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Hair straightening and curling products

Formaldehyde, thioglycolic und thiolactic acids, preservatives, fragrances, other ingredients and impurities

Joint campaign with the cantons Aargau and Basel-City (focus laboratory)

Number of analysed samples: 29

Number of non-compliances: 21 (72%)

Reasons for non-compliance: Formaldehyde (8), butylphenyl methylpropional (4), zinc pyrithione (1), allergenic fragrances not declared (6), preservatives not declared (3), colourants not declared (1), other ingredients not declared (2) past shelf life (3), insufficient or missing warnings (4)



AI generated image

Background and aims

About 15 years ago, a new type of permanent hair straightening became popular in Europe: so-called keratin hair straightening. The products used were considered to be particularly effective for straightening hair, and chemical hair straightening became a trend. The products all had one thing in common: the declared ingredient keratin, or rather hydrolysed keratin, which was said to be responsible for the effective hair straightening. The products mostly originated from Brazil or the USA. What the packaging did not reveal, however, was that the products contained high concentrations of formaldehyde, usually between 1 and 5%. Formaldehyde is sensitising, irritates the respiratory tract and is classified as carcinogenic and is therefore banned in cosmetic products in Europe and Switzerland. The target organ for the carcinogenic effect is the respiratory tract, which is also a cause for concern for employees in hair salons, as formaldehyde is released into the air as a gas, when the product is applied. European authorities therefore conducted a thorough market surveillance of such products and warned about them in the European rapid alert system Rapex (now Safety Gate). The State Laboratory Basel-City participated in market surveillance in collaboration with the federal government and other cantons between 2010 and 2012. This campaign led to the discovery of previously unpublished products containing formaldehyde which were also published

to warn the consumers¹. Shortly after, almost no such products could be found on the market. Most likely formaldehyde was replaced by the substance glyoxylic acid in most products, which is still not regulated in cosmetics. Recently, however, glyoxilic acid has gained attention due to its suspected effect of acute kidney failure².

In the past two years, isolated warnings about hair straightening products containing formaldehyde have re-emerged in Safety Gate. In some cases, the substance was even declared on the ingredients list. Such products can obviously not be legally sold, as formaldehyde is banned in cosmetics in Europe and Switzerland. Yet Keratin straightening still gets positive press coverage³.

If you want to permanently curl your hair, the natural structure of the hair is broken and then reshaped. The most commonly used substance for this is thioglycolic acid, which can also trigger allergic reactions or skin irritations. With the current market surveillance study, we have primarily tested hair straightening products that are used or sold in the Swiss cantons of Basel-Stadt and Aargau.

Legal basis

The requirements for cosmetics in Switzerland are set out in the Swiss Ordinance for Foodstuff and Utility Articles (Lebensmittel- und Gebrauchsgegenstände-Verordnung, LGV) which refers to Regulation (EC) No 1223/2009 on cosmetics and the Swiss Cosmetics Ordinance (VKos).

parameter	legal requirements
Banned substances (e.g. nitrosamines, formaldehyde, phenol)	LGV, art 54, par 1 - EC 1223/2009 Annex 2
Substances with restrictions (e.g. thioglycolic acid)	LGV, art 54, par 2 - EC 1223/2009 Annex 3
Colourants	LGV, art 54, par 3 - EC 1223/2009 Annex 4
Perservatives	LGV, art 54, par 4 - EC 1223/2009 Annex 5
Labelling	VKos, art. 8 and 9

Samples

20 of the 29 sampled products were hair straighteners. The remaining products were hair perming products (3), hair care products (3), hair shampoos (2) and one hair styling product with a claimed straightening effect. Almost half of the products sampled in the cantons of Aargau and Basel-City were sampled in hair and beauty salons that advertise hair straightening treatment to customers. Five products were taken from wholesalers, three from Africa/Asia shops and two from a department store. Two thirds of the samples originated from countries outside Europe.

Origin	Number of samples/sets
Brasil	6
USA	5
Israel	4
Germany	3
Italy	2
Canada	2
Peru	2
Spain	2
Turkey	2
Switzerland	1
Total	29

1 Kantonales Laboratorium Basel-Stadt, 29.9.2011, https://media.bs.ch/original_file/7b9ecba5ba289ba1df6b9d06784673c11c317b/jb-haarglaettung-2011.pdf

2 ANSES, 16.10.2024, Warning on the risks of hair straightening products containing glyoxylic acid; <https://www.anses.fr/en/content/warning-risks-hair-straightening-products-containing-glyoxylic-acid>

3 Vogue Germany, 11. Februar 2022; <https://www.vogue.de/beauty/artikel/keratin-glaettung-fakten-dauerhaften-haarglaettung>

Methods

The following methods were used to analyse the samples:

Parameter group	method
Multimethods for UV-absorbing Substances: <ul style="list-style-type: none"> • Preservatives • UV-active fragrances • UV-filters • Impurities (e.g. phenol) 	UHPLC-DAD at pH 2.7 and pH 6.2 after extraction with 0,1% phosphoric acid in methanol
Screening for critical substances	HPLC-HRMS after extraction with methanol
Thioglycolic acid and thiolactic acid	HPLC-DAD after extraction with 0,1% phosphoric acid in methanol
Formaldehyde, acetaldehyde and other aldehydes and ketones	HPLC-DAD after extraction with acetonitrile and in-line pre-column derivatisation with 2,4-dinitrophenylhydrazine and confirmation with post column derivatisation with acetylacetone
N-nitrosamines	HPLC-HRMS(/MS) after extraction with acidic water/methanol (polar) and methanol (apolar)

Results and measures

21 of the 29 analysed products (72%) did not comply with the requirements set out in legislation. The sales or application in studios of 11 products (38%) were banned due to the presence of prohibited ingredients such as formaldehyde (8) or other prohibited substances (5). The other substances, unlike formaldehyde, were even declared on the label. In addition, 15 products contained fragrances, preservatives or other ingredients, which were not declared on the label. Missing warnings (4) and expired best-before dates (3) were also reasons for non-compliance.

