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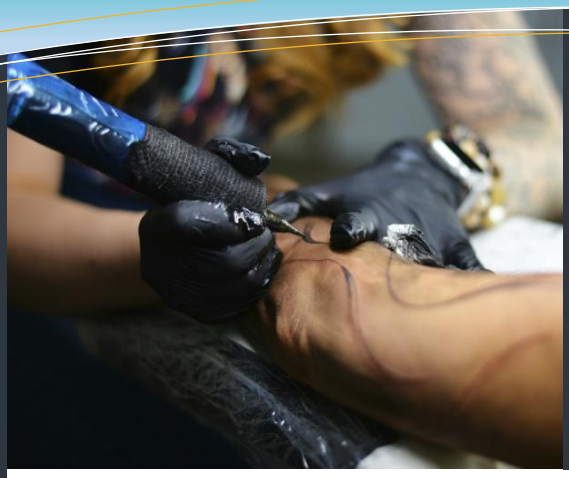
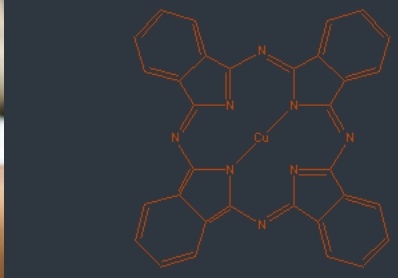
GERMAN SOCIETY OF
TOXICOLOGY

Poison of the month





Pigment blue 15: 3-Corimax Blue 7090P

Tattoo inks were selected as poison of the Month for February 2026

…because tattoos and PMU applications continue to be a growing trend, while toxicologically representing an unusual exposure scenario involving a permanent intradermal depot of particles and chemicals. This makes risk assessment particularly complex. Since 2022, this mixture- and particle-related issue has for the first time been addressed across the EU through REACH Annex XVII, Entry 75. The aim is to improve safety and to enable better information for individuals considering a tattoo or PMU.

Traditional tattoo pigments

Tattooing is culturally and historically widespread, and the pigments used were determined — and in indigenous communities are in some cases still determined — by local availability. In Polynesia, for example, but also in New Zealand among the Māori, traditional tattoo pigments were typically obtained as soot from burned oil-rich plant materials or wood and processed into a paste with water or oils. Application was carried out mechanically using combs or needles, resulting in deep, permanent deposition of particles in the tissue.

In Arctic regions, dark charcoal- and soot-based preparations have been described for markings and tattoos; these were obtained from lamps or fireplaces and introduced into the skin by puncture or thread techniques. Mineral earth

From Pigment to Persistence: Tattoo Inks in the Focus of Regulatory Toxicology

Whoever considers getting a tattoo is not only choosing a design, but also the permanent introduction of a chemically complex, particulate mixture into the skin. The same applies to permanent make-up (PMU), in which pigments are introduced for cosmetic contouring (e.g. eyebrows, eyeliner, lips). Even though the purpose and often the depth of application vary, the toxicologically decisive principle remains the same: pigments and accompanying substances are deposited in the tissue and remain there as a long-term reservoir. This particular feature explains why tattoo inks require critical toxicological evaluation and why the EU introduced risk-based exposure limits through the REACH restriction in 2022.

In typical topical cosmetics such as body lotion or sunscreen, exposure occurs predominantly at the surface and is temporally limited. During tattooing, pigment particles and accompanying substances are introduced into the dermis, where they may persist for years or even for life and interact within an immunologically active milieu that includes immune cells, such as macrophages.

An additional concern is that the pigments do not necessarily remain confined to the tattooed area. Besides their local persistence in the dermis, pigment and particulate components may be transported via the lymphatic system. Partly through cellular transport by macrophages and partly as free particles, micro- and nanoparticles can reach the lymph nodes and may therefore exert systemic effects beyond local reactions. Particle size, surface characteristics, and chemical composition influence uptake, persistence, and potential tissue reactivity. Risk assessment is further complicated by the fact that tattoo inks are not single substances, but mixtures of pigments, carrier fluids, and additives whose actual hazard potential is often shaped by contaminants or degradation products. Metal traces such as nickel, chromium, or cobalt may act as sensitizers.

In addition, polycyclic aromatic hydrocarbons (PAHs) have been described

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pigments such as red ochre (hematite) were also used, for example by Pacific indigenous peoples.

Consequential bans

Pigment Blue 15:3 (CI 74160) and Pigment Green 7 (CI 74260) were highly popular phthalocyanine pigments because of their strong colouring properties, light and weather stability, good dispersibility, as well as their opacity and long-term durability in tattoos. With the end of the extended transitional period in January 2023, tattoo and PMU mixtures containing these pigments may no longer be placed on the market or used. For manufacturers, this created considerable pressure to reformulate, as established formulations were no longer available and alternatives did not always achieve the same colour performance or stability. In parts of the industry, this ban was also viewed critically, since both pigments were prohibited less because of clearly demonstrated acute toxicity than under application of the precautionary principle: sufficient data were lacking on their long-term persistence in tissue and on the potential migration of particles via the lymphatic system. In addition, there were uncertainties regarding long-term effects and relevant contamination- and exposure pathways in practice. From a consumer perspective, however, this step represents a gain in safety because it reduces the likelihood that pigments whose suitability for lifelong intradermal exposure has not been sufficiently established from a regulatory perspective will be used.

as relevant impurities in black pigments, which is toxicologically significant particularly in view of the genotoxic and carcinogenic properties of individual PAHs. Further risks arise from microbial contamination as well as from allergenic or irritant auxiliary substances, such as certain preservatives or wetting agents.

Under UV exposure, but also during tattoo removal using laser technology, critical degradation products such as primary aromatic amines may be formed from certain classes of organic pigments; these must likewise be taken into account in the risk assessment. The assessment is made more difficult by the fact that many pigments were historically introduced as industrial pigments (e.g. for coatings, plastics, or printing inks) and were not originally developed for intradermal application. Accordingly, factors such as purity and secondary constituents only had to meet industrial standards.

With Regulation (EU) 2020/2081, REACH Annex XVII was supplemented by Entry 75. Since 4 January 2022, tattoo and PMU mixtures may no longer contain numerous hazardous substances, or may contain them only below defined, very low concentration limits. This is accompanied by specific labelling and information requirements indicating critical ingredients and relevant restrictions.

Binding substance limits and information requirements regarding product composition are intended to prevent the use of harmful tattoo pigments and thereby increase safety for individuals who decide to get a tattoo.

By Ute Haßmann

Literature and links:

- Regulation - 2020/2081 - EN - EUR-Lex
- ANNEX XVII TO REACH – Conditions of restriction Restrictions on the manufacture, placing on the market and use of certain dangerous substances, mixtures and articles, Entry 75 0fa98a4c-ff76-6d0b-d48a-8b94ccac9bae
- Synchrotron-based ν-XRF mapping and μ-FTIR microscopy enable to look into the fate and effects of tattoo pigments in human skin | Scientific Reports
- Questions and answers on the study lead of BfR investigating the distribution of tattoo ink as nano-sized particles in lymph nodes - BfR
- Foto of Liana S on Unsplash
- Pigmentblau 15: 3-Corimax Blue 7090P - Zeya Chemicals