

PAHs in Tattoo Colours

BMF 81 - PAHs in Tattoo Colours

People all around the world have been getting tattoos for many thousands of years, but recently tattooing became a mainstream culture, especially among young people. Ötzi (dated to 3250 BC) is currently the oldest known tattooed mummy; he had 61 tattoos in total. Indigenous tribes on all continents are using their specific traditional tattoos - not surprising that tattoo is a loanword from the Polynesian word tatau, meaning workmanlike or correct.¹

Nowadays, up to 25% US citizens are tattooed, in Europe approximately 10% of the population has tattoos. Permanent make-up/ cosmetic tattoos to enhance the contours of the face are also getting more and more common. Tattooing is performed by injection of inks into the dermis layer of skin using needles. Mainly black inks are applied but also coloured ones are used making more and more fancy tattoos possible.¹

In the last couple of years health risks from tattoo inks have been discussed – mainly related to hazardous substances like PAHs, phthalates or phenols, as well as carbon black and metals.

Regulation

In the US, tattoo inks are broadly covered under FDA regulation for cosmetics and colour additives. However, because of other public interests and a previous lack of evidence to support safety concerns, FDA has not regulated tattoo inks in their own right.²⁻³

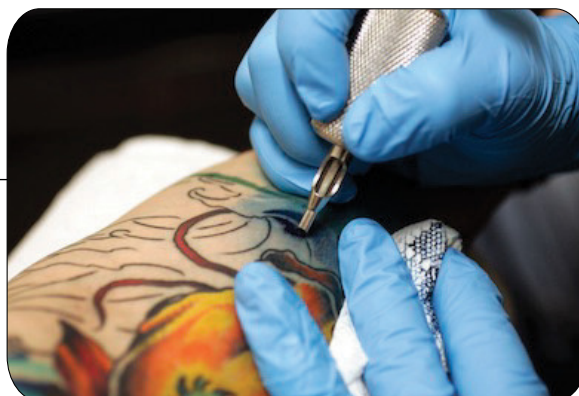
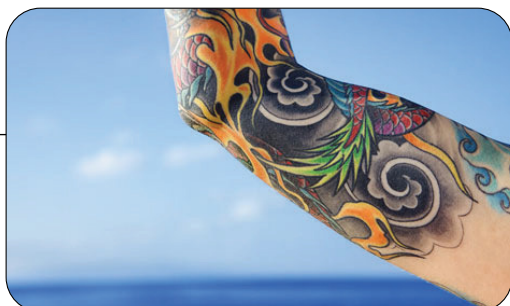
The Council of Europe has made recommendations on the composition of tattoo inks and listed substances that should not be present, as well as maximum allowed concentrations for impurities. Yet, not every member state of the EU has signed up to these regulations, arguing about strictness of the legislation. According to ResAP(2008)1 maximum allowed concentrations are 0.5 ppm for PAHs and 5 ppb for Benz[a]pyrene, respectively.⁴

In 2010, Bäumlér *et al.* published a study about tattoo inks containing PAHs in the journal *Experimental Dermatology*. They chose 20 different PAHs that are known as pollutants in the environment, food or cigarettes and analysed them by HPLC:

naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, benz[a]anthracene, chrysene, benzo[b]fluoranthene, benzo[k]fluoranthene, benz[a]pyrene, dibenzo[a,h]anthracene, benzo[ghi]perylene, indeno[1,2,3-cd]pyrene, dibenzo[a,e]pyrene, dibenzo[a,l]pyrene, 5-methylchrysene and benzo[j]fluoranthene.

These PAHs are known for their toxicity, carcinogenicity, and mutagenicity, and they were found in numerous tested tattoo colours. These PAHs are transported inside the human body together with black carbon when injected as tattoo ink into the skin. They may also bear another risk – derived from formation of singlet oxygen under UV radiation as long as PAHs are remaining in the skin.⁵

It is very easy to order tattoo ink on the internet, but it is not always straightforward to find out about the quality. So, if you are planning on getting a tattoo you may consider to ask for the ink's material safety data sheet!





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Reference materials from Chiron

Chiron AS has built up a strong reputation in PAH reference materials; most of them are available as neat material as well as in solution.

