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## **Gamma-Irradiation in Protection of Cultural Heritage – Effects on Model Cellulose Based Textiles**

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### Background of the study

Cellulose-based textiles are very common materials in cultural heritage (CH) collections (garments, upholstery, etc) and in art (painting canvases). Natural textile fibers are susceptible to biologic damage particularly by insects and fungi what is a serious problem in the preservation of such CH objects. The canvases are commonly coated with animal glue what makes them more susceptible to fungal attack.

Ionizing radiation has been recognized as a fast and efficient treatment of attack by living organisms, particularly insects. At Radiation Chemistry and Dosimetry Laboratory of Ruđer Bošković Institute radiation treatment of CH items is ongoing for about 25 years. Along numerous wooden, paper and leather objects textile artifacts mostly of ethnological significance, were efficiently disinfected by irradiation to 2 kGy or less. However, the application of higher doses needed for the control of fungi has to be justified particularly considering the effects on aged and deteriorated materials. Because of that this study is aimed to assess whether there are side-effects of the irradiation on cellulose-based textile fibers and to identify the type and the extent damage type if present. The role of glue-coating on radiation sensitivity of model canvases is also investigated.

### Methodology

The study consists of two parts. The first part was intended to identify the effect of irradiation and ageing. A set of cotton and linen model textile samples were irradiated and a part was also artificially aged. Two gamma-irradiation doses were selected: 6 kGy that is often used in treatment of fungi and a much higher dose of 120 kGy that is not used in radiation treatment but is expected to cause detectable side-effects. The samples were irradiated in contact with air at the dose rate of 2.8 Gy/s.

In a second part of the study linen samples as a model for painting canvas were coated with animal glue prior to irradiation. Those samples were exposed to a range of doses between 2 and 50 kGy at dose rates 0.1 and 9.8 Gy/s, also in contact with air. Before the post-irradiation analysis the glue was removed.

The samples were studied by FTIR-spectroscopy, microscopy and thermal techniques.

### Results

Slight changes due to irradiation of model cotton and linen textiles were observed only at the higher dose of 120 kGy but were comparable or lesser than those brought in by aging. Although the process of glue removal from model canvas samples might have somewhat obscured the results it seems that the coating reduces radiation sensitivity of model canvas.

### Conclusions

Since doses up to 10 kGy are needed for control of the most common fungi on CH textile materials the results are encouraging. Efficient radiation treatment of fungal contamination should cause no undesirable changes and thus be acceptable to conservator specialists.

## **Country/Organization invited to participate**

Croatia

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