Effect of Care Products on Leather Properties

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Abstract: Upholstery leathers for furniture and cars are subjected to intensive wear conditions and therefore, cleaning and care at regular time intervals are necessary or at least, very recommendable. A newly developed procedure was used to compare the effect of different commercially available care products, of their basic components and of several application means. The main influence of care products proved to be on handle, wet and perspiration rub fastness. Odour and in some cases soiling behaviour were affected. Depending on the leather, the effect of the same care product can vary substantially. Care-specific application means proved to be unproblematic.
Keywords: leather care; care products; basic components; leather properties

1 Introduction

Upholstery leathers for furniture and cars are subjected to intensive wear conditions and therefore, cleaning and care at regular time intervals are necessary or at least, very recommendable. Thereby, the choice of a suitable care product for the respective leather type and an appropriate application of it deserve special attention.

Within the last years, an increased number of expertises have confirmed that a long-term use of leather upholstery may cause a damage pattern giving a hint of inadequate application of leather care products. Occurrence of surface damages, i.e. finish partial flaking off or breaking, lead to customer complaints which often result in judicial conflicts, thus causing substantial costs to the leather manufacturing and processing industries. In addition, negative experiences regarding wear behaviour of leather cause a loss in credit of upholstery and automotive leather with all the detrimental economic consequences.

The leather manufacturing process is basically conceived to fabricate a long-lasting product, whereby surface design is included. However, it is known that depending on leather use (and that of the processed good, respectively) and the resulting wear conditions, a leather care is all the same essential in order to maintain an optimal condition of the material [1, 2].

Upholstery leather, like any other upholstery materials, is subjected to continuous dust and soiling. Therefore, a regular and type-matched care is advisable. Generally, customers should not let soiling to become too intensive, as this can complicate cleaning measures [3, 4].

The tasks of leather care are the adjustment to the new condition, the removal of wear marks and the "finishing" of leather for further wear by means of anti-soiling, hydrophobing and oleophobing treatment. Besides a certain impregnation, the leather during care has to retrieve the humidity and grease lost in use [5, 6]. Modern leather care products shall increase the protection of leather against numerous outer

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influences like mechanical abrasion, action of UV radiation and higher temperatures, humidity and diverse “chemical” media (oil, tensides, sun cream, perspiration, hand grease etc).

Occasionally, leather care products are sent to testing departments for checking their suitability for leather care. Depending on customer demands, products are applied on leather and visual appearance as well as convened parameters of the leather is assessed after certain idle period. This testing procedure does not include the influence of outer factors, that of aging and that of application mode. Therefore, a more realistic and reproducible suitability test is requested, based on simulations of wear aging and repetitive application of care products.

In the field of artificial aging of leather, a number of investigations have been made. By choosing the aging conditions as close as possible to real ones, a correlation has been found to a set of thermal storage conditions: On the basis of bending-stiffness measurement the storage of leather at 80 °C for 4 hours corresponds to a natural aging (living room) of approximately 9 months [7].

These findings were used in the systematic investigations on the effect of leather care – i.e. the character of leather care products, their basic components and the way of application on the leather surface – on the leather properties.

2 Experimental

One of the aims of the research project was to develop a reproducible procedure including 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, humid heat, mechanical load (rubbing under load), UV irradiation, perspiration action) with regard to their effect on leather properties, the combination of dry heat, rubbing and perspiration treatment has been selected. Wear simulation and care product application are forming a cycle which can be repeated, as often as necessary (Fig. 1).

The abrasion step was performed in the 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 artificial perspiration solution on filter paper having a close contact with the leather surface at 37 °C, for 3 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 following dry heat storage was performed in an oven at 80 °C for 4 hours.

In order to realise reproducible conditions and a good comparability, the cleaning / care step of the procedure was performed using the Martindale device. In this way, different amounts of care product, several application means, varying numbers of application cycles at two different loads were investigated. The final set of application conditions was designed in cooperation with a care goods producer as close as possible to the domestic reality. The used application means have been those provided by the producer.

For investigations, 9 different leathers including all the upholstery leather types (aniline, semi-

aniline and pigmented) were used. The leather finish was on the basis of polyacrylate or its combination with polyurethane. Leather samples were punched out from the hides in accordance with a well defined scheme. After being subjected to the cycles of the newly developed test procedure, specimens were punched out from the treated area of the leather sample and then the following different tests were conducted.

