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Uses and Prospects in γ-Biocide Treatments for Cultural Heritage

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Biocide treatment by γ-irradiation for wooden and archival items has been proposed more than 50 years ago, but, despite some resounding success and a demonstrated real efficiency, it is still of limited uses for heritage conservation. Indeed, if such denoted "nuclear"process can scare the less scientific public, more rational reluctance due to fear of negative effects induced by ionization in irradiated material have been expressed. Despite such, secondary effects are usually insignificant or very low, γ irradiation has been (and is still) often understood by many curators as resulting in a strong and irreversible degradation, comparable to well-known ultraviolet exposure ageing. Of course, as with any process in which we ask to be active—in this case to kill biodegrading species—it is impossible to ask for absolute harmlessness. Any biocide process, as innovative or not as it is, can be problematic. Anoxia is known to induce colour changes of some dyes. Ethylene oxide, not only being very dangerous, is very reactive. Temperature treatments can cause mechanical tensions and so on. In choosing between different ways to manage pest infestation, curators have to evaluate a balance between benefits and drawbacks, selecting the best compromise regarding the conservation issue (including the benefits and drawbacks of "doing nothing").

In this context, advantages of the γ irradiation are various. Beyond its proven effectiveness on any kind of living organism, whatever the life stage, this contactless technology meets very well the concept of minimum intervention, being able to insure the required successful conservation with very low impact, only "changing as much as necessary but as little as possible". The ability to treat by mass, even through packaging, and the absence of other associated heat effect or residue in processed materials are two other desired qualities. But it is definitively its reliability, besides its efficiency, which distinguishes γ irradiation, thanks to γ penetrating power and the facility to ensure that biocidal conditions are achieved everywhere in the volume.

In the other hand, possible secondary effects need to be evaluated carefully. Material behaviour under irradiation is studied in the field of heritage, as well as it is widely investigated in many areas (nuclear, space, medical, etc.). Effects depend largely on the type of material and on the absorbed dose. Very few materials are known to be incompatible with γ-irradiation biocide treatment. The possible interaction with informative properties of patrimonial goods (DNA information, dating parameters) is another relevant issue.

ARC-Nucléart, Grenoble, France, makes use of γ irradiation for more than 45 years for cultural heritage. While insects are most often targeted, mass treatment of fungal species contaminated collections are more and more demanded. It seems that during the last 10 or 15 years, it is also increasingly used around the world.

We will give an overview of the latest developments of this technique, both in actual use in France, and in the studies that are ongoing to quantify so-called secondary effects.

Country/Organization invited to participate

France

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