

Table 7 Result of ICP/MS screening analysis for white tattoo inks, µg/g

Element	DL	Colour no.				
		White	White	White	White	White
		4	14	22	46	59
Li	0.04	<DL	<DL	<DL	<DL	0.12
B	1	3.7	<DL	<DL	1.7	<DL
Na	1	650	78	110	110	430
Mg	0.1	8.2	8.6	9.2	9.5	310
Al	0.2	6800	5200	7800	11000	9000
Si	0.4	100	30	100	33	21
P	0.2	710	1.5	<DL	<DL	2.0
K	1	240	11	14	12	21
Ca	1	48	53	48	62	280
Sc	0.01	0.058	0.22	0.22	0.37	0.54
Ti	0.02	960	130	140	460	330
V	0.1	1.3	0.50	0.46	0.66	0.82
Cr	0.04	0.25	0.17	0.13	0.24	0.71
Mn	0.01	0.16	0.37	0.36	1.5	2.3
Fe	1	9.3	3.6	3.8	3.7	51
Co	0.01	<DL	0.011	<DL	0.019	0.04
Ni	0.02	0.83	1.5	1.5	3.8	1.9
Cu	0.02	1.3	12	0.27	6.3	0.52
Zn	0.2	6.4	1.7	1.9	3.0	3.0
Ga	0.01	1.04	0.61	0.71	0.99	1.1
As	0.04	0.24	<DL	<DL	<DL	0.17
Se	0.04	0.26	0.035	0.044	0.053	0.50
Rb	0.01	0.043	0.015	0.018	0.024	0.20
Sr	0.01	0.35	0.39	0.32	0.43	0.80
Y	0.01	0.26	0.026	0.023	0.034	0.12
Zr	0.01	20	1700	1300	2800	2300
Nb	0.01	0.80	0.012	0.011	0.02	0.025
Mo	0.01	<DL	0.012	<DL	0.015	0.015
Pd	0.01	0.19	0.017	10	21	17
Ag	0.01	0.019	0.29	0.21	0.51	0.40
Cd	0.01	<DL	0.095	0.019	0.028	0.072
Sn	0.04	<DL	0.036	<DL	<DL	<DL
Cs	0.01	<DL	<DL	<DL	<DL	0.013
Ba	0.01	1.3	0.78	0.52	0.53	1.0
La	0.01	0.023	0.012	0.017	0.022	0.089
Ce	0.01	0.034	0.019	0.025	0.029	0.16
Pr	0.01	<DL	<DL	<DL	<DL	0.022
Nd	0.01	<DL	<DL	<DL	0.012	0.088
Sm	0.01	<DL	<DL	<DL	<DL	0.016
Gd	0.01	<DL	<DL	<DL	<DL	0.016
Dy	0.01	0.020	<DL	<DL	<DL	0.015

Element	DL	Colour no.				
		White	White	White	White	White
		4	14	22	46	59
Er	0.01	0.026	<DL	<DL	<DL	<DL
Yb	0.01	0.041	<DL	<DL	<DL	<DL
Hf	0.01	0.28	21	17	28	38
Ta	0.01	0.044	<DL	0.012	<DL	<DL
Pt	0.01	<DL	0.21	0.16	0.30	0.25
Au	0.01	<DL	0.032	0.022	0.045	0.035
Pb	0.01	10	0.054	0.049	0.087	0.099
Th	0.01	0.24	0.013	0.022	0.030	0.21

Be, Ru, In, Sb, Te, Eu, Tb, Ho, Tm, Lu, W, Os, Ir, Hg, Tl, Bi and U were not demonstrated in the white tattoo inks.