Native:

Catalogue No.	Name	Formulation
0711.10	Naphthalene	10 mg neat or 1000 µg/mL in isooctane
0002.12	Acenaphthylene	10 mg neat or 1000 µg/mL in isooctane
0732.12	Acenaphthene	10 mg neat or 1000 µg/mL in isooctane
0217.13	Fluorene	10 mg neat or 1000 µg/mL in toluene
0816.14	Phenanthrene	10 mg neat or 1000 µg/mL in isooctane
1049.14	Antracene	10 mg neat or 1000 µg/mL in isooctane or toluene
0260.16	Fluoranthene	10 mg neat or 1000 µg/mL in toluene
0235.16	Pyrene	10 mg neat or 1000 µg/mL in toluene
0201.18	Benz[a]anthracene	10 mg neat or 1000 µg/mL in toluene
0212.18	Chrysene	10 mg neat or 1000 µg/mL in toluene
0263.20	Benzo[b]fluoranthene	10 mg neat or 1000 µg/mL in toluene
0265.20	Benzo[k]fluoranthene	10 mg neat or 1000 µg/mL in toluene
0239.20	Benzo[a]pyrene	10 mg neat or 1000 µg/mL in toluene
0203.22	Dibenzo[a,h]anthracene	10 mg neat or 1000 µg/mL in toluene
0222.22	Benzo[ghi]perylene	10 mg neat or 1000 µg/mL in toluene
0277.22	Indeno[1,2,3-cd]pyrene	10 mg neat or 1000 µg/mL in toluene
0244.24	Dibenzo[a,e]pyrene	10 mg neat or 200 µg/mL in toluene
0243.24	Dibenzo[a,l]pyrene	10 mg neat or 200 µg/mL in toluene
0296.19	5-Methylchrysene	200 µg/mL in toluene
0264.20	Benzo[j]fluoranthene	1000 µg/mL in toluene



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Internal standards

Most of these PAHs are also available as internal standards, both deuterated and fluorinated.

Deuterated PAHs:

Catalogue No.	Name	Formulation
0978.10	Naphthalene- <i>d</i> 8	10 mg neat or 1000 µg/mL in isooctane or toluene
1336.12	Acenaphthylene- <i>d</i> 8	10 mg neat or 1000 µg/mL in toluene
1524.12	Acenaphthene- <i>d</i> 8	10 mg neat or 1000 µg/mL in toluene
1530.13	Fluorene- <i>d</i> 10	10 mg neat or 1000 µg/mL in isooctane
0389.14	Phenanthrene- <i>d</i> 10	10 mg neat or 1000 µg/mL in isooctane or toluene
0390.14	Antracene- <i>d</i> 10	10 mg neat or 1000 µg/mL in toluene
1337.16	Fluoranthene- <i>d</i> 10	10 mg neat or 1000 µg/mL in toluene
0329.16	Pyrene- <i>d</i> 10	10 mg neat or 1000 µg/mL in toluene
1087.18	Benz[a]anthracene- <i>d</i> 12	10 mg neat or 1000 µg/mL in toluene
1024.18	Chrysene- <i>d</i> 12	10 mg neat or 1000 µg/mL in toluene
1348.20	Benzo[b]fluoranthene- <i>d</i> 12	10 mg neat or 100 µg/mL in toluene
1349.20	Benzo[k]fluoranthene- <i>d</i> 12	10 mg neat or 100 µg/mL in toluene
1088.20	Benzo[a]pyrene- <i>d</i> 12	10 mg neat or 100 µg/mL in toluene
1330.22	Dibenz[a,h]anthracene- <i>d</i> 14	10 mg neat or 200 µg/mL in toluene
1089.22	Benzo[ghi]perylene- <i>d</i> 12	10 mg neat or 1000 µg/mL in toluene
1531.22	Indeno[1,2,3-cd]pyrene- <i>d</i> 12	5 mg neat or 1000 µg/mL in toluene
11316.20	Benzo[j]fluoranthene- <i>d</i> 12	100 µg/mL in toluene

