# Nitrosamines in cosmetic products - risk of skin problems?

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For quite some time now print media and radio stations have been informing that a multitude of cosmetic products contain carcinogenic nitrosamines. The reports are based on random sample results of some State Health Agencies in Germany. The point here is whether an already known problem has now become a burning issue again? The following article gives detailed information.

What are nitrosamines and how do they develop? Secondary amines will react with nitrites and form nitrosamines in an environment with pH values below 7 which means an acidic environment. For quite a long time the main source of secondary amines has been the contamination of triethanolamines with diethanolamines caused by the synthetic manufacturing process. In cosmetic products triethanolamine is a frequent neutralizing agent for anionic emulsifiers and consistency agents. Diethanolamine in combination with nitrite may form N-nitrosodiethanolamine (NDELA). In this context it has to be mentioned that after the contents of nitrosamines and secondary amines have been restricted following the European Cosmetic Decree, NDELA in cosmetic products made in Europe is no longer an issue. With some exceptions though it may rather be a problem with imported cosmetic products.

**Where do nitrosamines hide?**

As analyses of the health agencies still are focused on NDELA, nitrosamines resulting from other secondary amines may slip through the net. Typical examples here are N-methylated amino acids like N-methylglycine also called sarcosine, naturally occurring secondary amines gained from vegetable extracts and contaminations from organic dyes. Additional nitrite sources are the preservatives bronidox (5-bromo-5-nitro-1.3-dioxane) and bronopol (2-bromo-2-nitropropane-1,3-diol), both frequently used in skin cleansing products like shampoos, and nitrogen dioxide ($NO_2$) which can be found in car exhaust fumes or is formed by chemical reaction of nitrogen and oxygen following electric discharges as for example thunderstorms or in power lines. By the way from the chemical point of view nitrogen dioxide is a radical. According to the European Cosmetic Decree a potential formation of nitrosamines in cosmetic products in connection with the above mentioned preservatives must be avoided. However in specific cases where a product which contains secondary amines is applied after a product containing preservatives, the potential formation of nitrosamines on the skin surface cannot be excluded completely.
So far however there is no hard evidence for a carcinogenic effect of nitrosamine contaminated products applied on the skin. Up to now experience is limited to nitrosamines inhaled with cigarette smoke or those formed by sodium nitrite from nitrite cured food reacting with secondary amines from vegetables or other food components. The concentration of nitrosamines formed in the stomach with the influence of hydrochloric acid (low pH!) may be multiplied by tens compared to the nitrosamines in cosmetic products, and its impact certainly is more significant specifically as the nitrosamines are directly absorbed. Gastroenteric carcinomas may develop as well as tumors in specific organs depending on the chemical structure of the nitrosamines.

**Vitamin C - a remedy here?**

The information that vitamin C and E additives in food will reduce the risk of nitrosamine formation which was even published by government institutions like e.g. the Bavarian State Ministry of the Environment, Public Health and Consumer Protection, definitely is inaccurate. It is a fact though that nitrite may be reduced to nitrogen monoxide NO by reaction of the vitamins mentioned, however as soon as atmospheric oxygen is involved, the circle starts all over again until the vitamins are spent. Internal studies carried out by companies using metalworking fluids which are involved in similar problems like cosmetics even have shown that antioxidants may in fact increase the NDELA concentration.

**How to protect yourself**

Hence a very complex issue which certainly bothers consumers. What can they do to pro-

tect themselves? It has to be stated though that there is no 100 per cent protection as secondary amines and nitrite alias $NO_2$ also occur in the natural environment. However, as far as cosmetic products are concerned it should be taken care that the above mentioned components are not used in the formulations. On the other hand, the risk involved with contaminated skin cleansing products may probably be neglected as they are not supposed to remain on the skin. The consumer may also draw comfort from the fact that the human organism is somehow adapted to this problem as it is also equipped with secondary amines. The skin is able to protect itself with its natural moisturizing factor (NMF) which mainly contains amino acids. In chemical respect amino acids may be classified as primary amines. They will also react with $NO_2$, however with the consequence that the molecule is destroyed in this process and harmless nitrogen will be formed. (rf. Kosmetische Praxis 2006 (2), 12-14).

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