

Survey of Chemical Agents in Consumer Products

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Surveying of chemical substances in earplugs

Phase 1: Collection of earplugs

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Preface

Earplugs are often made of plastics e.g. flexible polyurethane foam or silicone plastics. Earplugs may have different functions, but it is common to all of them that they are placed directly in the auditory canal and so close to the brain. They are often used for a long time together e.g. in the industry. Some types are stated to be dirt repellent; so they might be surface treated. To create a basis to enable one to prevent any hazardous effects to the users of earplugs, a survey of the chemical substances that are constituent parts of earplugs and – to the best – the amount or concentration in which they occur is wanted.

For practical reasons the project *Surveying of chemical substances in earplugs* is divided into two phases. Phase one includes a survey of the earplug products that are available on the Danish market. Phase two includes the proper elucidation of constituting substances based on the information on the materials and relevant chemical analysis.

This report includes phase 1.

Earplugs may have different functions. Most of them are intended generally to protect against noise. Some are particularly suitable to protect against interfering noise e.g. from machines, whereas they do not exclude ordinary speech and warning signals. Other products protect particularly against water intrusion and others are suitable to protect against malaise, pain and “plugs” in the ears during flying, driving in mountains, tunnel passages etc.

A borderland is individually shaped plugs to hearing aids (most often of silicone or acrylic plastics), hearing aids for musicians with an integrated filter and earplugs connected to headphones.

In this investigation the product area are limited as the above mentioned types are excluded. However, one product that is to be individually adapted to the shape of the auditory canal is included, because its purpose is stated to protect against hearing damages.

The Danish Technological Institute, The section of Plastics Technology, by M. Sc. Chem. Eng. Kjeld Karbæk has performed phase 1 in the period July – October 2001.

Summary and conclusions

With the object to create a basis to enable one to prevent any hazardous effects to people, who are using earplugs, it is a wish to obtain knowledge about the chemical substances that are constituent parts of earplugs. The task *Surveying of chemical substances in earplugs* is being performed in two phases. In the first phase, a general knowledge of the earplug products that are being sold in Denmark has been obtained. In the second phase, the constituting chemical substances in the marketed earplug products are to be clarified.

This report includes the first phase. Through purchase from selected retail shops and through searching on Internet and contact by telephone and e-mail with a number of dealers, importers and manufacturers a sample of each of the most often sold among the earplug products that are being sold in Denmark have been purchased. They have been listed in five categories with references to the place of purchase and the importer and/or the manufacturer. Totally 34 different products have been found and acquired.

Only for a few of the products information of the materials used has been found. However, polyurethane foam and silicone rubber (or plastic) are expected to be the dominating materials, but one product of poly(vinyl chloride) (PVC), one of wax impregnated cotton wool and one of down covered by a polyethylene film have also been found.

1 Collection of earplug products

1.1 OBJECTIVE

The objective of this first phase of the project *Surveying of chemical substances in earplugs* is to create a survey of the earplug products that are on the market in Denmark and which materials they are made of or are included in them.

Subsequently, this knowledge is to form a basis to plan the accomplishment of phase 2, which includes the proper survey of the substances that are constituent parts of these products

1.2 PROCEDURE

From a number of retail shops, which immediately are expected to sell earplugs, primarily materialists, pharmacies and Do It Yourself markets, samples of all of the different marketed earplug products have been purchased.

Furthermore, web sites dealing with earplugs have been searched on Internet. By this means, contact has been established with an additional number of dealers, importers and manufacturers of earplugs. Through telephone or e-mail requests a large number of a variety of earplug samples – most of them with data attached – have been acquired.

The found products, dealers, importers and manufacturers have been correlated with the Association of Danish Safety Suppliers to ensure that at least the most often sold products have been included in the collection.

1.3 RESULTS

A list of the collected earplug products is shown as Appendix A

In order to give clearness we have arranged them into the below mentioned five groups according to type (presentation and function). This is not an official grouping used in the trade. We have made the grouping solely for the sake of clearness.

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Type S: Plastics foam:

Moulded, flexible plugs – most often cylindrical or conical – often made of polyurethane foam. An example is shown in the photo in Figure 1.



Figure 1 Plugs of plastic foam on a headband

Type J: The Christmas tree model:
Lamellae arranged like on a Christmas tree
– of a flexible material – often silicone
plastic. See an example in the photo in
Figure 2.



Figure 2 The Christmas tree model

Type D: Down and cotton wool:
A wad of down covered by a flexible poly-
ethylene film – photo in Figure 3 – or a
cotton wool ball impregnated with a wax.



