

Influence of different types of heating system on particulate and gaseous pollutant deposition: the case of churches situated in a cold climate

Z. Spolnik¹, A. Worobiec¹, L. Bencs², L. Samek³, V. Kontozova¹, R. Van Grieken¹

¹Department of Chemistry, University of Antwerp, Campus Drie Eiken, Universiteitsplein 1, B-2610 Antwerp, Belgium

²Research Institute for Solid State Physics and Optics, Hungarian Academy of Sciences, P.O. Box 49, H-1525 Budapest, Hungary

³University of Mining and Metallurgy, Cracow, Poland

The probable negative effects of heating during cold seasons on works of art present in churches situated in cold regions is of great importance for conservation purposes. The aim of our research was to verify the influence of the used heating systems on the generation and transport of particulate and gaseous matter responsible for blackening and soiling of the precious works of art displayed within the churches. Three different types of heating system were investigated: hot-air blowing, provisory electrical heaters and electrical heated pews.

To determine the bulk chemical composition of the aerosols, energy dispersive X-ray fluorescence analysis was used. The size, chemical composition and abundance of single particles were determined by electron probe X-ray microanalysis. The level of some relevant gaseous pollutants was monitored inside and outside the churches by use of passive diffusion tubes. The details of the samplings and the measurements are discussed in [1, 2].

The obtained results show that the hot-air blowing system causes the deterioration of the plastered walls leading to the creation of extra internal source of Ca. It also can be considered as a factor re-suspending particulate pollution into the whole volume of the church. The combustion of diesel oil in the fuel-chamber warming air creates an internal source of NO₂.

The preliminary results obtained for the heating system consisting of provisory electrical heaters show that it does not have a significant influence on particulate and gaseous pollutions inside the church.

The most modern heating system, convenient for people, consisting of electrical heated pews demonstrates that it causes only the re-suspension of the particulate pollutions brought by visitors. However this negative effect was eliminated very fast after the system was switch off. However some extra amount of NO₂ inside the church was also observed.

1. Z. Spolnik, A. Worobiec, J. Injuk, D. Neilen, H.L. Schellen, R. Van Grieken. *Microchim. Acta* **145** (2004) 223-227.
2. V. Kontozova, F. Deutsch, R. Godoi, AF. Godoi, P. Joos, R. Van Grieken. In: Proceedings of 7th International Conference Art 2002, Antwerp, Belgium, pp.1-8.