References

- Resolution ResAP(2008)1 on requirements and criteria for the safety of tattoos and permanent make-up
- www.berlingske.dk/danmark/tatoverings-boom-blandt-unge-danskere
- www.politiken.dk/tjek/sundhedogmotion/levevis/561318/tatoveringer-blevet-allemandseje/Lokalavisen
- http://www.mst.dk/Virksomhed_og_myndighed/Kemikalier/Stoflister+og+databaser/Listen+over+farlige+stoffer/Søgning+i+farlige+stoffer.htm
- Engel, modern tat cause, contact dermatitis 2007
- Schmidt H. Tatoveringer. Kulturhistoriske, kunstneriske og medicinske aspekter. Løvens Kemiske Fabrik 1967; Nordstrøm J. Dansk Tatovering. Nordstrom, 2009. ISBN 978-87-993150-0-0
- Lehmann G et Pierchalla P. Tätovierungsfarbstoffe. Derm Beruf Umwelt 1988;36:152-56
- Baumler W et al. Q-switch laser and tattoo pigments: first results of the chemical and photophysical analysis of 41 compounds. Lasers in Surgery and Medicine 2000;26:13-21
- Anthony L et al. In vitro quantitative chemical analysis of tattoo pigments. Arch Dermatol 2001;137:143-47
- Cui Y et al. Photodecomposition of pigment yellow 74, a pigment used in tattoo inks. Photochemistry and Photobiology 2004;80:175-84
- Forte G et al. Market survey on toxic metals contained in tattoo inks. Science of the Total Environment 2009; 407:5997-6002
- www.aktionsplan-allergien.de
- www.foph-report_tattoo-colours_control-campaign
- Bekendtgørelse nr. 329, 2002 om klassificering, emballering, mærkning, salg og opbevaring af kemiske stoffer og produkter. http://www.mst.dk/Virksomhed_og_myndighed/Kemikalier/Stoflister+og+databaser/Listen+over+farlige+stoffer/Søgning+i+farlige+stoffer.htm
- Resolution ResAP(2008)1 on requirements and criteria for the safety of tattoos and permanent make-up (superseding Resolution ResAS(2003)2 on tattoos and permanent make-up)
- Farliga ämnen I tatueringfärger. Utredning av tellsynsansvar samt behov av ytterligare reglering – rapport från ett regeringsupdrag som utförts i samråd med Läkemedelsverket, Socialstyrelsen och Konsumentverket. Kemikalieinspektionen, juni 2010.
- Tattoo inks contain polycyclic aromatic hydrocabons that additionally generate deleteriuos singlet oxygen, Experimental Dermatology 2010;19:e275-e281
- DS/EN 14362-1 Metoder til bestemmelser af visse aromatiske aminer afspaltet fra azofarvestoffer og pigmenter
- "Hårfarve-, herunder hårblegemidler, Miljøstyrelsens kosmetikguide" <http://www.mst.dk/Borger/Kemikalier/Kosmetikguiden/V%C3%A6lg+et+produkt/02010700.htm>
- Kommissionens direktiv 2009/130/EF af 12. oktober 2009 om ændring af Rådets direktiv 76/768/EØF om kosmetiske midler med henblik på tilpasning af bilag III til den tekniske udvikling (EØS-relevant tekst). EU-Tidende nr. L 268 af 13/10/2009 s. 0005 – 0008
- Ekstra Bladet 28.4.2010