Banned substances in the analysed samples

Substance	Toxicity	Number of samples	Concentration range / remark
Formaldehyde	Carcinogenic, sensitising	8	0.8 – 8.2%
Butylphenyl methylpropional	Reprotoxic	4	Declared; max. 24 mg/kg
Zinc pyrithione	Reprotoxic	1	Declared; not quantified

Formaldehyde

Formaldehyde was previously used to harden nails or for preservation, but is now banned in cosmetics due to its carcinogenic properties. Out of 21 hair straightening products eight samples from four manufacturers contained undeclared formaldehyde in very high levels of between 0.8 and 8.2%. All products did not have any other functional hair straightening agent in the list of ingredients and keratin was not listed near the beginning. It can, therefore, be concluded that formaldehyde was added intentionally and did not form from another ingredient such as hydrolysed keratin i.e. the manufacturers deliberately added the formaldehyde, but did not declare it. The sale and use of such products was immediately banned. The State Laboratory Basel-City warns against the use of these products (see public warning at the end of this report).

Other prohibited substances

Until recently, butylphenyl methylpropional (lilial) was required to be declared as an allergenic fragrance. However, due to its classification as toxic to reproduction, its use is now prohibited. Experience has shown that some manufacturers struggle to adapt to legal changes or that products remain on the market longer than expected. Lilial was declared on the label of four products, and a maximum of 24 mg/kg of lilial was detected in the products. Zinc pyrithione is also a substance, which until recently was approved for cosmetics as a preservative and anti-dandruff agent. Due to the new classification as toxic to reproduction, this substance is also prohibited since December 2021. This substance was also declared on the label of one product.

Ingredients not declared on label

13 samples (44%) contained preservatives, allergenic fragrances, stabilisers and/or colourants which were not declared on the label.

Substances without listing on label

Substance group	Number of samples	Substances
Allergenic fragrances	6	Benzyl alcohol (5), coumarin (1), Benzyl benzoate (1)
Preservatives	3	Methylisothiazolinone/methylchlorisothiazolinone (3)
Colourants	1	C.I. 60730
Stabilisers	2	BHT (2), benzophenone-3 (1)

Although the samples were only tested for those allergenic fragrances that can be detected using HPLC and UV detection, we found undeclared fragrances in five products (benzyl alcohol (5), coumarin (1) and benzyl benzoate (1)). Investigations by a manufacturer showed that the fragrance benzyl alcohol was created during production or storage, as could have been expected from the composition. In the future, the manufacturer will declare this substance, even though it is not added during production. Three products contained between 1.5 mg/kg and 8.2 mg/kg of the allergenic preservatives methylisothiazolinone and methylchlorisothiazolinone. Two products contained the undeclared stabilizer BHT (butylhydroxytoluene; 114 and 1600 mg/kg) and one product contained the UV light absorber benzophenone-3 (40 mg/kg).

Non-compliant warning labels

For some ingredients, such as thioglycolic acid, warning labels are required under the Cosmetics Regulation. These were inadequate or missing entirely in four products.

Conclusions

More than ten years ago, it was discovered that many keratin-based hair straighteners contained high concentrations of formaldehyde. After intensive official controls and informing the public and industry associations, the European market seemed to have been cleaned up. Our current investigation shows that a large number of products containing formaldehyde are now again being used in hair and beauty salons in Basel and Aargau. Although the products are manufactured outside Europe, the company responsible for one brand is based in the EU. The products are easily available in Switzerland via the Internet and are usually imported directly by hair salons. Due to the high rate of non-compliance and the potential health risk from this product category, further controls will be necessary.

Public warning due to potetial risk to consumers' health

Products with high levels of formaldehyde may pose a risk to consumers' health and are therefore not considered safe. The State Laboratory Basel-City therefore warns against the products listed below in accordance with article 54 of the Swiss Federal Act on Foodstuffs and Utility Articles. It is strongly recommended that these products are neither used professionally nor in private settings.

Product	EAN/lot	Prod. date	Best before	Origin	Formaldehyde content
Honma Tokyo H-Brush B.Tox Platinum 2 Inten-sive Recons- tructive Mask Professional	EAN ? Lot: HT1700423	April 2023	04/2025	Brazil	1,9%
Honma Tokyo, Plasthair Bixy- plastia, Passion Fruit	EAN 7 898584 462900 Lot: HT0007/20	Dec 2020	12/2023	Brazil	5,0%
Honma Tokyo, H-Brush B.Tox Platinum 2 Inten-sive Recons- tructive Mask Professional	EAN 7 898584 460135 Lot: HT0003/21	Juli 2021	07/2024	Brazil	2,5%
Bien Cacau Professional 2 Brazi- lian Thermo Keratin	EAN ? ??????7 481080 Lot unbekannt	?	?	Brazil	8,3%
Cochoco Professional Gold Premium Keratin Treatment	EAN 7 142702 788534 Lot TV40- 512	?	12/2022	Israel	2,8%
Cochoco Professional Gold Premium Keratin Treatment extra shine	EAN 7 142702 788534 Lot W0230620	?	03/2027	Israel	0,8%
Cochoco Professional Original Premium Keratin Treatment Chocolate Hair Care Therapy	EAN 7 142702 788466 Lot nicht lesbar	?	11/2027	Israel	3,0%
Native Base Keratin Keratin Treatment for professional use only	EAN 8 681546 007252 Lot i11	?	?	Turkey	4,3%