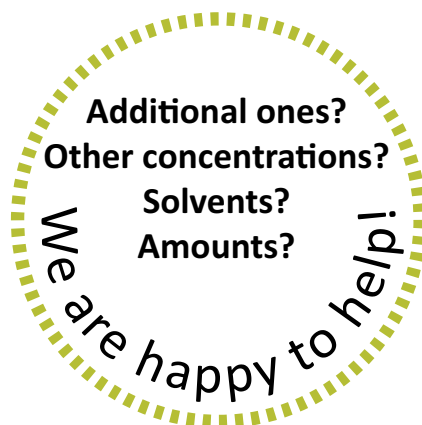


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Fluorinated PAHs:

Catalogue No.	Name	Formulation
1313.10	1-Fluoronaphthalene	1 g neat or 100 µg/mL in isooctane or acetonitrile
1314.12	5-Fluoroacenaphthylene	100 µg/mL in toluene
1315.13	2-Fluorofluorene	100 µg/mL in toluene
1328.14	2-Fluorophenanthrene	100 µg/mL in toluene
1316.14	3-Fluorophenanthrene	100 µg/mL in toluene
8891.14	4-Fluorophenanthrene	100 µg/mL in toluene
1319.16	3-Fluorofluoranthene	100 µg/mL in toluene or acetonitrile
1318.16	1-Fluoropyrene	100 µg/mL in toluene
1900.18	1-Fluorochrysene	100 µg/mL in toluene
1317.18	3-Fluorochrysene	100 µg/mL in toluene
1322.20	9-Fluorobenzo[k]-fluoranthene	100 µg/mL in toluene
2872.19	9-Fluoro-5-methylchrysene	50 µg/mL in toluene

**Please enquire if you
are looking for:**





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PAH Tattoo Colour Mix

Chiron recently launched a new mix used for analysis of tattoo colours:

Catalogue No.	Name	Full description
S-4884-K-IO S-4884-K-IOx5 S-4884-K-5IO	PAH Tattoo Colour Mix	PAH Tattoo Colour Mix 10 Compounds at 1000 µg/mL 1 x 1 mL, 5 x 1 mL or 1 x 5 mL, respectively Solvent: Isooctane 0711.10 Naphthalene [91-20-3] 1049.14 Anthracene [120-12-7] 0201.18 Benzo[a]anthracene [56-55-3] 0212.18 Chrysene [218-01-9] 0263.20 Benzo[b]fluoranthene [205-99-2] 0265.20 Benzo[k]fluoranthene [207-08-9] 0264.20 Benzo[j]fluoranthene [205-82-3] 0236.20 Benzo[e]pyrene [192-97-2] 0239.20 Benzo[a]pyrene [50-32-8] 0203.22 Dibenz[a,h]anthracene [53-70-3]
S-4883-100-IO S-4883-100-IOx5 S-4883-100-5IO	PAH Tattoo Colour IS Mix	Deuterated PAH Tattoo Colour Mix 9 Compounds at 100 µg/mL 1 x 1 mL, 5 x 1 mL or 1 x 5 mL, respectively Solvent: Isooctane 0978.10 Naphthalene-d8 [1146-65-2] 0390.14 Anthracene-d10 [1719-06-8] 1087.18 Benzo[a]anthracene-d12 [1718-53-2] 1348.20 Benzo[b]fluoranthene-d12 [93951-98-5] 1349.20 Benzo[k]fluoranthene-d12 [93952-01-3] 1525.20 Benzo[e]pyrene-d12 [205440-82-0] 1088.20 Benzo[a]pyrene-d12 [63466-71-7] 1330.22 Dibenz[a,h]anthracene-d14 [13250-98-1] 1024.18 Chrysene-d12 [1719-03-5]

References:

- [1] <https://en.wikipedia.org/wiki/Tattoo>.
- [2] <http://www.rsc.org/chemistryworld/2012/06/calls-better-tattoo-ink-regulation>.
- [3] <http://www.fda.gov/ForConsumers/ConsumerUpdates/ucm048919.htm>.
- [4] Resolution ResAP(2008)1 on requirements and criteria for the safety of tattoos and permanent make-up.
- [5] Regensburger et al. *Experimental Dermatology* 2010: 19, e275-e281.
- [6] Sarah Everts, C&EN Berlin, *Cen.acs.org*. Tattoo ink worries, August 22, 2016, pages 24-26. What chemicals are in your tattoo? <http://cen.acs.org/articles/94/i33/chemicals-tattoo.html>.



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*For ordering and information about prices and delivery in your country, please contact your **local distributor:***