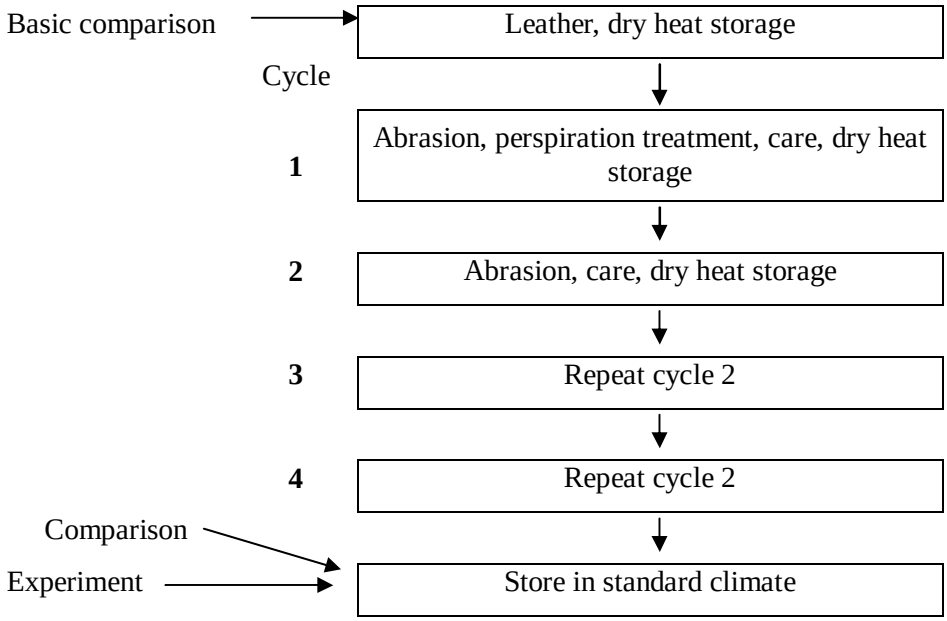


Fig.1 Flow chart of the final procedure

After the experiments, the treated leather samples ("experiment") were assessed with respect to their visual appearance, handle (feel) and several important tests (rub fastness, fastness to water spotting, light fastness, flexing endurance, finish adhesion, odour) and compared with leather in the original state ("basic comparison") and leather subjected to the procedure having no treatment with care products ("comparison").

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) and two special mild soaps on different leather types. 8 of the care products consisted of a cleaner and a conditioner (cream), 3 were all-in-one products. The composition of the single care products being unknown, only producer declaration on the label (if any) could be considered. The recommendation to perform a suitability test of the product in a hidden part of the leather before applying it was ignored bearing in mind the investigation aim.

In addition, more than 20 basic chemical components of care products like oils and waxes, polyacrylates, polysiloxanes, solvents, tensides, etc. were investigated on all of the leather types using the novel procedure. The 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 different sponges (polyurethane flexible foam, melamine resin and one of unknown composition) and cleaning clothes (cotton and microfiber fabrics).

3 Results and discussion

3.1 Effect of Care Products on Leather Properties

Generally, the procedure of wear and care simulation was performed over 4 cycles, being extended to 16 cycles for the selected care products and leather types. During cleaning and care operation, staining of the application means (sponge, cloth) was observed for the majority of cases. In this procedure, the discolouration during the 4 cycles could be either constant or showing increasing or decreasing intensity (Fig. 2). For some sensitive leathers, like aniline types, the colour loss of the leather by repetitive application (16 cycles) of care products was considerable.

