



Effect of care products on leather properties

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Upholstery leathers for furniture and automotive uses are subjected to intensive wear conditions. Cleaning and care at regular time intervals are therefore necessary, or at least highly recommended. The choice of a suitable care product for the respective leather type and the appropriate means of application deserve special attention.

Within the last few years, a number of examples indicate that inappropriate or inadequate application of leather care products may result in damage in long term use. The occurrence of surface damages, such as finish partial flaking off or breaking and colour change lead to customer complaints, and often result in legal conflicts. These cause substantial costs to the leather manufacturing and processing industries. In addition, there is a loss in consumer confidence in furniture and automotive leather with all the detrimental economic consequences.

The objective when manufacturing these leathers is to fabricate a long-lasting product, and this includes the surface design or characteristics. However, it is known that - depending on leather end-use and the resulting wear conditions - leather care is often essential to maintain the material in optimal condition ^(1, 2).

Clearly, upholstery leather (like any other upholstery material) is subjected to continuous dust and soiling so a regular and type-matched care is advisable. And, generally, customers should not let soiling become too severe, as this can complicate cleaning measures ^(3, 4).

It can be considered that the tasks of leather care are readjustment to the new condition, the removal of wear marks and the "finishing" of leather for further wear. This involves anti-soiling, hydrophobing and oleophobic treatment and includes a degree of impregnation, and often has to restore both the natural leather humidity and grease lost in use ^(5, 6). The products employed also need to increase the protection of leather against numerous external influences such as mechanical abrasion, the action of UV radiation and higher temperatures, changes in humidity, and diverse "chemical" media (oil, sun cream, perspiration, hand grease, etc).

A need for reproducible test methods

Occasionally, leather care products are sent to testing departments to assess their suitability for leather care. In this event, and depending on customer demands, products are applied on leather so that the visual appearance and appropriate leather properties can be assessed. Often, this testing procedure does not include the influence of factors associated with aging and the method of product application. In this situation a more realistic and reproducible suitability test is required that is based on simulations of wear aging and repetitive application of care products.

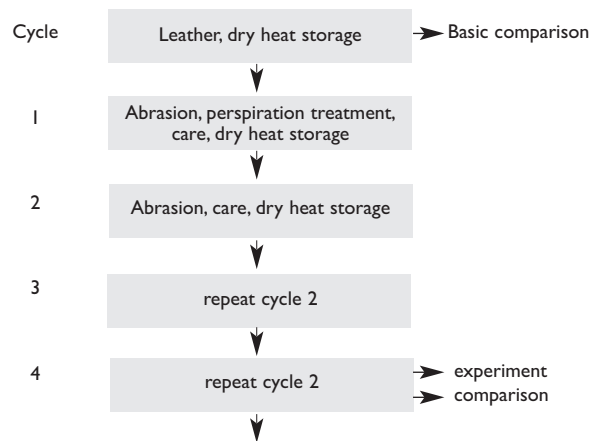
In the field of the artificial aging of leather, a number of investigations have been made, and a correlation has been found between realistic aging of leathers and a set of thermal storage conditions. On the basis of measuring the bending-stiffness of leathers, it has been established that the storage of leather at 80°C for four hours corresponds to a natural aging (in a living room) of approximately nine months ⁽⁷⁾.

The investigation

One of the aims of this research project was to develop a reproducible testing procedure that include both the simulation of different wearing loads and the well-defined application of cleaning and care products on the leather surface.

After studying various wearing factors - dry heat, mechanical load (abrasion / rubbing under load), artificial perspiration, UV irradiation, and humidity - in terms of their effect on leather properties, the combination of dry heat, abrasion and perspiration treatment was selected. This enabled a cycle of wear simulation and care product application that can be repeated as often as necessary. This cycle is illustrated in *Panel 1*:

Panel 1: Procedure cycles used for evaluation



With reference to *Panel 1*, in the first stage of the cycle three steps were developed:

- The abrasion step was performed in a Martindale device by fixing the leather sample in the lower position and by rubbing 1000 cycles with a defined wool cloth under a load of 12 kPa using the pilling head.
- Perspiration treatment was carried out by applying a constant amount of a solution of artificial perspiration on filter paper, followed by close contact with the leather surface at 37°C, for three hours and under a load of 2 kg. After this step, leather samples had to be dried overnight in standard climate conditions (23°C, 50% relative humidity).



- The dry heat storage was performed in an oven at 80°C for four hours.

