



January 3, 2004

Dakota Ag Innovations
40690 253rd Street
Mitchell, South Dakota 57301

RE: Dakota Magic Leather Cleaner
Use on Leather Upholstery

LEGEND TECHNICAL SERVICES, INC. (LEGEND) has been requested to evaluate the chemistry of Dakota Magic Leather Cleaner with respect to the potential for detrimental effects on either the leather upholstery over the life span of the leather or to the user of the product during application and subsequent use of the cleaned leather.

LEATHER BACKGROUND INFORMATION

Leather is manufactured from animal hides through a chemical process called tanning which involves removing the fat and water components of the hide and treating the remaining protein chemically to strengthen the peptide bonds. There are a number of tanning processes that can be employed and the final product varies considerably based on the hide and process. The leather used in automotive upholstery is generally a more durable material than some of the leathers used for other purposes such as suedes and nubuck leathers.

The major concern with leather cleaning is to avoid deteriorating the leather through the cleaning process. Leathers deteriorate by four means:

- Oxidation is most readily seen in very old dry leather, with surface cracking.
- Chemical damage can be through the effect of ultraviolet light, ozone, acid from nitrous pollutants in the air, or through chemical action following treatment with various chemicals.
- Internal chafing or breaking of fibers occurs when dry leather is flexed. A lubricant allows the fibers to slide one against the other.

- Abrasion can be external, from rubbing on the outside, or internal from dirt present in the leather.

REVIEW OF TRADITIONAL LEATHER CLEANERS/CONDITIONERS

There is consensus in the leather industry that appropriate leather cleaners are limited to water based surfactants. The use of ammonia and solvent based cleaners is to be avoided as they damage the leather. However, there is no industry consensus on the makeup of conditioning agents with some leather manufacturers recommending certain components and others cautioning the same components be avoided.

Cleaners

Available cleaners are predominantly water based surfactant products. The one generally recommended by leather manufacturers was Leather Master® cleaner. We obtained a bottle of the cleaner and analyzed it in the laboratory to determine its chemical composition. The cleaner is water based and has a neutral pH with approximately 1.2% solids. The solids content was determined to be a combination of polyoxyethylene (20) stearyl ether (CAS#9005-00-9) and Nonyl Nonoxynol-7-phosphate (CAS#66172-78-9). CAS#9005-00-9 is a wetting agent. CAS#66172-78-9) is a surfactant.

Another recommended cleaner was Ivory® hand dishwashing liquid diluted in water. Review of the material safety data sheet for Ivory dishwashing liquid identifies the components as Lauramide diethanolamine (DEA) CAS#120-40-1; sodium laureth sulfate CAS#9004-82-4; citric acid CAS#77-92-9; tetrasodium EDTA CAS#64-02-8; sodium chloride CAS#7647-14-5; sodium lauryl sulfate CAS#151-21-3; cocoaamidopropylbetaine CAS#61789-40-0; DMDM hydantoin CAS#6440-58-0; sodium sulfate CAS#7757-82-6; and water.

Conditioners

Conditioners are recommended to be used periodically on leather products by leather manufacturers to maintain the leather pliability and maintain the leather's ability to repel spilled material. The natural oils in leathers are semi-volatile in nature and over time will evaporate from the leather material resulting in a less flexible material subject to cracking. Exposure to heat as occurs in an automobile during the summer months accelerates the evaporation of these natural oils. The ultraviolet radiation in sunlight can chemically alter these oils.

The commercially available leather conditioners vary considerably in chemistry. The Neatsfoot oil products composed of animal oils and fats

are recommended by some leather manufacturers because of their chemical similarity to the natural leather oils. Other leather manufacturers discourage the use of Neatsfoot oil because of its fungal and bacterial biodegradability and potential to discolor the leather over time. Other products designed for conditioning leather use a combination of paraffinic oil and tallow in a water emulsion. This would be similar to the Neatsfoot oil in that tallow is an animal oil with the addition of high boiling paraffinic oils similar to motor oil. Other products use a combination of Neatsfoot oil, water, and dimethylpolysiloxane (silicone oil). Beeswax is also a recommended ingredient for leather conditioners.

DAKOTA MAGIC UPHOLSTERY CLEANER CHEMISTRY

Chemistry

As part of this evaluation, LEGEND reviewed the chemistry of the Dakota Magic Leather Upholstery Cleaner product. The chemical formulation is available upon request.

The Dakota Magic Leather Upholstery Cleaner is water based and is consistent with the leather manufacturer recommendations for a water based surfactant cleaning agent.

When looking at the chemistry of the Dakota Magic Leather Upholstery Cleaner the components that are different from other cleaners include the THFA and the sodium metasilicate. The THFA is an alcohol and does have some ability to remove oils from the leather. However, the dimethoxysiloxane hydroxyl terminated component will lubricate the leather and replace oils removed from the leather preventing drying out of the leather.

The sodium metasilicate pentahydrate ingredient also needs consideration as it results in a caustic pH for the cleaning product. The recommended pH for leather cleaners is neutral because the protein bonds in the leather can be broken down by either strongly acid or strongly alkaline conditions. However, soaking various upholstery leathers in the undiluted cleaner for 14 days showed no physical alteration in the leather. This indicates that the cleaner does not have sufficient hydroxyl anionic strength to alter the protein bonds to a measurable extent.

Health Risks To the Product User

The product is water based and does not have sufficient volatile components to pose an airborne exposure risk even if the entire container were applied at one time. The product has an alkaline pH and may result in slight dermal irritation to persons with pre-existing skin conditions such as psoriasis. Drinking the product may result in some gastrointestinal disturbance but it does not present an aspiration hazard if vomiting occurs.

Any residue remaining on the leather after cleaning with the product is expected to be minimal and not pose a hazard to the upholstery user.

Cleaner Application

The Dakota Magic Cleaner applied to leather furniture was observed to lift more soil from the leather surface than did the widely recommended Cleaners. The Dakota Magic Cleaner also provides a leather conditioning function resulting in a softer, more pliable leather after cleaning.

Given that the Dakota Magic Cleaner appears to effectively remove soils from the leather, the user is more likely to be satisfied with the cleaning results and less likely to attempt to use harsher chemicals such as straight solvents and household cleaners which are more likely to result in damage to the leather structure and eventual complaints from the leather user concerning the quality of the leather.

One element of caution as with all leather cleaning products, is the possibility of lifting dye from the leather during the cleaning process. The user should be directed to first apply the cleaner in an inconspicuous area to verify the dye will not be lifted from the leather during the cleaning process, although none was detected while testing Dakota Magic Leather Upholstery Cleaner.

SUMMARY

The Dakota Magic Leather Upholstery Cleaner performed well providing both cleaning and conditioning to the leather surface.

Review of the product ingredients did not indicate chemicals that would be incompatible with maintaining the leather over the life span of the material.

Product chemistry is water based and not expected to present an exposure hazard to persons applying the product or users of the cleaned upholstery.

REFERENCES

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- Infrared scans for residue of Leather Master® Soft Cleaner

STANDARD OF CARE

This report presents our findings and recommendations. Recommendations are based on current published information and regulatory requirements. Other than this no warranty or guarantee is made or implied.

Cordially,

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