

QUALITATIVE AND QUANTITATIVE DETERMINATION OF SALT EFFLORESCENCE. CASE STUDIES

O. GRUPČE¹, L.ROBEVSKA-ČUKOVSKA², I.KUZMANOVSKI¹, B. MINCEVA-ŠUKAROVA¹

¹Institute of Chemistry, Faculty of Natural Sciences and Mathematics,
“Ss Cyril and Methodius” University, PO Box 162,
*orhideja@pmf.ukim.mk

²Nacionalen konzervatorski centar, Centralna laboratorija, Evlija Čelebija, b.b.,
1001 Skopje, Republic of Macedonia

Target factor analysis (TFA) was employed into determining the composition of the efflorescence salts. Although this approach was developed for wall painting efflorescence, it is equally applicable to masonry efflorescence. The development of the TFA model for prediction of qualitative composition of deposited salts was based on the infrared spectra database of substances found in the efflorescence. The advantages of this method are:

- Target factor analysis allows assessment of the composition of the efflorescence salts through comparison of the actual infrared spectra with the ones from the database.
- If any uncertainty occurs in assessing the number of components in the mixtures, the visual comparison of the target transformed spectra and the spectra of the pure substances stored in the database, could help in determination of the exact number of chemical components of the efflorescence.
- The procedure does not require specialized software and if the mathematical procedure which drives the data analysis process is hidden under suitable designed graphical user interface, the analysis could be performed by person which is not an expert in the infrared spectroscopy.

Quantitative determination of the salts was performed using Principle Component Regression (PCG) and regression of Partial Least Squares (PLS). The optimization of the calibration models was based on the previously chosen experimental design.

The testing was performed in three churches in Republic of Macedonia. It was found that the most abundant salts were carbonates, sulfates and nitrates. The quantitative distribution of the different types of salts was random along the height of the walls, opposed to the well known distribution caused by the ground moisture. It seems that other factors (roof leakage, environmental position of the church) had effect on efflorescence distribution.