In the second stage of the cycle, to create both reproducible conditions and a good comparability, the cleaning and care step of the procedure was performed using the Martindale device as detailed. In this way, different amounts of care product, several application means and varying numbers of application cycles at two different loads were investigated. The application conditions were designed in cooperation with a care goods producer so that the conditions were as close as possible to the domestic reality. These conditions are summarised in *Panel 2*:

Panel 2: The conditions of application

Application: Martindale device

Two-components product

Cleaner:

- weighing on sponge
- application

removal of cleaner residues
air drying

Cream:

- weighing on fabric
- application

One-component products

Lotion:

- weighing on sponge
- application

removal of cleaner residues
air drying



The influence of care products on leather wear properties was assessed by testing:

- 11 commercially available products destined for the care of leather with smooth surface (e.g. pigmented, aniline),
- 2 special mild soaps on different leather types,
- 8 of the care products that consisted of a cleaner and a conditioner (cream),
- 3 all-in-one products.

In these investigations nine different leathers were used that included all upholstery leather types (aniline, semi-aniline and pigmented), and the leather finish was based on polyacrylate, or polyacrylate in combination with polyurethane.

Leather samples for evaluation were taken from the hides in accordance with a well defined scheme, and after subjection to the test cycles, specimens were punched out from the treated areas of the leather sample. The test procedures that were used to evaluate these treated samples are set down in *Panel 3*.

This approach ensured that the treated leather samples were assessed with respect to their visual appearance, haptic properties (feel), rub fastness, fastness to water spotting, flexing endurance, finish adhesion, light fastness and odour. Comparisons could be made with leather in the original state (basic comparison) and leather subjected to the procedure but having no treatment with care products (comparison).

In addition, more than 20 basic chemical components of care products – such as oils and waxes, polyacrylates, polysiloxanes, solvents, etc. - were investigated on all of the leather types using the procedures as detailed. These components were applied in the same concentrations (2%–12%) as they are contained in the care product.

The influence of application means was tested by using

Panel 3: Test procedures

- Rub fastness (ISO 11640)
- Fastness to water spotting (according to ISO 15700)
- Flexing endurance (ISO 5402)
- Finish adhesion (ISO 11644)
- Light fastness (ISO 105-B02)
- Odour (RAL GZ 430, fast method)

Additional assessments:

- appearance
- haptic (feel)



different sponges (polyurethane flexible foam, melamine resin and one of unknown composition) and cleaning pads (cotton and microfibre fabrics).

The effect of care products

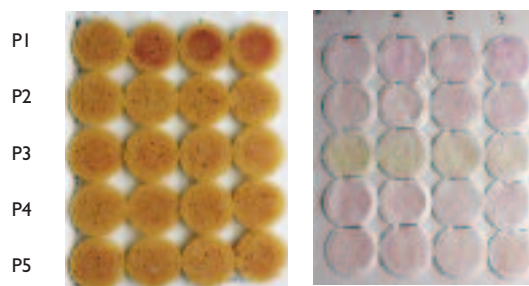
In general, the procedure for simulating wear and care was performed over four cycles, although this was extended to 16 cycles for selected care products and leather types.

STAINING OF MATERIALS USED FOR THE APPLICATION OF CARE PRODUCTS

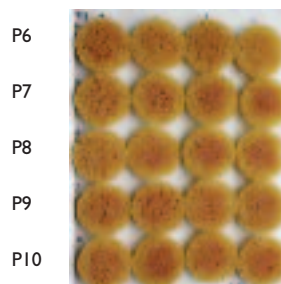
During cleaning and care operation, staining of the sponges and pads used for the application of care products – known as the “application means” – was observed for the majority of cases. In this event, the discolouration during the four cycles could be either constant or show increasing or decreasing intensity as in the example given in *Panel 4*:

Panel 4: Discolouration of the application means after use. Comparison of care products (on red aniline leather)

Two-components care products



All-in-one care products





The staining assessment of the pads and sponges used as the application means is set down in *Panel 5*:

Panel 5: Staining and evaluation of the application means

P	1	2	3	4	5	6	7	9	10	11	12	13				
Leather type	S	F	S	F	S	F	S	F	S	S	S	F	S	F	S	F
Aniline LGR	++	++	+	++	+	++	+	++	++	++	++	++	++	++	++	++
Semi-aniline LGR	++	++	+	++	+	++	+	++	++	+	++	++	++	++	++	++
Aniline Producer X	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++
Semi-aniline Producer X	-	*							*				*			
Pigment. I. Producer X	-	*	-	*	-	++	*	-	*	+	-	*	-	*	-	-
Semi-aniline Producer Y	-	+	-	+	-	++	-	+	+	+	+	-	+	-	-	-
Semi-aniline Producer Z	+	+								++					+	+
corrected, pigm. I. Producer Z	+	+								++					-	*

++ strongly stained
++ clearly stained
+ lightly stained
- not stained
S sponge
F fabric

Grey cells – experiment not performed

THE EFFECTS OF CARE PRODUCTS ON LEATHERS

There were many effects, and combinations of these effects when using the different care products across the leather examples, and four aspects were identified:

