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Fungal Decontamination of Historical Oil Painting by Using Gamma Ray

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Preserving historic heritage is the duty of a nation that cares about its history. Canvas based paintings are mainly subject to fungal infestation under improper conservation conditions. The aim of this study was evaluation of optimal gamma ray dose for fungal decontamination of a historical oil painting in dimensions of 3.03m x 1.60 m of XIXth century stored in Melal museum of Saa d-abad Palace .

Sampling was done from 31 points of the discolored points directly by wet sterile swab then surface cultured on SDA medium. Growth of fungi was determined after 8-12 days incubation in 29°C. Classification was based on overall morphological properties.

Colors used were identified with infrared spectroscopy (mid and far regions). Type of canvas was identified by checking the fiber, type of burning, burning behavior when away from the flame, burning smell and ash type.

Fungi resistance to irradiation was investigated on strips made of similar canvas painted with the same colors. Light-thermal aging of strips were done in a QUV/Spray device powered with fluorescent lamp with the emission maximum of 0.71 W/m² for UVB 313nm , in 60 °C for 100 hours, 4 hours in 100%relative humidity in 50°C. Aged strips were inoculated with spore suspensions and exposed to 0.2-2 kGy of gamma rays from 60Co in GC220, dose rate of 2.08Gy/Sec calibrated with fricke dosimeters. Radiation survival spores were cultured and counted after 5 days. D10 was determined by graphing survival populations after a series of radiation dose. Irradiated strips with 5-25 kGy were subjected to sterility test. The minimum dose in which fungal growth is detected after 14 days of incubation in maximum two tests out of 20 was the sterilization dose.

Sampling indicated that Penicillium and Aspergillus were common fungi of the front and the back and between canvas and the frame.

Infrared spectroscopy revealed that burnt umber brown and vagone green earth were common colors used in the painting. Checking the fiber showed that linen was the board type. The mean D10 value of Penicillium crysogenum ATCC12690 and Aspergillus niger CBS 104.57 on aged colored linen strips was 0.9-1 kGy. There were differences between D10 values on culture medium (0.41 and 0.34 kGy for Penicillium and Aspergillus respectively) and canvas stips (0.9-1 and 0.9 kGy for Penicillium and Aspergillus respectively) and no significant differences on aged and not aged strips. Aged strips showed better capacity for spore recovery (1.7%) comparing not aged (0.15%). This may be due to production of nutrition elements in ageing process.

Sterility test indicated that minimal dose of 5 kGy was sufficient for sterilization of strips with 2.7 x 10⁶ cfu of each fungus.

The color measurement of aged and irradiated samples will be studied later.

In conclusion and according to fungal contamination of the painting the dose of 5kGy is suitable for decontamination.

Country/Organization invited to participate

Iran, Islamic Republic of

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