LEATHER STANDARD

Testing methods

OEKO-TEX® LEATHER STANDARD

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General remarks

This document informs about the analytical methodology applied for chemical safety testing in all laboratories of the OEKO-TEX® Association. The methods described below are applied to any article certified under the certification scheme OEKO-TEX® LEATHER STANDARD. If an article shall be certified according to this standard and also contains textile and non-textile (e.g. metallic) components or chemicals (e.g. gel pouches), these materials are tested according to the conditions and criteria of OEKO-TEX® STANDARD 100, OEKO-TEX® ORGANIC COTTON or OEKO-TEX® ECO PASSPORT. For these methods, please refer to the corresponding testing method documents.

Abbreviations

- AAS - atom absorption spectrometer
- CI - chemical ionisation
- DAD - diode array detector
- EI - electron impact
- FLD - fluorescence detector
- IC - ion chromatography
- ICP - inductively coupled plasma
- GC - gas chromatography
- LC - liquid chromatography
- MS - mass spectrometry
- OES - optical emission spectroscopy
- UV/VIS - ultraviolet-visible

pH value (ML-01)

The pH value is determined according to ISO 4045 using purified water as extraction solution.

Formaldehyde (ML-08)

The determination of free and released formaldehyde is performed according to ISO 17226-1 using an aqueous extraction followed by DNPH derivatization and HPLC-DAD analysis of the extract.

Extractable heavy metals (ML-10)

Heavy metals except chromium (VI) are extracted with artificial acidic sweat solution according to ISO 17072-1. The extract is analysed by ICP-OES, ICP- MS or AAS. Metallic accessories with a surface finish or coating are subjected to an additional test for extractable nickel after a pretreatment (wear and corrosion according to EN 12472:2020, used for its abrasion medium).

Chromium(VI) (ML-12)

Whenever possible the examination according to ISO 17075-2 (determination by IC) is performed. When this is not possible, the colorimetric procedure by UV/VIS (ISO 17075-1) is per- formed, in which 1,5-diphenylcarbazide is oxidized by Chrom(IV) and a complex is formed which can be quantified photometrically.

Total heavy metals (ML-21)

Total heavy metal analysis is based on DIN EN ISO 17072-2. Samples are chemically digested using acids to obtain a clear extract containing heavy metals, which is afterwards analysed by ICP- OES, ICP-MS or AAS. Different sample components, which can be differentiated macroscopically (base material, paints, etc.), are separately analysed. This allows to analyse total lead content according to requirements of the American legislation for children's articles (CPSIA, Consumer Product Safety Improvement Act).

Pesticides (ML-06)

Polar and apolar pesticides are extracted by ASE (or Soxhlet) using methanol or acetone, or using a QuEChERS extraction. After clean-up, extracts are analysed for pesticides with GC-MS and LC-MS.

Chlorinated phenols (ML-07)

The tests are performed according to ISO 17070. The substances are stripped off the leather sample by steam distillation. After extractive acetylation, the organic phase is analysed for chlorinated phenols by GC-MS or GC-ECD.

Phthalates & siloxanes (ML-18)

Analysis of phthalates follows the procedure defined in DIN EN SO 14389:2023-01, with leather specific modifications. Siloxanes are also analysed according to this method. Extraction of the testing material with tetrahydrofuran is followed by precipitation of the polymers with (cyclo)hexane. The extract is analysed by GC-MS.

Organic tin compounds (ML-17)

The method is based on DIN EN ISO 22744-1 with modifications. After an extraction with an ethanol/acetic acid solution and tropolone followed by derivatisation with sodium tetraethyl borate. The extract is then analysed by GC-MS.

Bisphenols & related substances (ML-40)

The determination of bisphenols & related substances is performed by extraction of samples with THF in an ultrasonic bath followed by a polymer precipitation with methanol or (cyclo)hexane. The extract is then analysed by LC-MS.

Process preservative agents (ML-29)

The analysis of process preservative agents follows DIN EN ISO 13365-1. Analytes are extracted in an ultrasonic bath extraction with acetonitrile. The filtered extract is then analysed by LC-DAD or LC-MS.

Azo dyes, arylamines and aniline (ML-03)

Tests for azo dyes, which may be cleaved into carcinogenic arylamines, are carried out according to ISO 17234-1 and 17234-2 and are combined with the analysis of aniline (both as free chemical residue and cleavable form within colourant. Samples are defatted, reduced with sodium dithionite and extracts are analysed with two chromatography methods, preferably LC-MS and GC-MS.

Allergenic, carcinogenic and other banned colourants & quinoline (ML-04)

The identification and quantification of dyestuff with allergenic or carcinogenic potential, other banned dyestuff and pigments and Michler's ketone and base is achieved by hot acetone extraction and analysis by LC-DAD or LC-MS.

Chlorinated benzenes and toluenes (ML-02)

The method is based on DIN EN 17137, with leather specific modifications. After an ultrasonic bath extraction of the testing materials with dichloromethane, the extracts are analysed by GC-MS.

Polycyclic aromatic hydrocarbons (PAH; ML-23)

The method is based on DIN EN 17132:2019-09, with leather specific modifications. The method is based on an extraction of the test samples with toluene. The extracts are analysed with GC-MS.