(1) Loss of colour

For some sensitive leathers, such as the aniline types, the colour loss as a result of these repetitive applications (16 cycles) of care products was considerable, and examples are given in *Panels 6 and 7*:

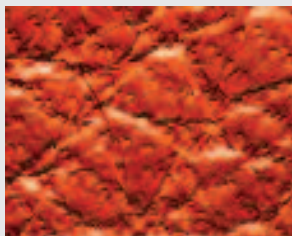
(2) The visual appearance of leather surfaces

Cleaning/care products acted on the visual appearance differently:

- an increase in gloss was observed in the majority of cases, even when compared to the “comparison” leather.
- some of the care products produced a matting effect on several leather surfaces.
- an increase in surface adhesion of dust, fibres, abrasive debris was found with some leathers.

Panel 6: Surface of red aniline leather after 16 cycles. Product by Producer X

(Magnification x25)



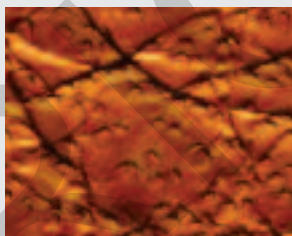
Experiment PI, 16 cycles



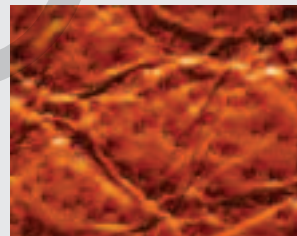
Comparison PI, 16 cycles

Panel 7: Surface of brown aniline leather after 16 cycles. Product by Producer LGR.

(Magnification x25)



Experiment PI, 16 cycles



Comparison PI, 16 cycles

(3) Properties associated with leather handle

With respect to leather handle, the variations found was even greater than effects on visual appearance. The effect of a certain care product also proved to be non-predictable. In one product example, using the same conditions on different leather surfaces produced a full range of leather-handling characteristics: these have been described as “pleasant dry”, “fatty and slightly sticky” or “rough and creaky”.

Panel 8: The effect of different care products applied on red aniline leather (Producer X)

Application	dry 50	Rub fastness wet 20	perspir. 20	Fastness to water spotting (modified)	Light fastness rate	Odour rate
Basic comparison	4-5	4	3-4	> 30 min, no changes	3	2.7
Comparison	4-5	3-4	3-4	> 30 min, no changes	3	2.2
Product 1	4-5	3-4	3-4	> 30 min, n.ch./dark stain	3	1.7
Product 2	4-5	4-5	4	> 30 min, no changes	3	1.9
Product 3	4-5	3-4	4-5	> 30 min, no changes	3	1.8
Product 4	4-5	4-5	4	> 30 min, no changes	3	1.8
Product 5	4-5	4-5	4-5	> 30 min, n.ch./dark stain	3	1.5
Product 6	5	4-5	4-5	> 30 min, no changes	3	2.1
Product 7	4-5	4-5	3-4	> 30 min, no changes	3	1.8
Product 8	4-5	3-4	3	> 30 min, no changes	3	1.9
Product 9	4-5	4	4-5	> 30 min, no changes	3	2.0
Product 10	4-5	4	4	> 30 min, no changes	3	2.3

(Underlined rub fastness rates give a hint on the tendency)



(4) The wear properties of leathers

The effect of care products on wear properties that could be measured was considered to be rather positive, and an example when applied to red aniline leather is given in *Panel 8*.

Across the full range of leathers and care products, improvement of rub fastness and odour were observed, but rarely any change in light fastness (example: see *Panel 7*). Finish adhesion and flexing behaviour were not affected, but, in rare cases, a negative change in water spotting behaviour resulting in stains was observed (example: *Panel 7*, Products 1 and 5). An impairment of wet and perspiration rub fastness was experienced with certain leathers (example: *Panel 7*, products 1, 3 and 8).

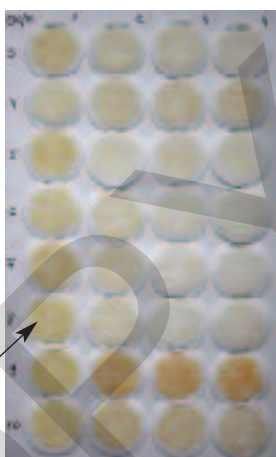
The effects of basic components within care products on leathers

The effect of the basic components contained within leather care products was investigated for all leather types (aniline, semi-aniline and pigmented) by performing four wear and care simulation cycles. Eight basic components were tested on each of the leathers. An example of the transfer of colour to the application pads from semi-aniline leather, together with a list of these components, is given in *Panel 9*:

Panel 9: Application pads after care of semi-aniline leather

Basic components

- 3 – Matting agent
- 4 – Acrylate, fluorinated
- 5 – Triethylcitrate
- 6 – Fatty acid amide, modified
- 7 – Reactive polyurethane
- 8 – Fragrance
- 9 – Polyurethane
- 10 – Oils, sulfonated



Application pads after care

In all of the investigations - but especially, in the treatment of aniline and semi-aniline leather - all of the application means became stained to a certain extent (example: *Panel 9*, pad staining with all eight basic components tested).

