

Survey of chemical compounds in consumer products

Survey no. 2 – 2002

Investigation of pigments in tattoo colours

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Preface

The Danish Environmental Protection Agency has implemented some projects with the overall purpose to go through chemical substances in consumer products.

The purpose of the project mentioned in this report is to identify the pigments that are used in tattoo colours on the Danish market.

The investigation only comprises colours which are used for tattoos carried out with traditional methods in which colour is entered into the skin by means of a needle. So-called temporary tattoos are not included in the investigation (often these are called henna tattoos) - a subject is painted onto the skin. Likewise the widely used transfer tattoos among children (a small pre-printed picture, which is transferred to the skin) are not included.

Today, there is no legislation focusing specifically on the colouring agents used as tattoo colours.

This report therefore contributes to the overall basis of knowledge on which the EU will consider the need for special legislation on tattoo colours, and if so, will draft such regulations.

The aim of the project was, thus, to investigate which branches use pigments, and which pigments have been assessed in other contexts and which have not. Therefore, even if the pigments investigated are compared to the pigments specified in Statutory Order on Cosmetic Products, this approach does not support a strategy aiming at including tattoo colours in such legislation. The Danish Order was used only as a basis for comparison, and as a basis for the assessments made.

Finally, the Danish EPA does not intend to compare the cosmetic tattooists with traditional tattooists, since – apart from the use of pigment colours - these two branches differ in terms of both methods, techniques and purpose.

The project is carried out by Chemtox A/S.

1 Summary and conclusions

1.1 Definitions

Colloquially the terms dyes, colours and pigments are often used at random. In this report the terms are used in a unambiguous way so that:

- Tattoo colour = the final formulation of a dye or pigment which the tattooist is using and which is primarily injected under the skin.
- Dye = a substance which maintains its characteristic colour even if it is divided into individual molecules (often soluble colours).
- Pigment = a colouring product which consists of primarily uncoloured molecules which cause a refraction through their arrangement of crystals and this gives a specific colour. If a pigment is divided into individual molecules it loses its colour.

This project has shown that no dyes are used in the tattoo colours in question but solely pigments. This was expected, as pigments are much more likely to give a permanent settlement in the skin than dyes. Furthermore, pigments are generally much more fast to light than dyes.

1.2 Summary

This project has identified various suppliers of tattoo colours used at the Danish market through interviews with traditional tattooists and cosmetic tattooists. Through a subsequent contact with the suppliers some pigments used in these tattoo colours have been identified.

A number of manufactures of industrial pigments have been contacted, and their common assent is that they do not make pigments targeted at the tattoo business.

Some dermatological departments at Danish hospitals have also been contacted but no further information was received through this approach.

The project has unambiguously been focused on identifying the pigments used. It has not been part of the project to identify other ingredients (dispersing accessory agents, stabilisers, solvents, preservatives, etc.). It has also not been within the frame of the project to make health or risk assessments of the pigments identified.

1.3 Conclusion

1.3.1 Traditional tattooists

Among the tattooists it was possible to obtain contact to during this project there was only one who makes his own tattoo colours. All other tattooists use tattoo colours made by foreign manufactures.

The choice of suppliers is very homogeneous as a majority of tattooists primarily use colours from only one supplier, whereas some of the suppliers only have a few customers among Danish tattooists. A few suppliers are only used by one single tattooist.

The homogeneity and the openness of the suppliers in question as well as their interest in co-operating on this project indicate that the pigments found in this project represent a very large part of the pigments used in general.

On the other hand it must also be assumed that the many part-time or pronounced amateur tattooists in Denmark use tattoo colours from other suppliers, as several hundred suppliers of tattoo colours can be found on the Internet.

Without any problems anybody can order all necessary equipment and tattoo colours to start working as a tattooist.

Contrary to others some of the suppliers used by most of the tattooist in this study only sell to customers already recommended by other known customers. In this way these suppliers try to avoid a more "doubtful" use of their tattoo colours and equipment.

A total of 17 pigments have been identified in the products for which information has been received. These pigments are all generally used industrial pigments and they are not different from the ones used within other lines of businesses. Inorganic pigments like iron oxide and titanium oxide as well as organic pigments of the types azo, phthalocyanine, acridine and naphthol and carbon black are used.