- www.ft.dk/dokumenter/tingdok
- Kemikalieinspektionen, Farliga ämnen i tatueringfärger, rapport 3/10 af juni 2010, www.kemi.se
- Nordstrøm J. Dansk Tatovering. Nordstrom, 2009. ISBN 978-87-993150-0-0
- Berlingske Tidende 9.7.2010
- MetroExpress 16.9.2009 med reference til YouGov Zaperas Danmarkspanel
- Olsen L, Takiwaki H, Serup J. High-frequency ultrasound characterization of normal skin. Skin thickness and echographic density of 22 anatomical sites. *Skin Res Technol* 1995;1:74-84
- Engel E et al. Modern tattoos cause high concentrations of hazardous pigments in skin. *Contact Dermatitis* 2008;58:228-233
- Engel E et al. Tattooing of skin results in transportation and light-induced decomposition of tattoo pigments – a first quantification *in vivo* using a mouse model. *Exp Dermatol* 2009;19:54-60
- Feldman RJ, Maibach HI. Regional variation in percutaneous penetration of C-14 cortisol in man. *J Invest Dermatol* 1967;48:181-183
- Tang J et al. Distribution, translocation and accumulation of silver nanoparticles in rats. *J Nanosci Nanotechnol* 2009;8:4924
- Nasir A. Nanoparticles in vaccine development: a step forward. *J Invest Dermatol* 2009;129:1055-1059
- Trouiller B et al. Titanium dioxide nanoparticles induce DNA damage and genetic instability in vivo in mice. *Cancer Res* 2009;69, 8784-9
- Oberdörster G. Nanotoxicology: an emerging discipline evolving from studies of ultrafine particles. *Environmental Health Perspectives* 2005;113:823-39
- EC. Risks and Health Effects from Tattoos, Body Piercing and Related Practices, Ispra, 05 May, 2003
- Hoegsberg T, Serup J. Tatoveringer i dermatologisk perspektiv. *Ugeskr Laeger* 2011;173:34-39
- Gutermuth J. et al. Cutaneous pseudolymphoma arising after tattoo placement. *J Eur Acad Dermatol* 2007;21:566-67
- Armingier WG, Caldwell EH. Primary lesion of a non-Hodgkin's lymphoma occurring in a skin tattoo: case report. *Plast Reconstr Surgery* 1978;62:125-27
- Sanguenza OP et al. Evolution of B-cell lymphoma from pseudolymphoma. *Am J Dermatopathol* 1992;14:408-13
- Kluger et al. Skincancers Arising in Tattoos: Coincidental or not? *Dermatology* 2008;217:219-221
- Kemikalieinspektionen rapport 3/10, Farliga ämnen i tatueringfärger, 2010, www.kemi.se
- Goldstein N. Complications from tattoos. *J Dermatol Surg Oncol* 1979;5:869-878
- Friedman T. et al. Tattoo pigment in lymph nodes mimicking metastatic malignant melanoma. *Plast Reconstr Surgery* 2003;111:2120-22
- Moehrie M. et al. Tattoo pigment mimics positive sentinel lymph node in melanoma. *Dermatology* 2001;203:342-44
- Rorsman H et al. Tattoo granuloma and uveitis. *Lancet* 1969;2:27;
- Saliba N. et al. Tattoo-associated uveitis. *Eye (London)* 2010;24:1406

- Resolution ResAP(2008)1 on requirements and criteria for the safety of tattoos and permanent make-up
- Resolution ResAP(2008)1 on requirements and criteria for the safety of tattoos and permanent make-up
- Farliga ämnen I tatueringfärger. Utredning av tellsynsansvar samt behov av ytterligare reglering – rapport från ett regeringsuppdrag som utförts i samråd med Läkemedelsverket, Socialstyrelsen och Konsumentverket. Kemikalieinspektionen Rapport Nr 3/10, 2010.
- Vejledning til udarbejdelse af "Kortlægning af kemiske stoffer i forbrugerprodukter". MILJØstyrelsen, Kemikalier, Forbrugergruppen, 18. juni 2009.
- http://reach.jrc.it/docs/guidance_document/information_requirements_en.htm?time=1222948859
- Principper for sundhedsmæssig vurdering af kemiske stoffer med henblik på fastsættelse af kvalitetskriterier for luft, jord og vand. Elsa Nielsen, Grete Østergaard, John Christian Larsen og Ole Ladefoged. Afdeling for Toksikologi og Risikovurdering, Danmarks Fødevareforskning. Miljøprojekt Nr. 974 2005.
- Metoder til fastsættelse af kvalitetskriterier for kemiske stoffer i jord, luft og drikkevand med henblik på at beskytte sundheden. Vejledning fra Miljøstyrelsen Nr. 5 2006.
- Guidance on information requirements and chemical safety assessment Chapter R.8: Characterisation of dose [concentration]-response for human health. European Chemicals Agency, 2008.
- Guidance on information requirements and chemical safety assessment Chapter R.8: Characterisation of dose [concentration]-response for human health. European Chemicals Agency, 2008.
- Europarådets Resolution ResAP(2008)1 on requirements and criteria for the safety of tattoos and permanent make-up. Adopted by the Committee of Ministers on 20 February 2008 at the 1018th meeting of the Ministers' Deputies.
- Europarådets Resolution ResAP(2008)1 on requirements and criteria for the safety of tattoos and permanent make-up. Adopted by the Committee of Ministers on 20 February 2008 at the 1018th meeting of the Ministers' Deputies.
- Council Directive 67/548/EEC of 27 June 1967 on the approximation of laws, regulations and administrative provisions relating to the classification, packaging and labelling of dangerous substances. Official Journal of the European Communities L 196, 16.8.1967, p. 1.
- Beltoft V. and Nielsen E (2001): Evaluation of health hazards by exposure to aluminium and inorganic compounds and estimation of a quality criterion in drinking water. Institut for Fødevaresikkerhed og Toksikologi, Fødevaredirektoratet. Baggrundsrapport udarbejdet for Miljøstyrelsen.
- JECFA (2007). Aluminium from all sources, including food additives (addendum). In: WHO Food Additive Series 58, pp. 119-207.
- Nielsen E. and Ladefoged O. (2006): Evaluation of health hazards by exposure to Inorganic water-soluble barium compounds. Afdeling for Toksikologi og Risikovurdering, Danmarks Fødevareforskning. Baggrundsrapport udarbejdet for Miljøstyrelsen.
- IARC Monographs on the evaluation of carcinogenic risks to humans, Volume 87, Inorganic and Organic Lead Compounds. IARC, Lyon, France, 2006.