Although no perceptible colour change of the leather surface was observed with any of the samples, there was a varied influence on visual appearance. Generally, no changes of the surface or gain in gloss were observed, however:

- Sulfonated oils, triethylcitrate and the ester of sulfosuccinic acid produced matting on sensitive samples, such as aniline leathers.
- Polysiloxanes proved to have a negative effect and resulted in an increase of soiling behaviour on the surface of leathers.
- The repeated application of single basic components also produced a variety of handle changes. The strongest influence occurred when polysiloxanes were applied, irrespective of the leather type.

Regarding the wear properties of leather, a differentiation between basic components is possible only on the basis of rub fastness. In a few cases, a certain influence on fastness to water

spotting was found.

Except for polysiloxanes, the basic components generally improved wet rub fastness and perspiration rub fastness, but did not have any impact on dry rub fastness. Polysiloxanes acted inversely: whilst wet and perspiration rub fastness were improved, dry rub fastness was impaired.

The effect of the application means

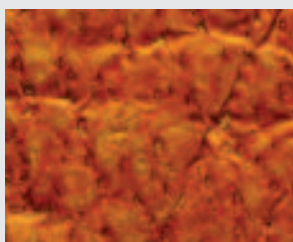
The effect of the different means of application was investigated using an all-in-one care product (Product 7). In this series the test procedure was extended to 16 cycles and carried out on aniline leather. Two types of cleaning pads that are commonly available in households, two sponges provided by care product producers, and one sponge promoted as “soil eraser” for different household applications were used in parallel experiments. These are listed in *Panel 10*:

Panel 10: Application means for care products Product 7 (LGR) on mid-brown aniline leather

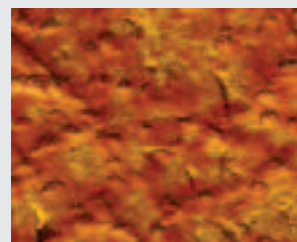
- Cotton fabric
- Microfibre fabric
- Sponge P1 (polyurethane flexible foam)
- Sponge P12 (yellow, unknown material)
- “Soil eraser” sponge (melamine resin)

One type of sponge – the “soil eraser”, based on melamine resin – had a detrimental influence on the leather surface. Damage to the finish was apparent after four repeated care cycles, with significant damage after 8 - 16 cycles until finally the grain itself was exposed. This is shown in *Panel 11*:

Panel 11: Leather surface after treatment Application means “Soil Eraser” sponge, Aniline leather, Product 7 (Magnification x25)



Experiment P7, 8 cycles



Comparison P7, 16 cycles

None of the other application means caused any significant changes of leather properties, and no discernible differentiation among them was possible.

Summary of findings

The procedures developed to investigate the influence of a range of care products and the means of application on leather properties under wear conditions proved to be suitable. Based on these procedures, the findings from the investigation can be summarised in the following three sections:



(1) The effect of care products

- Some care products caused remarkable changes in both the appearance and handle of leathers.
- At the same time, certain products caused an increased in the adherence of soil (dust and fibres).
- The effect of care products on leather odour was variable, but in most cases positive or neutral.
- There was a significant influence on wet rub fastness and with perspiration rub fastness.
- There was a limited effect on fastness to water spotting of individual leathers.
- In the case of sensitive leathers (aniline), even an appropriate care product when repetitively applied can cause a loss of colour, change in hue and even damage of the surface.

(2) The effects of individual components in care products

- The basic components contained within care products showed an impact on handle, rub fastness, fastness to water spotting, and partly on finish adhesion.
- The effect on leather properties was of different intensity, and dependent upon on the individual leather.
- Some of the polysiloxanes investigated and polyacrylate dispersions caused a remarkable change in the soiling behaviour of the leather surface.

(3) The effect of the application means

- The application means provided by leather care producers showed no negative effect on leather, except for sensitive leathers.

- Some application means that are available for household cleaning – such as “soil eraser” – caused heavy damage to the leather surface. ☹

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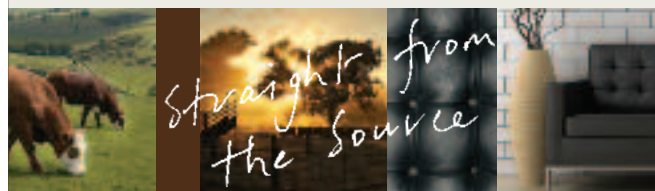
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