SmiTools - Emission

the origin, testing and prevention of emission

In this SmiTools Smit & zoon is sharing a synopsis on the topic 'Emission'. Learn about the different ways to measure emission, the origin of emission and what to do to prevent e.g. odour, free formaldehyde, gravimetric fogging, VOC, FOG, etc..

Introduction

Nowadays much more time is spent in interiors than it was in the past. This requires standards for protecting human health and for clean living conditions. Nowhere have these standards been more stringent than in the car industry. The car's interior is more and more a living room on wheels and subject to a diversity of influences on health and well-being from the materials applied that surround the driver and passengers.

Increased interior temperature of up to 120°C surface T, due to aerodynamic and stylistic demands, are not an exception when a car is left standing in full sun for some time. The high surface temperatures cause problems inperceivable as yellowing, shrinkage, or undesired ageing of parts of a car's interior.

It is, however, the emission of low and medium volatile substances which creates a risk for health and well being.

What causes emissions?

Emissions are caused by certain ingredients of a material which are released in to the air at specific temperatures. The temperatures at which the individual ingredients become volatile differ.

Is there a method for measuring emissions?

The methods differ depending on the type of emission to be measured. Some of the emissions can be detected by humans, while they are unconscious of the presence of others. Some emissions can be fully analysed, while others can only be subjectively described.

What methods do exist for measuring emissions?

For measuring the different emissions the main test methods used are, the:

- Odour test
- Formaldehyde test
- Fogging test, gravimetric and reflectometric
- Static headspace test
- Dynamic headspace test
- Emission chamber test

Odour

Test method

To detect and describe a leather's odour the samples are assessed by a panel of at least three persons. The sample consists of a leather cutting which has been heated for a set period in a glass bottle. The common standard is 80°C/2hrs.

The result is described on a scale of 1-6:

1: not perceivable

2: perceivable, not disturbing

3: clearly perceivable, not yet disturbing

4: disturbing

5: strongly disturbing

6: intolerable

The maximum tolerated value is "3".

Origin

Chemical residues from liming, de-liming and bating are the most common source of smell. Other possible causes for its occurrence are improper auxiliaries used, interactions between dyes/retanning agents/fatliquors, and the activity of micro organism.

Prevention

To wash and drain properly, especially during beam house processes, is essential. Intense drying ensures that the leathers are freed from some of the substances well before they could enter the interior. Retanning agents, fatliquors and dyes are to be carefully selected. Tests to exclude interactions between dyes/retanning agents/fatliquors under different are part of the development process. To counter the activity of microorganisms the use of preservatives is necessary.

Formaldehyde

Test methods

Two methods are available for formaldehyde: one where a leather samples is cut into pieces and washed in a detergent solution of 40°C; one where a samples is left to hang in a bottle above water for 3 hours at 60°C.

In both cases the liquid can either react with DNPH and measured with HPLC (formaldehyde-selective), or with acetyl acetone and measured with UV spectrophotometer (not formaldehyde-selective). The method where cuttings are washed in detergent solution is used for non-automotive leathers. The method with the sample hanging is used for automotive purposes since it mimics the car interior's environment more than the first method which, on the other hand, again more resembles the interaction between a perspiring foot and the shoe.

Origin

Free formaldehyde is present in many auxiliaries in minimal quantities only. It does not pose a risk since it is easily removed during processing. The reacted formaldehyde, on the other hand, can be released during extended periods as releasable formaldehyde.

Sources of releasable formaldehyde are syntans, amino resins, biocides, dyeing auxiliaries or finishing products. The main risk for subsequent release of formaldehyde relates to the use of conventional amino resins since the formaldehyde-nitrogen bond has reduced stability to the influence of periods of heat and moisture.

Prevention

The replacement of conventional amino resins by specialized products from the SAFETAN range nearly eliminates the formaldehyde releasing potential of any leather. Leather quality is not compromised by their use since their performance equals that of the conventional products.

"Formaldehyde-catching" products, also described as "scavengers" are neither effective nor lasting method to prevent the release of formaldehyde from leather.

Note : We have a separate SmiTools on 'Free Formaldehyde'.

Fogging

Test methods

A round leather specimen rests on the bottle of a glass jar which is immersed in an oil bath of 100°C for a set period. The emissions precipitate on either a cooled aluminium foil or a glass plate. The precipitation is weighed for gravimetric fogging, or its effect on the glass plate's reflectance measured (reflectometric fogging)

Origin

The main origin of fogging is the fatliquor chosen. Fatliquors contain constituents that become volatile and precipitate under the circumstances described and thus cause unwanted high fogging values.

Prevention

Fogging is an issue limited to the use of leathers for automotive purposes. To prevent the release of constituents causing fogging, fatliquors specifically designed for this purpose are to be used.

Static headspace

Test methods

Small leather cuttings are treated are subjected to 120°C during a five-hour period. The released volatile compounds are detected by gas chromatography and expressed as total carbon emission. There is no identification of individual substances.

Origin

The emitted materials are volatile organic compounds with a boiling point up to 265°C. Common compounds are, among others, alkanes, ethers ketones, alcohols and certain aldehydes (yet formaldehyde is not detected).

Prevention

The use of solvent-free or solvent –reduced auxiliaries and processes is a condition for reducing the total carbon emission.

Intense washing and drying reduce the amounts further.

Dynamic headspace

Test methods

A small leather sample is deposited in a desorption tube and treated with a stream of an inert gas. The first step is at 90°C for 30 minutes and then cooled down to -150°C. In the second step the same sample is treated at 120° for 60 minutes and also cooled down. The results are expressed in detail as:

- Total emission
- Identification of substances (as far as possible)
- Identification of harmful substances
    - carcinogenic
    - mutagenic
    - repro-toxic

Results distinguish between VOC and FOG. VOC is the abbreviation for Volatile Organic Compounds; FOG is not an abbreviation but stands for low and medium-volatile compounds.

Origin

VOC und FOG emissions are mainly caused by organic auxiliaries used during wet processes and finishing. Some compounds are typical for VOC: e.g. aldehydes, fatty acids (<C18), formic acid. Others typical for FOG: e.g. anti-oxidants and tri-butoxyethyl phosphate. Some compounds are common: alkanes, fatty esters, fatty alcohols, glycol ethers, or phthalates

Prevention

VOC emissions can be reduced by intense drying of the leather, since they are mainly caused by solvents & carriers.

FOG emissions stem from the products' active ingredients can therefore not be reduced by intense drying.

Contact Smit & zoon for further information

The information given in this SmiTools is just a synopsis on the topic. We would be glad to help you further in case of questions, the sharing of information or help with choosing the right wet-end products for your application. Please feel to contact your usual relations within Smit & zoon.

Contact details

Smit & zoon

E-mail : linfo@smitzoon.com

Website : http://www.smitwet-end.com

Phone : 0031 294 238 800

All data and recommendations herein are accurate at the time of publication. A. Smit & Zoon B.V. reserves the right to modify them without notice. Work conditions and type of raw material can effect the final results. It is the responsibility of the user to apply the recommendations to the actual conditions and particular purpose. No rights or claims can be drawn based on this document in any way.

Texts, comments & photo's shown in this documents are property of A. Smit & zoon B.V.. They may not be used, re-used or copied in any way without written approval of A. Smit & zoon B.V.