No assessment has been made of the health risks in connection with the use of the pigments for this purpose.

1.3.2 Cosmetic tattooists

This part of the project is based on a far narrower data basis than the part about traditional tattooists. This means that the list of the pigments used is not as complete and adequate as the previously mentioned.

This is partly owing to the fact that it has been difficult to identify performers of cosmetic tattooing (= micro pigmentation), and partly because of a substantial less interest among the suppliers to hand over information for this project.

The results in this report are therefore solely based on information from the two importers found on the Danish market.

A total of 11 pigments have been identified in the products for which information has been found.

The pieces of information received indicate that the tattoo colours used for cosmetic tattoos and which are sold by the two participating importers only contain pigments which are allowed for use in all sorts of cosmetics according to the statutory order on cosmetics. This is significantly different than the tattoos colours used for traditional tattooing in which pigments permitted as well as prohibited in cosmetics are used. Iron oxide pigments are used to a

greater extend in cosmetic tattooing, but azo and quinolin pigments as well as titanium oxide are also used.

In the same way as it has been ascertained by going through the traditional tattoo colours nothing here indicates that the pigments used for cosmetic tattooing are manufactured specifically for this purpose. It has to be concluded that industrial standard pigments are used.

3 Project presentation

Humans have always wanted to change and embellish their surroundings and their bodies. Body painting has always been (and is still) an important part of the blemish ideals in all societies all over the world.

Tattoos have a special place among body ornaments, as they cannot be washed or worn off like body paint. A tattoo gives a permanent decoration.

By all types of tattoos pigments are entered under the top layer of skin by means of a needle. This process ensures that the pigments cannot be removed, but simultaneously the organism is exposed to the ingredients in the tattoo colour in a very direct way.

Products sprayed into the body are normally comprised by the Medicines Act whereas tattoo colours, which are categorised as being somewhere in between remedies, and cosmetics are not comprised by any special laws. By contrast they are comprised by the Product Safety Act as general products and it should be classified and labelled according to the statutory order on classification, packaging, labelling, sale and marketing of chemical substances and products.

4 Procedure

By way of introduction this survey has been carried out by identifying "traditional" tattooists as well as "cosmetic" tattooists.

Our distinction between traditional tattooists and cosmetic tattooists corresponds to the way the performers themselves distinguish and like the business functions in general.

The main work of traditional tattooists is tattooing (in some cases it is combined with piercing, etc.) based on principles and methods which have developed for centuries. Cosmetic tattooists primarily work at beauty parlours, and cosmetic tattoos only present a small (and quite new) part of their range.

In principle the same techniques are used by cosmetic tattooing as by traditional tattooing but normally specially fitted equipment suited for the "cosmetic" angle is used in which the customers get a permanent (face) makeup.

Searches on the Internet and in telephone databases have resulted in the identification of 53 actual tattooists in Denmark. It is estimated that this search result comprises a very large part of the tattooists working seriously and professionally with tattooing. However, according to sources within the business there are also some tattooists who work part-time or on an amateur basis, but it has not been possible to get in contact with this part of the business.

The search for cosmetic tattooists was far more difficult as normal beauty parlours offer this kind of permanent makeup, and often these do not advertise especially for this part of their business. It is only a small part of their other cosmetic services.

All identified tattooists traditional as well as cosmetic were contacted by mail and subsequently interviewed by phone.

Through this interview suppliers of tattoo colours were identified, and subsequently they were contacted and asked to contribute to the project with information about the pigments used.

On the basis of these supplier contacts, sets of typical tattoo colours were purchased to be used in connection with a perhaps later analysis of the products.

Concurrently contact was taken to some of the large manufactures of industrial pigments to obtain information about pigments used for tattooing if possible.

In conclusion dermatological hospital departments were contacted to include the experiences of these departments of possible injuries or reactions seen in connection with tattoos.

5 Results

5.1 Interviews with traditional tattooist

Generally the attitude of the interviewees was very positive and there was a great willingness to help and answer questions.