*Figure 3 Down plugs covered by a
Polyethylene film*

Type Q: Mouldable (silicone): A cylindrical shaped plug of a mouldable silicone rubber. (is not depicted).

Type A: Others (is not depicted)

Totally, 34 different products were collected grouped with seventeen products of type S (plastics foam), ten products of type J (the Christmas tree model), two of type D (down and cotton wool), four of type Q (silicone) and one product, that does not immediately fit into any of the other groups.

More of the acquired products are available in different sizes and are sold in different packaging sizes. Some of the reusable products are mounted with a string, others on a headband. For some of these products replacement plugs are available.

The Association of Danish Safety Suppliers have informed us that each ear-plug product that is being sold within the EU, must be CE marked and so fulfil the relevant requirements of EN 352-2 1993. This standard deals with the sound damping properties of earplugs. However, information on this is not given for all the products. The products about which this information has been found are marked so in the list in Appendix A

1.4 SUPPLEMENTARY REMARKS

The main consumption of earplugs is expected to be on disposable plugs made of plastics foam – presumably of polyurethane. In the nature of the case, the consumption of reusable plugs is expected to be significantly less than the consumption of disposable plugs. Further, it is expected that the most sold products to private people are being sold from materialists, pharmacies and Do It Yourself markets, whereas the industry, which represents the biggest purchaser group, mainly buys directly from importers.

Information about materials is available about only a few of the products. We presume that most of the foam-plug products are made of polyurethane; however, according to the description one foam-plug product is made of poly(vinyl chloride) (PVC). The reusable plugs are expected to be made mainly of silicone. The mouldable plugs are made of silicone according to the descriptions. The nature of the down material in the only found down product is not informed, but the surrounding film, which alone comes into contact with the skin, is informed to be polyethylene.

Bilag A

Sample marked	Product description	Remarks
TYPE S: PLASTICS FOAM		
S-1	Disposable earplug of moulded polyurethane foam (PUR)	EN ^{*)} Available in two sizes and in a number of packaging sizes
S-2	Replacement earplugs on a foldable headband	EN ^{*)}
S-3	Soft energy absorbing poly-foam; available corded and uncorded	Available in different packaging sizes
S-4	Headbanded hearing aid with plugs of PUR foam	EN ^{*)}
S-5	Soft, comfortable and unobtrusive hearing protection	EN ^{*)}
S-6	Hexagonal moulded earplugs of expanding plastics foam	EN ^{*)}
S-7	Moulded plugs of expanding plastics foam (PVC)	EN ^{*)}
S-8	Corded and uncorded moulded plugs of expanding plastics foam (PUR)	EN ^{*)}
S-9	Corded and uncorded reusable foam earplugs	Available in three sizes
S-10	Expandable earplugs made of polyurethane foam (PUR)	
S-11	Earplugs	
S-12	Earplugs	
S-13	Corded metal detectable earplugs	
S-14	Low pressure banded earplugs	
S-15	Silky foamplugs PUR	EN ^{*)}
S-16	Foamplug on a shaft for no-touch mounting	EN ^{*)}
S-17	With segmented headband giving countless adjusting possibilities	EN ^{*)}
TYPE J: CHRISTMAS TREE MODEL		
J-1	To prevent water intrusion and protect against noise	EN ^{*)}
J-2	Pressure controlling disposable earplugs of soft silicone plastic	
J-3	Earplugs for swimming	
J-4	Reusable earplugs	
J-5	Corded or headbanded reusable earplugs of silicone rubber	EN ^{*)}
J-6	Corded and uncorded reusable earplugs	EN ^{*)} Available in two sizes
J-7	Earplugs with an insertion tool	
J-8	With a filter – for music	EN ^{*)}
J-9	Comfortable – “rolling“ not required	EN ^{*)}
J-10	Particularly for the food industry; with an in-moulded metal ball for tracing by a metal detector	EN ^{*)}

TYPE D: DOWN OR COTTON WOOL		
D-1	Disposable earplug made of Eardown® (a wad of down) covered by PE film	EN ^{*)} Available in two sizes and in a number of packaging sizes
D-2	Ear balls against noise (a cotton ball with wax)	
TYPE Q: MOULDABLE (SILICONE)		
Q-1	Silicone earplugs for efficient protection against water in the auditory canal	
Q-2	Ear putty silicone earplugs	
Q-3	none	
Q-4	To prevent hearing damages. Individually mouldable after imprint of the auditory canal	EN ^{*)}
TYPE A: OTHERS		
A-1	Pressure reducing earplug. Against malaise, pain and "plugs" in the ears during flying, driving in the mountains, tunnel passage etc. Reusable	

EN^{*)}: Fulfils the relevant requirements in EN 352-2:1993