

HOW TO CREATE A SAFE ENVIRONMENT FOR CULTURAL OBJECTS

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Exhibit cases should protect cultural objects from dust as well as from mechanical damage. Due to the fact that building materials, including woods and coatings, are generally the main sources of VOC in the indoor environment we have to ask the question, to what extent show cases might endanger the exhibits due to atmospheric conditions inside the cases.

In order to provide a reduction of pollution, only low emission materials should be used for the construction or decoration of show cases. The aim of the present research project is the characterisation of hazardous volatile organic compounds and the determination of air exchange rates to estimate the risk of damage.

For the determination of the volatile organic compounds (VOCs) different methods were applied. In a first step different materials were investigated with a dynamic headspace method (direct thermal extraction). Samples were heated up to 40 °C and analysed directly with GC/MSD.

Starting from these results emission test chamber measurements were performed. VOC sampling was accomplished using Tenax TA tubes with a follow-up thermal desorption and GC/MSD analysis. The semi volatile organic compounds (SVOCs) were collected on polyurethane foams. After solvent extraction the analysis was also carried out with GC/MSD.

For the characterisation and quantification of aldehydes and ketones derivatisation with DNPH followed by solvent extraction with acetonitrile and HPLC analysis was used (the samples were collected in cartridges containing dinitrophenylhydrazine where carbonyl compounds were changed to hydrazones).

The determination of the air exchange rates was carried out with a tracer gas method (N₂O). An external pump was connected as by-pass to the exhibit cases to avoid any intervention on the gas mixture inside the cases. The decrease of N₂O was observed and monitored for 24 hours. The determination of the N₂O concentration profile was done with an infrared photometer in a non-dispersive mode, also connected as by-pass to the exhibit show case. An important technical advantage of this method is the fact that no additional driving power (e.g. excess pressure) is required for tightness control. Due to the results which lead to a direct calculation of the air exchange rate no further correlation analysis is necessary.

The results of this study confirm the importance of the careful choice concerning building materials for show cases. Furthermore the analyses clarify that certain organic compounds might be a problem for the exhibits in show cases with low air exchange rates.

References

VDI 3862, Part 3 (12/2000) und DIN ISO 16000, Part 3 (08/2002)

DIN ISO 16000, Part 6 (09/2002)

VDI 4300, Part 7, (07/2001)