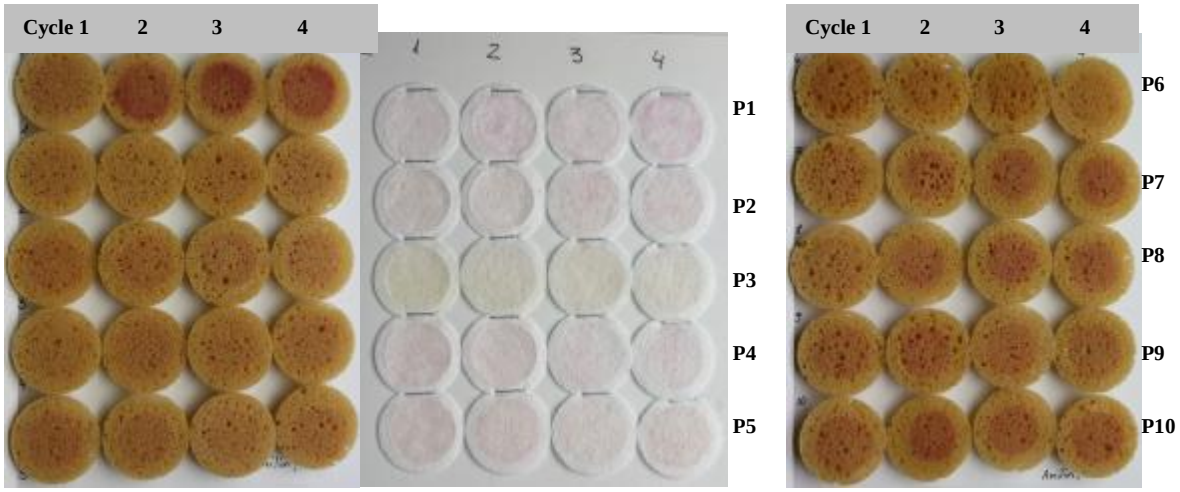


Fig. 2 Application means after care, products P1-P10, red aniline leather

Cleaning / care products acted on the visual appearance differently: for the majority of cases, an increase in gloss was observed, even when compared to the "comparison" leather. But some of the care products produced a matting effect on several leather surfaces. Others (P2, P4) with several leathers caused an increased adhesion of dust, fibres, abrasive debris on the surface.

With respect to leather handle, the variety of results was even greater. The effect of a certain care product proved to be non-predictable: using the same experimental conditions on different leather surfaces handling characteristics described as "pleasant dry", "fatty, slightly sticky" or "rough, creaky" were obtained.

Considering measurable wear properties by using the newly developed procedure (4 cycles), the effect of care products could be assessed as rather positive. Improvement of rub fastness and odour were

observed and rarely, of light fastness (Tab. 1). Finish adhesion and flexing behaviour were not affected. In rare cases, a negative change in water spotting behaviour resulting in stains (P1, P5 and P8) was observed. An impairment of wet and perspiration rub fastness was found for certain leathers in relation to the application of care products P1, P3 and P12.

Tab. 1 Effect of different care products applied on red aniline leather (producer X)

Experiment	Rub fastness			Fastness to water spotting	Light fastness	Odour
	dry	wet	perspir.			
	50	20	20	(modified)	Rate	Rate
Basic comparison	4-5	4	3-4	> 30 min, no changes (n. ch.)	3	2,7
Comparison	4-5	3-4	3-4	> 30 min, no changes	3	2,2
Experiment P1	4-5	3-4	3-4	> 30 min, n. ch. /dark stain	3	1,7
Experiment P2	4-5	4-5	4	> 30 min, no changes	3	1,9
Experiment P3	4-5	3-4	4-5	> 30 min, no changes	3	1,8
Experiment P4	4-5	4-5	4	> 30 min, no changes	3	1,8
Experiment P5	4-5	4-5	4-5	> 30 min, n. ch. /dark stain	3	1,5
Experiment P6	5	4-5	4-5	> 30 min, no changes	3	2,1
Experiment P7	4-5	4-5	3-4	> 30 min, no changes	3	1,8
Experiment P8	4-5	3-4	3	> 30 min, no changes	3	1,9
Experiment P9	4-5	4	4-5	> 30 min, no changes	3	2,0
Experiment P10	4-5	4	4	> 30 min, no changes	3	2,3

n. ch. No changes perspir. With perspiration solution

Underlined rub fastness rates give a hint on the tendency

3.2 Effect of Basic Components on Leather

The effect of basic components of leather care products was investigated for all leather types (aniline, semi-aniline and pigmented) by performing 4 wear and care simulation cycles. Bearing in mind care products consisting of cleaner and conditioner, the basic compounds were assigned, if possible, to one of them. This correlation has let to determine the conditions to be used in the cleaning / care step (i.e. application means, number of cycles in the Martindale device).

After completion of the procedure, no perceptible colour loss of the leather surface was observed. But especially in case of treatment of aniline and semi-aniline leather all the application means used were stained to a certain extent (Fig. 3).

The influence on visual appearance varied. Generally, no changes of the surface or gaining in gloss were observed. As expected, sensitive leathers like aniline were more affected. Sulfonated oils, triethylcitrate and the ester of sulfosuccinic acid produced matting on this leather type.

In the conditions applied, polysiloxanes proved to have a negative effect on soiling behaviour of the surface for all leather types. An increased adhesion of soiling was observed in the treated area of the leather sample.

