



Preservation and Conservation (PAC) Programme Frequently Asked Questions

Treating Fungal and Mould Infestation

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Q: What are the signs of fungi or mould on paper?

A: Signs include visible damage caused by fungi like the discoloration of the paper and weakening of the paper structure. Mould stains paper irreversibly. The stains are often irregular shaped or round, and of different colours such as black, brown, green, yellow. Under magnification, mould can appear three-dimensional if it is still active.

Fungi increases the rate of deterioration in paper by breaking down the cellulose chains and accelerating the formation of acids. Often areas that have mould-damage will also take up water more slowly. Fungal growth on a can also decrease the integrity of the papers and other materials in the collection items.

Q: What are favourable conditions for fungal growth*?

A:

Optimum temperature	RH	Moisture content of material allowing spore germination
21°C-35°C	90%-100%	Above 10%

*These are also prime conditions for insects.

Q: What are the main species of fungi that grow on paper materials?

A: Common species of fungi that are seen to grow on paper include:

Aspergillus niger, *Aspergillus glaucus*, *Aspergillus flavus*, *Aspergillus restrictus*, *Alternaria sp.*, *Penicillium sp.*, *Curvularia sp.*, *Trichoderma sp.*, *Fusarium sp.*, and *Cladosporium sp.*

Q: Is the reddish-brown stain that can be found paper known as “foxing” a result of fungal growth?

A: Possibly. Foxing can be caused by multiple factors, including:

- inorganic factors like the presence of ferrous or ferric compounds.
- Paper being bleached by chlorine chemicals.
- Fungi.

Please note that foxing is not strictly regarded as a dangerous process for documents, therefore no further treatment is recommended.

Q: How does fungi decompose cellulose in paper materials?

A: Fungi can cause decomposition through the following processes:

Oxidation - Fungi oxidize cellulose to oxycellulose and turn it to soluble products which can be absorbed by the mycelium of the fungi.

Hydrolysis- The glucosides linkages between individual glucose units are: hydrolysed by the cellulases enzyme secreted by fungi.

Q: How do I remove fungi (mould and mildew) found on books?

A: To mitigate mould or fungi it is most important to put them in a dry environment and reduce the humidity in the air. All cleaning should trap the mould instead of spreading it to adjacent areas. After treatment, items should be kept in dry environments where the humidity and temperature can be controlled.

- Manually cleaning of dried spores with a soft-hair brush near a vacuum cleaner with a HEPA filter to trap the spores.
- Removal of active mould and mildew with a spray of 70% Ethyl alcohol or 70% isopropyl alcohol in water. Areas of inactive mould may be cleaned with this solution.
- Fumigation books using Thymol. This is not recommended as it has serious health and safety implications for anyone handling the books, such as staff and readers.