

# Formaldehyde

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Formaldehyde is a colourless gas in room temperature, very easily soluble in water, and it has a pungent smell and a locally irritating effect on the mucosa. Formalin is a saturated 37% water solution of formaldehyde. Formaldehyde is a very common substance in the chemical industry; the world production exceeds 5 billion tons/year; besides the chemical industries high concentration of formaldehyde occurs in car exhausts, 29-43 ppm. Also smog can be an important source of formaldehyde. In Los Angeles the outdoor air has a content of formaldehyde between 0.005-0.12 ppm. A heavy smoker exposes himself to large amounts of formaldehyde. Cigarette smoke contains 40 ppm. In recent American studies it has been found that formaldehyde concentration can be considerable in new house constructions where fibre board is used. It has also been reported concentrations up to 2.5 ppm in new caravans where the owners have complained of odour and mucosal irritation. In USA it has been demonstrated that large problems with exposure to formaldehyde exist in the fibre board and car manufacturing where certain procedures give especially high exposure. Even in the textile industry the great problem with formaldehyde has been known since long. In USA more than 60 occupations have been identified where man is potentially exposed to formaldehyde.

Formaldehyde is in small quantities a normal component of metabolism in animals including man. The harmful effect of formaldehyde can be related to its high tendency to react with nucleic acids, proteins and amino acids in the cells. Formaldehyde reacts easier with RNA in the cell than with DNA.

According to Acheson et al. (1984) epidemiological studies on humans have not shown any connection between formaldehyde exposure and nasal cancer in the chemical industry in England. American studies as the case control study at The Dupont factories where production of formaldehyde has occurred since many years, showed a light excess of cancer but this was not statistically significant (Clary et al., 1982). Further examination of American morticians and embalmers have been somewhat difficult to interpret. The frequency of brain tumours has shown to be somewhat higher in anatomists and pathologists. Isolated cases of nasal cancer have, however, been reported in the scientific literature. Furthermore, since several years it has in USA been an intense debate on this topic and

several of the epidemiological studies have been criticized and several toxicological authorities have maintained that the existing American epidemiological studies in no way prove that formaldehyde is not a human carcinogen (Gibson, 1982). Concerning the biological effects of formaldehyde it is above all the extensive American experimental animal study on rats and mice which was performed at the Chemical Industry Institute of Toxicology in North Carolina, which has drawn much attention (Clary et al., 1982).

At this well established research center it was found that nearly half of the more 200 rats which were exposed to 15 ppm formaldehyde during 24 months, developed a nasal cancer of squamous cell type. In corresponding studies on mice a significant increase of nasal mucosal changes in the formaldehyde exposed groups was found but only a few nasal cancers. When considering respiratory patterns it was shown that the amount of formaldehyde which comes into close contact with the nasal mucosa is much higher in the rat than in the mouse, and a good accordance concerning dose-response was therefore found.

Formaldehyde has been shown to be mutagenic in various bacterias, moulds and certain insects without presence of other active substances. Toxic effects on man is well established since long concerning the mucosa of the eyes and the upper and lower air ways. Short time assays have not revealed any mental effect by formaldehyde. Most people are able to significantly differ air free from formaldehyde and air mixed with formaldehyde of a level above 1.2 ppm. The threshold value has been said to vary between 1.2 and 2.1 ppm, but there are still no proves that there is a threshold limit value in the population where no individual can not feel irritating effects of formaldehyde.

Allergenic effects from formaldehyde are well documented concerning both skin and air-ways.

We are at present performing experimental studies with combined exposure of rats to wood dust and formaldehyde which is of certain practical interest. These studies are, however, not finished yet.

#### REFERENCES

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