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TATTOO PIGMENT DECOMPOSITION – FROM PREDICTIVE PYROLYSIS TO LASER IRRADIATION

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Aim: In previous investigations, we characterized the decomposition patterns of several organic pigments including a wide range of toxic and carcinogenic compounds using pyrolysis-gas chromatography with mass spectrometric detection (Py-GC/MS). Similar decomposition patterns were published on UV and laser light irradiation for a few azo pigments. Such health concerns led to a switch from azo compounds towards non-azo pigments by some tattoo ink manufacturers although no studies have been reported on whether or not these would be indeed safer than their progenitors.

Method: Aqueous pigment dispersions of Blue 15:3, Red 254, Red 170, Yellow 138, Orange 13 and Violet 19 were irradiated with medical ruby (694 nm) and neodymium-doped yttrium aluminium garnet (Nd:YAG, 532 and 1064 nm) lasers and subsequently analyzed for decomposition products using GC/MS.

Results / Discussion: Decomposition products from laser irradiation correlate to those detected with Py-GC/MS. Cleavage of Blue 15:3, Red 254 and Yellow 138 resulted in the formation of different nitriles or imides with non-carcinogenic but irritating or toxic properties. Red 170 and Orange 13 were mainly cleaved at their azo- or amide bonds resulting in carcinogenic compounds which is consistent with previous studies. However, for pigment Violet 19 no cleavage products were detected under given laser irradiation parameters and it is therefore considered to be stable under these conditions.

Conclusion: The risk for decomposition of very lightfast pigments under laser irradiation has been underestimated in the past. Thus, also decomposition products of pigments with known and unknown toxicological properties should be considered for risk assessment of tattoo inks.