Siegfried Nagel, Technical Director at German leather chemical specialists, Schill + Seilacher Leather, looks at the role leather odour chemistry plays in automotive interiors to provide a sense of luxury.

Car interior odour emission testing.
Image permission Daimler AG, Germany

Leather odour contributes to luxury interiors

Making leather has always been a competition between the tanner's effort to create a material and nature's will to decompose. The highly prized collagen has to remain in the tanner's hands, but most of the other natural materials a hide contains, we want to make disappear to make the final leather.

Unfortunately, any leather production leaves some degraded residues of protein, a varying amount of natural grease and a long list of chemical impurities inside the fibre structure. Even worse, those materials in each piece of leather not only remain inside but also evaporate; creating a number of other chemical substances recognised in emission tests and in the surrounding odour.

Siegfried Nagel, Technical Director, Schill + Seilacher Leather

Looking just at the odour, for many years the typical leather smell was an important part of leathers' value[1]. But, in more modern times, the identification of serious hazardous compounds in interior material emissions has switched the end consumer's opinion into a search for emission free materials.

Adapting to these changes, the tanner's first reaction was to cut any hazardous materials from their chemical sourcing list, but do tanners ever consider what is found in the leather's natural emission sources? Modern chemistry offers a few solutions to absorb odour, to eliminate unpleasant smells, or even to avoid the creation of malodour right at the decomposition source. So to understand the required pathway of malodour elimination, we first have to identify the single substances, their chemical classes as well as their reactivity in order to select the appropriate additive tools.

Learning from aroma designers and master perfumers, at Schill + Seilacher, we also use single substance identification methods such as headspace or thermodesorption tests followed by chromatographic detection. These methods show each substance that evaporated from either food, flowers or, in our industry segment, the car interior material[2]. The latest test chambers even simulate daily use conditions for complete cars, and test the emission mix in the passenger air space (see image).

But, even when best available analysis technology is used, judging pleasant or unpleasant smells is still done exclusively in our brains, and the information collected by the millions of olfactoric epthelium in our nose is unfiltered and transferred direct into the limbic system. We cannot stop or control these transfers; the emotion of smell starts there.

Any odour information, even when not rational, is recognised due to very low concentrations of some smells, and influences our decisions to feel more or less comfortable in a room, or even moving away from it spontaneously, with no explanation.

As this has a major impact on people's perception, it guides scent technology for hotels, shops, car designers as well as, in the case of unpleasant odour, it influences decisions whether to buy or not a product.

What kind of substances create a 'no' decision in the case of leather and leather products?

A) Protein degradation mainly results in unpleasant smelling amines; the worst examples being indole, skatole, putrescine and cadaverine. Such amines are created not only during beamhouse processing, but also by wastewater recycling as they are carried back into tannery processes and trapped in the leather structure.

