reports of its use in the cleaning plant made possible the following recommendations for the handling of fur and leather materials.

VIII. STANDARD PRACTICE FOR CLEANING FUR AND LEATHER MATERIALS

1. PREPARATION OF PARAFFIN-NAPHTHA LIQUOR

(*a*) FOR FUR.—Two pounds of shaved or chipped paraffin (melting point 45° C.) in a container are placed in hot water or over a steam cooker until the paraffin is melted. Pour the paraffin into a stone jar (about 15-gallons capacity) containing 10 gallons of naphtha. More or less can be made up if desired, using the same proportions.

(*b*) FOR LEATHER.—Proceed as for fur, except use 2½ pounds of paraffin to 25 gallons of naphtha.

2. WHITE-FUR CLEANING

Step 1. Hand-brush with naphtha containing alcoholic-benzine soap.[7] (One pint alchoholic-benzine soap to one-half gallon of naphtha.)

Step 2. Rinse in clear naphtha for five minutes.

Step 3. Centrifuge for three minutes.

Step 4. Soak in paraffin-naphtha liquor for five minutes.

Step 5. Centrifuge for three minutes.

Step 6. Hang in a room with a good circulation of warm air (not exceeding 120° F.).

[7] Alcoholic-benzine soap is a potash-oleate or potash-stearate soap containing 10 to 30 per cent methyl alcohol.

3. COLORED-FUR CLEANING

Step 1. Brush the soiled linings or unusually soiled portions of the material with alcoholic benzine soap.

Step 2. Rinse in clear naphtha for 10 minutes.

Step 3. Centrifuge for three minutes.

Step 4. Soak in paraffin-naphtha liquor for five minutes.

Step 5. Centrifuge for three minutes.

Step 6. Hang in a room with a good circulation of warm air (not exceeding 120° F.).

4. FUR-TRIMMED GARMENT CLEANING

Step 1. Clean in the usual way.

Step. 2. Saturate the fur trimmings with the paraffin-naphtha liquor following the dry-cleaning operation.

Step 3. Centrifuge for three minutes.

Step 4. Hang in a room with a good circulation of warm air (not exceeding 120° F.).

5. LEATHER-GARMENT CLEANING (EXCEPT GLOVES) METHOD 1

Step 1. Clean for 10 minutes in dry-cleaning machine containing 2½ pounds of paraffin to each 25 gallons of naphtha (no soap).

Step 2. Tumble the material cold for 20 minutes.

Step 3. Hang in a room with a good circulation of warm air (not exceeding 120° F.).

6. LEATHER-GARMENT CLEANING (EXCEPT GLOVES) METHOD 2

Step 1. Hand-brush the entire garment with the paraffin-naphtha liquor. Special attention should be given to soil or obstinate stains, both with the paraffin-naphtha treatment and brushing with alcoholic-benzine soap.

Step 2. Rinse in clear naphtha for five minutes.

Step 3. Centrifuge for three minutes.

Step 4. Soak in paraffin-naphtha liquor for five minutes.

Step 5. Tumble the material cold for 20 minutes.

Step 6. Hang in a room with a good circulation of warm air (not exceeding 120° F.).

7. WHITE-GLOVE CLEANING

Step 1. Place 1 peck of maple-wood balls 1¼ inches diameter in an open-mesh bag 20 by 30 inches in size. Add sufficient white gloves to fill the bag loosely and tie securely.

Step 2. Place bag (or bags) in a dry-cleaning machine the cylinder of which does not exceed 30 inches in diameter. Fill the cylinder to approximately one-sixth of the diameter with new clean naphtha in which 1 pound of ordinary benzine soap has been dissolved. Clean for five minutes and drain. (This removes the surface soil.)

Step 3. Fill the machine again to one-sixth of the diameter with clean naphtha in which has been dissolved alcoholic-benzine soap in the proportions of 1 quart soap to 50 gallons of naphtha. Clean for 15 minutes and drain.

Step 4. Rinse for five minutes in paraffin-naphtha liquor.

Step 5. Centrifuge for three minutes.

Step 6. Inflate each glove and evaporate the remaining naphtha in a noncorrosive rotating cylinder by circulating warm air (not exceeding 110° F.).

8. COLORED-GLOVE CLEANING

Step 1. Place 1 peck of maple-wood balls 1¼ inches diameter in an open-mesh bag 30 by 30 inches in size. Add sufficient colored gloves to fill the bag loosely and tie securely.

Step 2. Place bag (or bags) in a dry-cleaning machine the cylinder of which does not exceed 30 inches in diameter. Fill the cylinder to approximately one-sixth of the diameter with clean paraffin-naphtha liquor in which 1 pound of ordinary benzine soap has been dissolved. Clean for 15 minutes and drain.

Step 3. Rinse for five minutes in paraffin-naphtha liquor.

Step 4. Centrifuge for three minutes.

Step 5. Inflate each glove and evaporate the remaining naphtha in a noncorrosive rotating cylinder by circulating warm air (not exceeding 110° F.).

IX. THE VALUE OF THE PARAFFIN-NAPHTHA METHOD

Since the method given herein has been subjected to a more or less rigorous trial for over six months it may be of interest to indicate some of the advantages to be obtained by its adoption.

The method is based on the dry-cleaning process. Since the most delicate fabrics are cleaned by this process it is obvious that the fur will be subjected to a minimum amount of wear and tear, in contrast to some of the methods in which solid material is rubbed onto the fur to absorb the dirt. The linings and threads will be cleaned thoroughly at the same time.

Naphtha has an additional property which is of value in the consideration of this process; that is, it will kill moth life, vermin, and germ life. It is generally conceded that the dry-cleaning process renders the material sterile except for some few rare organisms. This is especially important, for furs are usually cleaned in the spring previous to storage during the summer months, so although the naphtha does not render them moth proof they are effectually freed of moth life and can be kept so by careful packing.

The addition of paraffin to the cleaning process has added several valuable features. It keeps intact or restores the "fat-liquor" con-

tent which is reduced by the dry-cleaning process alone. It restores the appearance of the fur or leather. In some cases the material seems improved in luster, probably by the paraffin which remained as a very thin coating on the hair. The paraffin used in such small percentages can not be detected on the fur and leather, for it is comparatively odorless and colorless.

Paraffin is a member of the methane or paraffin series. It is inert to such chemical agents as acids, alkalies, and strong oxidizing agents. In fact, Richter,[8] in emphasizing the inert properties and stability of paraffin, states that it "is not attacked by fuming nitric acid." As it is a saturated hydrocarbon, it does not become discolored or rancid, as do many vegetable and animal oils, and so may be used on white as well as dyed fur. Its present comparative cheapness is another thing in its favor, and it may be bought in large quantities and stored until used.

The water-repellent property of the paraffin treatment has been demonstrated in protecting the alum-tanned leather from loss of the tannage it ordinarily undergoes when treated with water. Paraffin coatings have been used to shower proof silk and cotton materials. Some of the leather dressings used for waterproofing are in large part paraffins. Of course, the amounts of paraffin deposited on the leather using the proposed process are quite small, but at least some preservation of the leather may be expected.

The application of the method requires no more skill or attention than the usual dry-cleaning processes. Fairly large amounts can be absorbed by the leather without matting the fur or making it feel greasy. If by chance too much is used, a short run in naphtha alone will remedy the difficulty.

Dyed leather or fur may be cleaned without loss of color except in the rare cases where the dyestuff is soluble in naphtha, and even then the "bleeding" is in no case as great as when dry cleaning without the paraffin is used.

WASHINGTON, August 16, 1927.

[8] Richter, Organic Chemistry, 1, p. 79; 1916.