- Nielsen E (2004): Evaluation of health hazards by exposure to lead and inorganic lead compounds and estimation of a quality criterion in soil. Afdeling for Toksikologi og Risikovurdering, Fødevarer- og Veterinærinstituttet. Baggrundsrapport udarbejdet for Miljøstyrelsen.
- IARC Monographs on the evaluation of carcinogenic risks to humans, Volume 58, Beryllium, Cadmium, Mercury, and Exposures in the Glass Manufacturing Industry. IARC, Lyon, France, 1993, p. 119.
- Straif K, Benbrahim-Tallaa L, Baan R, Grosse Y, Secretan B, El Ghissassi F, Bouvard V, Guha N, Freeman C, Galichet L, Coglianò V (2009). A review of human carcinogens - Part C: metals, arsenic, dusts, and fibres, on behalf of the WHO International Agency for Research on Cancer Monograph Working Group. International Agency for Research on Cancer, Lyon, France. *Lancet* 10, 453-454.
- European Union Risk Assessment Report. Cadmium oxide. CAS No.: 1306-19-0, EINECS No: 215-146-2. European Communities, 2007.
- Scientific Opinion: Statement on tolerable weekly intake for cadmium. EFSA Panel on Contaminants in the Food Chain (CONTAM), EFSA Journal 2011;9(2):1975.
- Cadmium. In: Joint FAO/WHO Expert Committee on Food Additives. Seventy-third meeting, Geneva, 8-17 June 2010. Summary and Conclusions, p. 17. Issued 24 June 2010.
- IARC Monographs on the evaluation of carcinogenic risks to humans, Volume 49, Chromium, nickel and welding. IARC, Lyon, France, 1990. pp. 257-446.
- Straif K, Benbrahim-Tallaa L, Baan R, Grosse Y, Secretan B, El Ghissassi F, Bouvard V, Guha N, Freeman C, Galichet L, Coglianò V (2009). A review of human carcinogens - Part C: metals, arsenic, dusts, and fibres, on behalf of the WHO International Agency for Research on Cancer Monograph Working Group. International Agency for Research on Cancer, Lyon, France. *Lancet* 10, 453-454.
- European Union Risk Assessment Report. Chromium trioxide, sodium chromate, sodium dichromate, ammonium dichromate and potassium dichromate. CAS-No.: 1333-82-0, 7775-11-3, 10588-01-9, 7789-09-5 and 7778-50-9, EINECS-No.: 215-607-8, 231-889-5, 234-190-3, 232-143-1 and 231-906-6. European Communities, 2005.
- Nielsen E. (1997). Evaluation of health hazards by exposure to copper and estimation of a limit value in drinking water. Instituttet for Toksikologi, Levnedsmiddelstyrelsen. Baggrundsrapport udarbejdet for Miljøstyrelsen.
- European Union Risk Assessment Report. Copper, copper II sulphate pentahydrate, copper(I)oxide, copper(II)oxide, dicopper chloride trihydroxide. CAS No.: 7440-50-8, 7758-99-8, 1317-39-1, 1317-38-0, 1332-65-6, EINECS No: 231-159-6, 231-847-6, 215-270-7, 215-269-1, 215-572-9. Voluntary Risk Assessment, European Copper Institute, June 2007.
- IARC (1990). IARC Monographs on the evaluation of carcinogenic risks to humans, Volume 49, Chromium, nickel and welding. IARC, Lyon, France, 1990. pp. 257-446.
- Straif K, Benbrahim-Tallaa L, Baan R, Grosse Y, Secretan B, El Ghissassi F, Bouvard V, Guha N, Freeman C, Galichet L, Coglianò V (2009). A review of human carcinogens - Part C: metals, arsenic, dusts, and fibres, on behalf of the WHO International Agency for Research on Cancer Monograph Working Group. International Agency for Research on Cancer, Lyon, France. *Lancet* 10, 453-454.