After a general introduction of Chemtox A/S and a more detailed description of this project as well as a discussion about the meaning of the project for the individual tattooist the following main areas were uncovered:

- Tattooists' experience of customers' allergic reactions or the like
- Tattooists' experience of different types/suppliers of tattoo colours
- Tattooists' choice of suppliers on the basis of parameters like durability of the final tattoo, the technical usability of the colour, supplier documentation, etc.
- Suppliers used.

On the basis of statements from the interviewees a quite clear picture was formed of the use of tattoo colours on the Danish market.

Jointly all tattooists they have a very clear attitude to the tattoo colours they use. In general they are very aware of using non-allergenic products, but they do not have access to exact information, and therefore they have to trust the statements from suppliers that their products are "allergy-tested" or "approved".

Generally it is not possible for tattooists to evaluate if these statements are true, but they have to rely on their own and their colleagues' experiences when choosing suppliers. Concurrently very few allergic problems have been reported from customers.

In connection with the interview one Danish manufacturer of tattoo colours has been identified, but it has been evaluated that the market share of this manufacturer is very limited. Generally most tattooists use tattoo colours bought from foreign manufactures.

5.1.1 Interviewed tattooists

Fifty-four tattooists located evenly in Denmark were identified and were part of the interview investigation. The Danish EPA is informed of names and addresses of all involved tattooists and distributors.

5.1.2 Suppliers of tattoo colours

5.1.2.1 *Actual suppliers of tattoo colours*

This list only includes suppliers of tattoo colours, which deliver tattoo colours used by one or several of the interviewed tattooists.

- Custom Tattoo Suppliers
- Davis's Tattooing Supplies
- Dermagraphics Manufacturing & supply Inc.
- Dynamic Color Co.
- Huck Spaulding Enterprise Inc.
- Micky Sharpz Supplies Limited
- National Tattoo Supply Inc.
- Robinson & Dixon
- Skin & Colors tattoo produkt,
- Tattoo InKorporated Ltd.
- Tattoo-Shop

5.1.2.2 *Other suppliers of tattoo colours*

In addition to the actual suppliers of tattoo colours black ink (developed, intended and marketed for drawing and writing purposes) from the following companies, which expressly do not recommend their products for tattooing is widely used:

- Indian Ink
- Pelikan Ink

5.2 Interview of cosmetic tattooists

As previously mentioned the identification of companies dealing with cosmetic tattoos has been more difficult than the identification of "traditional" tattooists. Through direct searches for micro pigmentation and permanent makeup only two companies were found. These both offer equipment/colours and training within the area cosmetic tattooing, and one also makes cosmetic tattoos. Both companies were very positive towards the investigation and have contributed with information.

Other companies within cosmetic tattooing have been found through searches for beauty parlours, makeup artists, hairdressers, etc. but generally permanent makeup is only a small part of their work area. At the same time it can be concluded that only a few of the thousands of Danish beauty parlours work within the area of cosmetic tattooing.

However, the companies found dealing with cosmetic tattoos were informed about this project by letter and subsequently interviewed by phone like the traditional tattooists.

We note that the interest for participating in this investigation and the sincerity about the used products was generally less among the cosmetic tattooists than among traditional tattooists.

5.2.1 Interviewed cosmetic tattooists

Four cosmetic tattooists were identified and participated in the investigation

5.2.2 Suppliers of colours for cosmetic tattooing

- Ann Artis
- Kallisto Equipment

5.3 Contact to manufactures of pigments

There are several manufactures of pigments but as it may be assumed that there are no manufactures which solely make pigments for tattooing, this must mean that the pigments used for tattooing are made by the companies making industrial pigments for general use (colour and lacquer, plastic, food, etc.). To determine if this is the case, and if special pigments are used within the tattoo area and if standard pigments are used, a row of manufactures of pigments (all represented at the Danish market) were contacted:

- Colortrend (Degussa),
- Akzo,
- Sun Chemimals
- and Bayer.

Concordant these suppliers could inform that they do not manufacture special pigments for tattooing, and in general they did not have any knowledge of a possible use of their standard pigments for this purpose. However, one single supplier had at some time been in contact with the tattooing business and had also supplied one single manufacturer of tattoo colours with samples of standard pigments.

However, none of the manufactures would deny that their pigments are used for this purpose but as the course of sales outlets takes place through several importers and distributors they often do not know for which purpose the pigments are finally used.