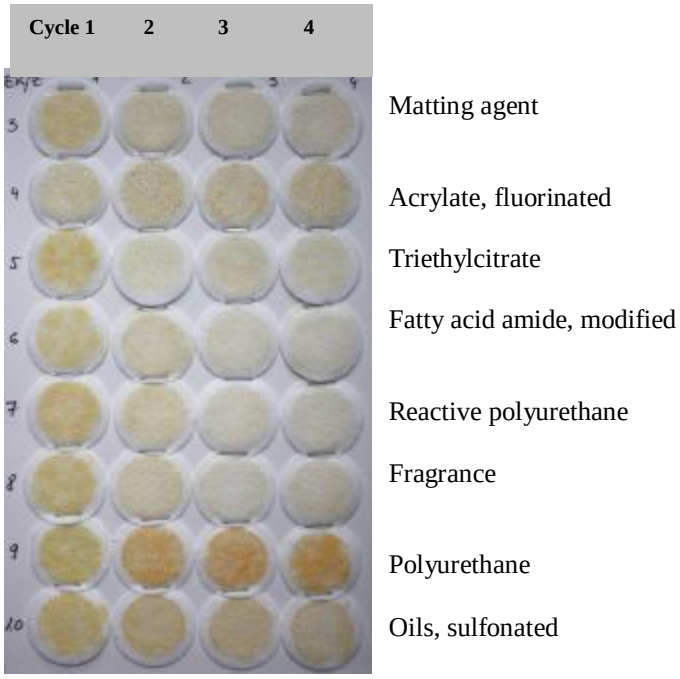


Fig. 3 Application pads after care of semi-aniline leather

The repeated application of single basic components produced a variety of handle changes. The strongest influence occurred when polysiloxanes were applied, irrespective of the leather type.

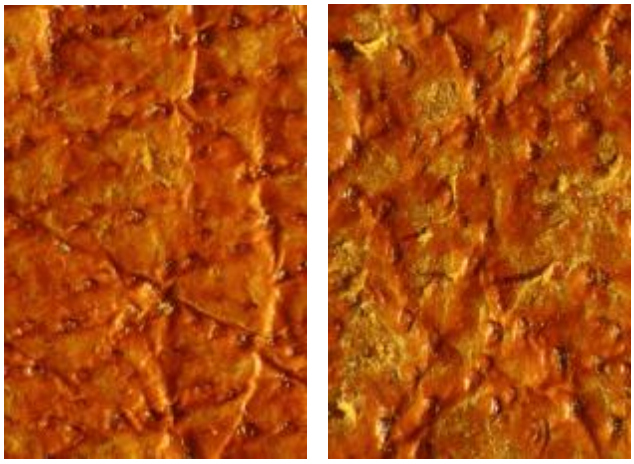
Regarding the wear properties of leather, a differentiation between basic components is possible only on the basis of rub fastness. In a few cases, a certain influence on fastness to water spotting was given.

Except for polysiloxanes, basic components generally improved wet and perspiration rub fastness without any impact on dry rub fastness. Polysiloxanes acted inversely: whilst wet and perspiration rub fastness were improved, dry rub fastness was impaired. As expected, these components generated bonding problems during finish adhesion testing.

3.3 Effect of Application Mode

The effect of the application mode was investigated by means of an all-in-one care product (P7). The test procedure was extended to 16 cycles and carried out on aniline leather. Two types of cleaning clothes (cotton and microfiber) available in household and three sponges (2 provided by care product producers, 1 promoted as “soil eraser” for different household applications) were used in parallel experiments.

One type of sponge (“soil eraser”, based on melamine resin) had a detrimental influence on the leather surface: already after 4 repeated care cycles, a significant damage of the finish appeared (Figure 4). As the use of other application means caused no significant changes of leather properties, no differentiation among them was possible.



8 cycles 16 cycles

Fig. 4 Effect of "soil eraser" on leather surface

4 Conclusions

Results of this investigation allow summarising the following:

Including relevant wear conditions, the newly developed procedure proved to be suitable in recording influences of care products on leather properties. Some care products caused remarkable changes in both appearance and handle of the leather. At the same time for certain products an increased adherence of soil (dust and fibres) was observed. The effect of care products on leather odour was variable, but in most cases positive or neutral.

Under the conditions used, care products had a significant influence only on rub fastness (wet and with perspiration) and a limited effect on fastness to water spotting of individual leathers. In case of sensitive leather (aniline), even an appropriate care when repetitively applied can cause a loss of colour, change in hue and even damage of the surface.

Application means provided by producers showed no negative effect on leather, except for sensitive leathers. Other means available in household like "soil eraser" damaged the leather surface heavily.

Basic components of care products had an impact on handle, rub fastness, fastness to water spotting and, partly on finish adhesion. Thereby, the effect on leather properties was different regarding intensity and tendency, depending on the leather. Some of the polysiloxanes investigated and polyacrylate dispersions caused a remarkable change in soiling behaviour of the leather surface.

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