DETERMINATION OF HAZARDOUS COMPOUNDS IN INDOOR AIR: FIELD STUDIES

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INTRODUCTION

Rooms comprise a considerable part of man’s environment; a large proportion of the population, after all, spends up to 90% of the day indoors. Until now, the attention of experts and the public has been chiefly directed towards those rooms in which professional work is performed. These rooms are monitored by work-protection legislation. Other indoor areas in public buildings such as hospitals, schools, kindergartens, swimming pools, administration buildings, vehicles and the home have so far attracted little attention as elements of the environment. However, the air in these spheres of life is frequently more severely affected by materials hazardous to health than outdoor air. Under certain conditions, so-called risk groups react much more sensitively to air pollutants indoors than outdoors.

The most important air pollutants and their sources in rooms are:

- Tobacco smoke
- Combustion gases from open fires, particularly gas stoves
- Solvents and other volatile or particulate substances from cleaning and preservative agents, building materials and do-it-yourself products, insecticides, wood protection agents, paints and glues, etc.
- Infectious and allergenic microorganisms
- Engine exhaust emissions and fuel tank vapours entering the interior of vehicles.

All these air pollutants may be hazardous to health depending on the type and duration of their effect. Most of the air pollutants cannot yet be assessed in rooms as the type, duration and concentration level differ greatly and there is generally a lack of representative data.

One, perhaps the most important, prerequisite for assessing the exposure of persons in rooms, is a suitable, inexpensive measuring process which can be applied with the broad scope required. It is also important that both sampling and analysis take up as little time as possible.

MEASURING METHODS

The measurement of formaldehyde and many solvents was performed, if possible using test tubes. In this process, a fixed, defined volume of air is passed over reagents in the tube and a colour change directly indicates the concentration of the substance to be measured. The measuring range for formaldehyde (0.04 - 0.5 ppm) is sufficient to check that limits are maintained.

To measure formaldehyde specifically and precisely, a defined air volume is sucked through a tube packed with silica gel or passed through distilled water. The formaldehyde is then spectrochemically analyzed in the laboratory. The rapid test-tube process has considerable advantages for monitoring formaldehyde concentration in practice, e.g. the test result is indicated immediately. This means that it is possible to perform immediate measurements to determine emission sources or, if required, further measurements of other pollutants, based on the obtained results, can be made. The process is simple and the sampling time is short. Several measurements per building can be conducted inexpensively in a very short time. The process can also be performed by experienced personnel with lower qualifications. The pri-
mary disadvantage is the unspecificity of the reaction. Mutual sensitivities are frequent and must be accounted for and detected immediately to avoid errors in interpretation.

The standard procedures for detecting formaldehyde are much more sensitive and, above all, specific. For this reason they are indispensable for conducting precise measurements in low concentration ranges. The disadvantage here is the increased technical sophistication and the increased time required to take samples. They can often only be performed by specialists due to the use of dangerous chemicals, and the sophisticated and expensive laboratory analysis.

The wood preservatives, pentachlorophenol (PCP) and lindane, are collected in adsorption solutions and measured using HPLC methods or gas chromatography. Solvents are adsorbed onto suitable base materials and examined with chromatography techniques.

RESULT AND DISCUSSION

Since 1984 more than 1500 measurements of hazardous compounds have been conducted in indoor environments. As the measurements are conducted on request, the indoor air pollutant most familiar to the population - formaldehyde - played the most significant role. The measurement of other wood preservatives, also in the public eye, e.g. pentachlorophenol (PCP) and lindane, were much less frequently carried out due to the high sophistication of the measurements and analysis. Thus, we are unable to provide representative data for these substances. The case is different with formaldehyde. Here, 898 measurements, some from the brief tests and some from precision measurements, could be consulted to assess the situation.

![Pie chart showing the percentage of investigations in various kinds of buildings during 1984 - 1989](image_url)

- private homes (No. 357) 40.0%
- schools (No. 108) 12.0%
- kindergarten (No. 288) 32.0%
- public building (No. 37) 6.0%
- admin.buildings (No. 51) 4.0%
- offices (No. 31) 3.0%
- caravans (No. 26) 3.0%

Fig. 1: Investigations in various kinds of buildings during 1984 - 1989