5.4 Contact to dermatological departments

Even though this project does not comprise health assessments of the found pigments we tried to obtain information from dermatological hospital departments about the extent of possible reactions in connection with tattoos for the sake of completeness. We contacted four different hospital departments found through "danderm" and through a contact with the coordinator on: Danish information about dermatovenerology – DIDV.

<http://www.danderm-pdv.is.kkh.dk/>

Professor doc. med. Klaus E Andersen at the Dermatological Department I of Odense University Hospital informed that allergic reactions of tattoo colours are seldomly seen today. Unfortunately, it has not been possible to obtain contact with other relevant persons.

5.5 Identified pigments

The pigments mentioned in table 5.5.1 have all been positively identified through information from the suppliers of tattoo colours mentioned in section 5.1.2. The table does not represent all pigments used in the products on the Danish market but solely comprises the pigments found on the basis of information from the suppliers who wanted to participate in this investigation.

Furthermore, the table contains information about the commonly used name of the pigment, CAS-no., chemical name, CI (Color Index) number, and field of application according to the statutory order on cosmetics.

For each pigment it is stated if it is approved for use in cosmetics and in such case the fields of application are specified (according to appendix 4 in the statutory order on cosmetics):

Group 1: Substances allowed in all cosmetics.

Group 2: Substances allowed in all cosmetics with the exception of cosmetics to be used around the eyes, mainly eye makeup and removers.

Group 3: Substances solely allowed in cosmetics but which should not be in contact with mucous membranes.

Group 4: Substances solely allowed in cosmetics which temporarily may be in contact with skin.

It has to be emphasised that a statement of the classification from the statutory order on cosmetics does not indicate that tattoo colours are subject to the provisions of this act. The classification is only included to create a basis for comparison of individual pigments.

Table 5.5.1

a. Pigments used in general tattoo colours

Name	CAS-no.	Chemical name	Field of application cosmetics	CI-no.
Pigment Orange 36	12236-62-3	2-((4-chloro-2-nitrophenyl)azo)-N-(2,3-dihydro-2-oxo-1H-benzimidazol-5-yl)-3-oxobutanamid	Not approved	11780
Pigment Yellow 74	6358-31-2	2-[(2-methoxy-4-nitrophenyl)azo]-N-(2-methoxyphenyl)-3-oxobutyramid	Not approved	11741
Pigment Red 170	2786-76-7	4-[[4-(aminocarbonyl)phenyl]azo]-N-(2-ethoxyphenyl)-3-hydroxynaphthalen-2-carboxamid	Not approved	12475
Pigment Yellow 97	12225-18-2	N-(4-chloro-2,5-dimethoxyphenyl)-2-[[2,5-dimethoxy-4-(phenylamino)-sulfonyl]-phenyl]-azo]-3-oxo-butanamide	Not approved	11767
Pigment Red 146	5280-68-2	N-(4-chlor-2,5-dimethoxyphenyl)-3-hydroxy-4-[[2-methoxy-5-(phenylamino)carbonyl]phenyl]azo]naphthalen-2-carboxamid	Not approved	12485
Pigment Brown 25	6992-11-6	4-[(2,5-dichlorophenyl)-azo]-N-(2,3-dihydro-2-oxo-1H-benzimidazol-5-yl)-3-hydroxy-2-naphthalenecarboxamid	Not approved	12510
Pigment Red 266	36968-27-1	Naphthol red	Not approved	12474
Pigment Violet 23	6358-30-1	8,18-dichlor-5,15-diethyl-5,15-dihydroindolo[3,2-b:3',2'-m]triphenodioxazin	Group 4	51319
Pigment Red 122	980-26-7	Quino(2,3-b)acridin-7,14-dion, 5,12-dihydro-2,9-dimethyl-	Group 4	73915
Pigment Yellow 1	2512-29-0	2-[(4-methyl-2-nitrophenyl)azo]-3-oxo-N-phenylbutyramide	Group 3	11680
Pigment Orange 43	4424-06-0	Bisbenzimidazo[2,1-b:2',1'-i]benzo[lmn][3,8]phenanthrolin-8,17-dion	Group 3	71105
Pigment Green 7	1328-53-6	Polychloro copper phthalocyanine	Group 2	74260
Pigment White 6	13463-67-7	Titandioxid	Group 1	77891
Pigment Red 101	1309-37-1	Jern(III)Oxide	Group 1	77491
Pigment Blue 15	147-14-8	tetrabenzo-5,10,15,20-diazaporphyrinphthalocyanin	Group 1	74160
Pigment Blue 15:3	147-14-8	tetrabenzo-5,10,15,20-diazaporphyrinphthalocyanin	Group 1	74160
Pigment Black 7	1333-86-4	Carbon Black	Group 1	77266