- Nielsen E and Larsen PB (2010): Evaluation of health hazards by exposure to nickel, inorganic and soluble salts and proposal of a health-based quality criterion for drinking water. Afdeling for Toksikologi og Risikovurdering, Fødevareinstituttet, Danmarks Tekniske Universitet / Miljøstyrelsen. Baggrundsrapport udarbejdet for Miljøstyrelsen.
- IARC Monographs on the evaluation of carcinogenic risks to humans, Volume 47, Titanium dioxide. IARC, Lyon, France, 1989. p. 307.
- 150. Titanium dioxide. FAO Nutrition Meetings Report Series 46a.
- European Parliament and Council Directive 94/36/EC of 30 June 1994 on colours for use in foodstuffs. Official Journal of the European Communities L 237/13, 10.9.1994.
- Opinion of the Scientific Panel on Food Additives, Flavourings, Processing Aids and materials in Contact with Food on a request from the Commission related to the safety in use of rutile titanium dioxide as an alternative to the presently permitted anatase form. The EFSA Journal (2004) 163:1-12.
- Kommissionens direktiv 2006/33/EF af 20. marts 2006 om ændring af direktiv 95/45/EF for så vidt angår sunset yellow FCF (E 110) og titandioxid (E 171) (EØS-relevant tekst). EU-Tidende nr. L 082 af 21/03/2006 s. 0010-0013.
- Halappanavar S. Jackson P., Williams A., Jensen K.A., Hougaard K.S., Vogel U., Yauk C.L., Wallin H. Pulmonary response to surface-coated nanotitanium dioxide particles includes induction of acute phase response genes, inflammatory cascades, and changes in microRNAs: A toxicogenomic study. Environ Mol Mutagen 2011; DOI 10.1002/em.20639.
- IARC Monographs on the evaluation of carcinogenic risks to humans, Volume 93, Carbon Black. IARC, Lyon, France, 2006.
- 636. Carbon Black. WHO Food Additive Series 22.
- Jacobsen N.R., Pojana G., White P., Møller P., Cohn C.A., Korsholm K.S., Vogel U., Marcomini A., Loft S., Wallin H. Genotoxicity, cytotoxicity and reactive oxygen species induced by single-walled carbon nanotubes and C60 fullerenes in the FE1-MutaTMMouse lung epithelial cells. Environ Mol Mutagen 2008;49:476-87.
- Jacobsen N.R., Saber A.T., White P., Møller P., Pojana G., Vogel U., Loft S., Gingerich J., Soper L., Douglas G.R., Wallin H. Increased mutant frequency by carbon black, but not quartz, in the lacZ and cII transgenes of muta mouse lung epithelial cells. Environ Mol Mutagen 2007;48:451-61.
- Copper phthalocyanine. CAS No.: 147-14-8. OECD SIDS, UNEP Publications.
- IARC Monographs on the evaluation of carcinogenic risks to humans, Volume 92, Some Non-heterocyclic Polycyclic Aromatic Hydrocarbons and Some Related Exposures. IARC, Lyon, France, 2010.
- Evaluation of health hazards by exposure to PAH and estimation of a quality criterion in soil. Afdeling for Toksikologi og Risikovurdering, Fødevare- og Veterinærinstituttet. Baggrundsrapport udarbejdet for Miljøstyrelsen.
- Polycyclic aromatic hydrocarbons, selected non-heterocyclic. Environmental Health Criteria 202. IPCS, WHO, 1998.
- IARC Monographs on the evaluation of carcinogenic risks to humans, Supplement 7, Aniline. IARC, Lyon, France, 1987, p. 99.