Fig 1: Type and grade of wet-blue odour

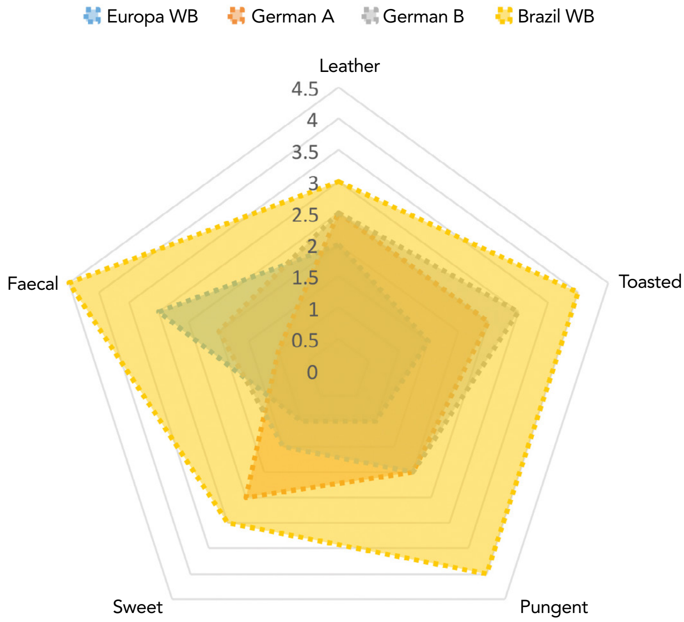


Fig 2: Type and grade of malodour

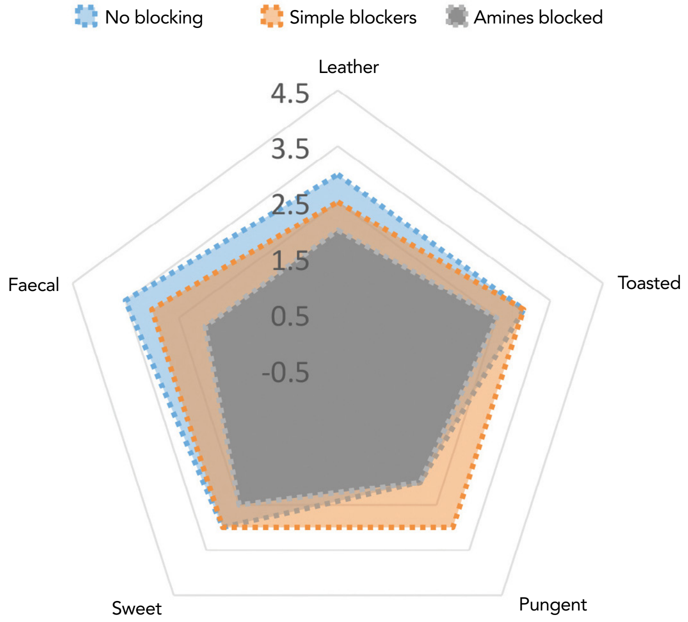
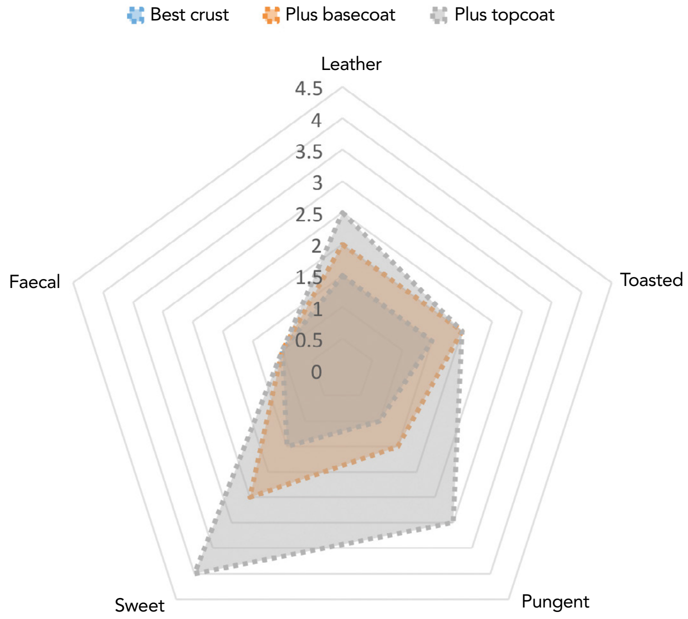


Fig 3: Type and grade of wet-blue odour



B) Another group of sometimes pleasant perfume ingredients, but often pungent occurring odour, are various aldehydes released from oxidative decomposed natural fat and low quality natural based fatliquors[3].

C) Breakfast odour from coffee and toasted bread is a nice smell to many. But several leather additives dried to powders, or the rapid drying of leather itself, create roasted notes which become unacceptable in higher concentrations. This substance group is often controlled by reducing to the lowest required offer of vegetable extracts or syntans.

Odour made visible

During several years of odour testing, VDA 270, the Schill + Seilacher 'noses team', recognised a repeated number of typical leather odour types and learned how to visualise this picture. A very nice 'Whiskey Wheel' was invented for fine tuning aroma visualisation. The Daimler method DBL5306 also uses an odour type description for all car interior materials. For leather specifically, there are mainly five connected odour types, good enough to describe all odours present.

The leather odour circle naturally contains the typical leather smell, which is composed of a mix of pleasant types. A roasted type smell is also always present in traditional leather, and even the pungent odour from aldehydes is often found.

More pleasant aldehydes create the sweeter smells, where small amounts of amines often are mixed in. The strong amine based faecal notes are also present in very small amounts, contributing to really good odours as found in high class perfumes, close to that found in nice leather.

Visualising odours helps to grade different malodours and new find pathways to reduce them (see Figures 1-3).

Amine elimination

In terms of natural malodour in a load of wet-blue, no clear differences are found within the various producers, however, different results can been seen between suppliers from different continents (see Figure 1).

This is caused by significant differences in hide preservation, water recycling and beamhouse processing. So far, this is an unavoidable situation.

Solutions for this amine load can be the so called "amine blockers", of varying chemistries and application. Schill & Seilacher recently developed an amine blocker particularly suitable for application during pretanning and early retanning process steps, without any other disadvantages on automotive leather types (see Figure 2).

However, this additive represents only a part of the whole odour control technology, and needs to be adjusted according to the raw material origin.

Fatliquor under control

Another established odour control technology is part of the Schill + Seilacher's fatliquors range, which also protects against residual natural grease content in any leather. Highly effective antioxidant compounds are micro dispersed in all fats and oils to protect those softening materials from oxidative degradation and an unpleasant smell release. As a side effect, this protection also prevents chrome tanned leathers from generating carcinogenic chromate compounds (chrome VI).

Here we should mention that leather's contribution in the total aldehyde emission detected is around one third in a worst case scenario. The majority of aldehyde released from a car interior is created by ageing of plastic, foam and rubber.

Important to note:

Aqueous basecoats are normally suitable for low smell leathers and do not add serious amounts of sweet or pungent smelling solvents, or odours after proper drying.

Finishing top coats still contain technically required and, so far dramatically reduced but still detectable, solvents of varying chemistry and smell. This substance group can only be handled by the addition of highly effective odour absorbents in some selected process steps.

Looking ahead

Looking ahead, even some further production steps also require odour control solutions, even when the product is in use by consumers. It should be part of future efforts to eliminate finishing solvent residues present in every leather article. This is the future playground for creative chemists and leather experts. ▪

Reference: 1: http://www.fragrantica.com/notes/Leather-156.html
2: http://www.filkfreiberg.de/fileadmin/user_upload/Emissionsmessmethoden.pdf
3: Patent DE19860610 B4 - A method for inhibiting the Cr (VI) formation in chrome-tanned leather and use of antioxidants