Table 5.5.1 continued

b. Pigments used in cosmetic tattoo colours

Name	CAS-no.	Chemical name	Field of application cosmetics	CI-no.
Pigment White 6	13463-67-7	Titandioxide	Group 1	77891
Pigment Brown 6	52357-70-7	Ironoxide	Group 1	77499
Pigment Red 101	1309-37-1	Iron(III)oxide	Group 1	77491
Jernoxid	1345-25-1	Iron(II)oxid	Group 1	77489
Pigment Yellow 42	51274-00-1	Ironhydroxidoxide	Group 1	77492
Sudan Rød	1229-55-6	1-[(2-methoxyphenyl)azo]-2-Naphthalenol	Group 1	12150
Food Yellow 13	8004-92-0	2-(1,3-Dioxindan-2-yl)quinoline-disulfonic acid sodium salt;	Group 1	47005
Mangan Violet	10101-66-3	Mangan Ammonium Pyrophosphate	Group 1	77742
Food Red 17	25956-17-6	2-Naphthalensulfonic acid, 6-hydroxy-5-((6-methoxy-4-sulfo-m-tolyl)-azo)-, disodium salt	Group 1	16035
Food Blue 2	3844-45-9	Disodium bis[4-(N-ethyl-N-3-sulfonatophenylmethyl)aminophenyl]-2-sulfonatophenylmethylium	Group 1	42090
Acid Red 87	17372-87-1	2,4,5,7-Tetrabromofluorescein	Group 1	45380:3

6 Supplementary remarks

53 Danish tattooing companies are involved in this project, and we assume that this number comprises the main part of all full-time professional companies in Denmark.

During this project a very positive contact was established to DTL (Danish Tattoo Organisation) which is the largest trade organisation at the Danish market with approx. 40 members. In addition to this organisation some tattoos are affiliated to DPT (Danish Professional Tattooists).

The main part of the interviewed tattooists were very positive towards the thought of getting permanent guidelines of what tattoo colours are allowed to contain, as they are strongly concerned about the safety of their customers.

Today there are not any uniform rules or standards of which raw materials to use by the manufacturing of tattoo colours, or how finished tattoo colours should be tested. Therefore, the suppliers use some more or less relevant praises of their products. Some refer to an ISO 9002 approval, others to tests carried out by microbiological or human toxicological companies. However, in general only relatively few suppliers have documentation, and it is difficult for customers (tattooists) to evaluate the quality and meaning of the (claimed) documentation.

However, according to sources within the trade there are at least 200 tattooists in Denmark of which many are just amateurs. The attitude of these tattooists, and which tattoo colours they use, is not known, as it has not been possible to get in contact with these.

It seems that a large part of professional tattooists mainly use the same few suppliers, but they all have alternative suppliers of some tattoo colours. As these frequently used suppliers at the same time are the most positive towards this investigation, we estimate that the pigments identified in this investigation are some of the most used among professional tattooists.

However, this does not exclude that alternative suppliers or suppliers of non-interviewed tattooists use other pigments as a simple search at the internet can identify hundreds of suppliers all over the world, who all deliver world-wide.

Apparently slightly different pigments are used for cosmetic tattooing as iron oxide pigments have been identified to a larger extend in these colours. But the data basis of this evaluation is quite thin, as it is limited to information from the two identified Danish importers of colours.

Internationally there is, if not just as many suppliers of colours for cosmetic tattooing as for traditional tattooing, a large number of suppliers. Interestingly many suppliers of traditional tattoo colours also offer colours for cosmetic tattooing, but it is not directly possible to evaluate if the same types of pigments are used in both types of colours or if there is a difference.