- European Union Risk Assessment Report. Aniline. CAS No.: 62-53-3, EINECS No.: 200-539-3. European Communities, 2004.
- IARC Monographs on the evaluation of carcinogenic risks to humans, Volume 73, *ortho*-Anisidine. IARC, Lyon, France, 1999, p. 49.
- European Union Risk Assessment Report. *o*-Anisidine. CAS No.: 90-04-0, EINECS No.: 201-963-1. European Communities, 2002.
- IARC Monographs on the evaluation of carcinogenic risks to humans, Volume 57, *para*-Chloroaniline. IARC, Lyon, France, 1993, p. 305.
- 4-Chloroaniline. Concise International Chemical Assessment Document 48. WHO, 2003.
- IARC Monographs on the evaluation of carcinogenic risks to humans, Volume 77, 4-Chloro-*ortho*-toluidine. IARC, Lyon, France, 2000, p. 323.
- IARC Monographs on the evaluation of carcinogenic risks to humans, Volume 99, Some Aromatic Amines, Organic Dyes, and Related Exposures. IARC, Lyon, France, 2010.
- Bioassay of 4-chloro-*o*-toluidine hydrochloride for possible carcinogenicity, CAS No. 3165-93-3. National Cancer Institute, Carcinogenesis Technical Report Series No. 165, 1979.
- IARC Monographs on the evaluation of carcinogenic risks to humans, Supplement 7, 3,3'-Dichlorobenzidine. IARC, Lyon, France, 1987, p. 193.
- IARC Monographs on the evaluation of carcinogenic risks to humans, Volume 99, Some Aromatic Amines, Organic Dyes, and Related Exposures. IARC, Lyon, France, 2010.
- 3,3'-Dichlorobenzidine. Concise International Chemical Assessment Document 2. WHO, 1998.
- IARC Monographs on the evaluation of carcinogenic risks to humans, Volume 16, 2,4-Diaminotoluene. IARC, Lyon, France, 1978. pp. 83.
- Diaminotoluenes. Environmental Health Criteria 74. IPCS, WHO, 1987.
- IARC Monographs on the evaluation of carcinogenic risks to humans, Volume 79, 2,4-Diaminoanisole. IARC, Lyon, France, 2001, p. 621.
- IARC Monographs on the evaluation of carcinogenic risks to humans, Supplement 7, 2-Naphthylamine. IARC, Lyon, France, 1987, p. 261.
- IARC Monographs on the evaluation of carcinogenic risks to humans, Volume 99, Some Aromatic Amines, Organic Dyes, and Related Exposures. IARC, Lyon, France, 2010.
- IARC Monographs on the evaluation of carcinogenic risks to humans, Volume 48, 5-Nitro-*ortho*-toluidine. IARC, Lyon, France, 1990. p. 169.
- IARC Monographs on the evaluation of carcinogenic risks to humans, Volume 99, Some Aromatic Amines, Organic Dyes, and Related Exposures. IARC, Lyon, France, 2010.
- *o*-Toluidine. Concise International Chemical Assessment Document 7. WHO, 1998.
- *o*-Toluidine, CAS No.: 95-53-4. OECD SIDS 2004, UNEP Publications.
- Council Directive 67/548/EEC of 27 June 1967 on the approximation of laws, regulations and administrative provisions relating to the classification, packaging and labelling of dangerous substances. Official Journal of the European Communities L 196, 16.8.1967, p. 1.
- Principper for sundhedsmæssig vurdering af kemiske stoffer med henblik på fastsættelse af kvalitetskriterier for luft, jord og vand. Elsa

Nielsen, Grete Østergaard, John Christian Larsen og Ole Ladefoged.
Afdeling for Toksikologi og Risikovurdering, Danmarks
Fødevareforskning. Miljøprojekt Nr. 974 2005.

- IARC Monographs on the evaluation of carcinogenic risks to humans, Volume 99, Some Aromatic Amines, Organic Dyes, and Related Exposures. IARC, Lyon, France, 2010.
- McFadden N., Lyberg T., Hensten-Pettersen A. Aluminium-induced granulomas in a tattoo. *J Am Acad Dermatol*, 1989;20:903-8.
- Chong H et al. Persistent nodules at injection sites (aluminium granuloma) – clinicopathological study of 14 cases with a diverse range of histological reaction patterns. *Histopathology* 2006;48:182-88.