Ionizing Radiation for the Preservation and Conservation of Photographic and Cinematographic Films

Maria Luiza E. Nagai*, Paulo S. Santos & Pablo A. S. Vasquez
Instituto de Pesquisas Energéticas e Nucleares (IPEN/CNEN-SP), São Paulo, SP

Context
• Brazilian weather conditions affect directly tangible materials causing deterioration notably getting worse by insects and fungi attack.
• Contamination by fungi is one of leading causes of problem in photographic and cinematographic collections.
• Ionizing radiation recovery to treat materials affected by fungi and insects has been used effectively in cultural heritage artifacts.

Goal of the study
• Characterization of the films.
• Evaluate gamma and electron beam radiation effects for the disinfection of photographic and cinematographic films.
• Check the effect of ionizing radiation-induced crosslinking (vinegar syndrome)

Materials and Method

Films Samples
Figure 1. Samples of photographic negative (NS) and cinematographic film (F1) selected from University of Sao Paulo libraries.

Results
FTIR-ATR samples characterization

Figure 2. The infrared spectra of two samples showed coincident peaks of cellulose triacetate (CTA), gelatin and triphenyl phosphate (TPP).

Methodology
• Samples were irradiated by gamma rays and electron beam with the following absorbed dose 2, 6, 10, 15, 20, 25, 100 and 200 kGy. Dose rate was 5-6kGy/h.
• Samples were analyzed by FTIR-ATR to characterization organic compounds of the materials.
• Measures by UV-Visible spectroscopy were undertaken to verify changes in the absorption of electromagnetic radiation due to the properties of the films induced by gamma radiation.
• Scanning electron microscopy (FEG-SEM) and EDS spectroscopy was used to analyze and characterize the non-irradiated (0kGy) and the effective disinfected (10kGy) films samples.
• Thermal analyzes by thermogravimetry (TG) and different scanning calorimetry (DSC) were performed to verify for possible crosslinking effects to treat vinegar syndrome films.

Conclusion
• Results showed that disinfection by gamma rays and electron beam radiation can be achieved safely applying radiation absorbed doses between 6 kGy to 10 kGy with no significant change or modification of main properties of the constitutive polymeric materials.
• Gamma rays and electron beam irradiation, due to the effect of crosslinking is presented as an alternative to treat films affected by "vinegar syndrome" applying absorbed dose of 50 kGy in order to increase shelf life of cultural heritage materials.

Acknowledgments
ApoyOnline, USP and IPEN for financial support

Contact
malunagai@usp.br