



UVC Treatments of Mouldy Books

The rationale behind the use of UVC radiation for the killing of moulds on books and the benefits and limitations of its use.

UVC radiation is used in germicidal and microbiological applications to kill bacteria and moulds. Its application combined with autoclaving is widely used in hospitals for sterilisation of operating theatre instruments and in more general applications of air handling systems and air treatment plants, such as cooling coils. Disaster relief water treatment plants utilise UVC as the sterilising agent for the delivery of a safe water supply when the local infrastructure has failed.

UVC is always used in a light tight chamber or in a setup that precludes exposure to any person in the vicinity. This means that using a dosimeter for exposure measurements is required to ensure that the correct exposure has been given to kill the mould. The dosimeter is also used to check on the lamp output – something which does decline over time and the optimal distance from the lamp to achieve the correct dose. Hospitals will use glass vials with live mould/bacteria cultures in them which, after exposure, are cultured to see if they grow. The culturing takes around 4 – 5 days before the exposed bundle can be declared sterilised or not as the case may be.

Culturing exposed moulds is not a practical step for conservation labs treating a mouldy collection. Coupled with this is the question of what level of risk, such as surviving mould, is acceptable? Remembering of course that books in particular are brush/vacuumed after exposure and go back into a storage environment (cleaned and disinfected, leaks fixed) with some inactivated mould, begs the question of how much is too much?

Besides the DNA disruption to living cells, UV and UVC in particular cause damage to heritage materials at a cellular level – the damage such as fading, loss of strength and auto-catalytic oxidation affecting both support and media of an object.

From the American Air and Water website (accessed 27th June, 2024) a table of kill factors of various bacteria, moulds and viruses gives the 90% and 99% kill factors for these using a lamp emitting UVC at 800 microW per cm² at 1 foot or 300mm from the lamp.

The data from the AAaW Table for *Aspergillus niger* suggests a time of 2.75 minutes for a 90% kill factor and 6.8 minutes for a 99% kill factor. The 90% time is just under 50% of the 99% time. Is the 99% kill worth the damage while balancing this with the knowledge that the mould may well have

been killed but the support and fabric of the object has had a considerable UV exposure. Also bear in mind that UVC treatment is not a residual treatment, the object can be infected and grow mould with the next water damage event.

This paper aims to present a practical method of treating mouldy books with reasonable certainty of the correct exposure of UVC. Both the benefits and the limitations of UVC will be discussed.

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