Brominated and phosphor organic flame retardants (ML-30)

The determination of banned flame retardants is performed according to ISO 17881-1 (brominated) and 17881-2 (phosphororganic). Samples are extracted with toluene or acetone, respectively, and extracts are analysed by GC-MS or LC-MS, respectively.

Solvent residues (ML-26)

The method is based on an extraction of the test samples with methanol. The extracts are analysed with GC-MS.

Alkylphenols & alkylphenol ethoxylates (AP & APEO; ML-25)

The method is based on DIN EN ISO 18218-1, with leather specific modifications. After extraction of the test samples with methanol in an ultrasonic bath, the extracts are analysed with LC-MS.

Per- and polyfluoroalkyl substances (PFAS; ML-22)

PFAS analysis is carried out in accordance with DIN EN 17681-1:2025, with leather specific modifications. PFAS are extracted from the samples using strongly alkaline methanol in an ultrasonic bath. This alkalinity allows for hydrolysis of, for instance, fluorinated polymers and esters and results in release of PFAS. After neutralization with acid, PFAS are analysed using LC-MS.

Total fluorine (ML-42)

The method is based on DIN EN 17813 with modifications or ASTM D7359-23 with modifications. Samples are directly combusted with oxygen. Resulting HF is collected in absorber solution and can be analysed for fluorine content using IC.

UV stabilisers (ML-28)

The method is based on ISO 24040, with leather specific modifications. After extraction of samples with tetrahydrofuran (THF) and polymer precipitation with acetonitrile, the extracts are then analysed with LC-MS.

Short & medium chain chlorinated paraffins (SCCP & MCCP; ML-24)

The method for determination of the short and medium chain chlorinated paraffins is based on an extraction of the testing material with a mix of dichloromethane/(cyclo)hexane, followed by a clean-up and subsequent analysis with GC-MS. For a total analysis (sum of short, medium and long chained chlorinated paraffins) the instrument is operated in EI mode. CI mode is used for the identification and quantification of SCCP and MCCP congeners present in the sample.

N-nitrosamines and N-nitrosatable substances (ML-34)

During this test according to EN 71-12, The N-nitrosamines and N-nitrosatable substances migrate into a saliva test solution. The N-nitrosatable substances react to N-nitrosamines by acidification. The analysis of the freely available as well as produced N-nitrosamines is done by LC-MS.

VOCs, glycols, cresols & chlorinated solvents (ML-31)

The sample to be analysed for volatile organic compounds, glycols, cresols & chlorinated solvents is baked out by thermodesorption. The released substances are enriched on suitable trapping material and analysed by GC-MS.

Dimethylfumarate (DMFu; ML-27)

The method is based on DIN EN 17130:2019-09, with leather specific modifications. After an extraction of the samples with acetone and preconcentration, the extracts are analysed with GC-MS.

Glutaraldehyde (ML-41)

Glutaraldehyde is extracted from the leather samples in the ultrasonic bath with an aqueous solution and derivatized with DNPH, followed by an analysis through LC-DAD.

Melamine (ML-44)

The samples are extracted with water in a shaking bath (according to Japanese Law 112 / JIS L 1041 – 2011) and then analysed on LC-DAD and / or LC-MS.

N-(hydroxymethyl)acrylamide (ML-43)

The method is based on extraction of samples with hot water in an ultrasonic bath. The extract is analysed by LC-DAD.

Phenol & related substances (ML-39)

The determination of phenol is performed by extraction of the test material with methanol in an ultrasonic bath. The extract is analysed by LC- FLD additionally equipped with a DAD.

Emission of volatile chemicals (ML-14 &ML-15)

For the determination of emitted volatile chemicals, the methods are based on ISO 16000-3 (formaldehyde) and ISO 16000-6 (VOCs), using an emission chamber according to ISO 16000-9. For emission of VOCs, a screening in a Markes microchamber instead of an emission chamber according to ISO 16000-9 can be used. Formaldehyde is adsorbed on DNPH cartridges, eluted with acetonitrile and analysed using LC-DAD or LC-FLD. For VOC analysis, different adsorbents are used and analysis is performed by thermal desorption and GC-MS.

Colour fastness (ML-09)

In all colour fastness tests cited below, only the fastness grades with respect to staining of the adjacent fabrics are determined. The basic methods for performing and evaluating the test are ISO 105-A01 and ISO 105-A03. More specifically, the following tests are performed:

- Determination of colour fastness to water according to ISO 11642
- Determination of colour fastness to rubbing according to ISO 11640
- Determination of colour fastness to saliva according to ISO 105-A01
- Determination of colour fastness to perspiration according to ISO 11641

Odour (ML-16)

A sample of defined area is conditioned in a desiccator of set humidity and the odour formed is evaluated sensorially by a set of test persons. All articles are subjected to a preliminary odour test, which, if failed, stops the certification procedure. The odour from mould, high boiling fractions of petrol (from colour printing), fish (from permanent finishing) or aromatic hydrocarbons will lead to a test failure. Moreover, odourants (perfumes) used for removing / covering the smell originating from production (oil, fats, dyestuffs) must not be detected during sensory odour testing.

Glitter fastness (ML-47)

Adhesive tape is applied to a leather surface with applied glitter particles and pressure is applied by a standardized rubbing motion. The tape is removed and the number of glitter particles in a defined tape area is counted.