Evaluation of Disinfection Methods Used in Czech State Archives – Advantages, Disadvatages, Problems

Michal Ďurovič

University of Chemistry and Technology Prague

National Archives Prague

Národní archiv

Objective and purpose of disinfection

Death and removal from living and working environment of human microscopic fungi (on objects in the air)

Dividing of disinfection methods in archives and libraries

- *Individual methods* – for individual objects, small amount of disinfected materials

- *Mass methods* – for all or great parts of archival funds and collections

Individual methods of disinfection

ALCOHOLS

- denaturing of the micro-organism proteins
- disinfectant effects: methanol, ethanol, propanol, **butanol**
- In conservation practice: vapours of butanol with 4 % water, 48 hours, 25 °C

- **Disadvantage:** danger of swelling or even dissolving of coloured layers or wax seals

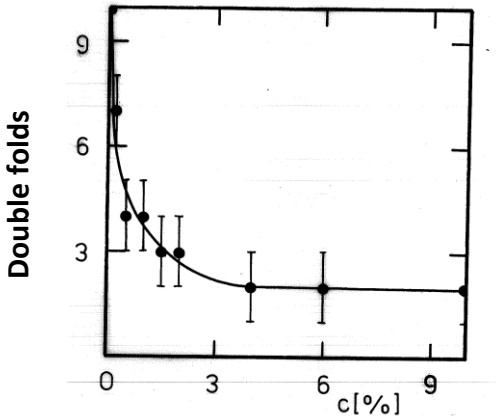
Individual methods of disinfection

PHENOLS

- o-phenyl phenol and p-chloro-m-cresol (Preventols)
- effective substances
- can be used also in the form of vapours (25 °C, 48-hours exposure).

QUATERNARY AMMONIUM SALTS (QAS)

- mild disinfectants without sporocidic effect
- recommended that at least 2% aqueous or water-ethanol solutions
- must be removed from paper in the water bath after disinfecting



Concentration of QAS

Mass methods of disinfection

ALKYLATING AGENTS - ethylene oxide

change the properties of nucleic acids and proteins and thus destroys microorganisms and their spores

Technology of National Archives in Prague

- 10 % ethylenoxide
- 90 % carbon dioxide
- 16 hours in chamber (contact with gas)
- 6 days ventilation (removing of ethylenoxide residues from records)

Disadvantages:

- toxic and is suspected of carcinogenicity
- complex technical equipment is required for its use
- without prevention to future
- on the contrary desinfected materials are more sensitive to future microbiological attack

Mass methods of disinfection

ETOXEN technology in National Archives in Prague

Disinfection Chambers MATACHANA

Mass methods of disinfection

ETOXEN technology in National Archives in Prague

Controling computer and gas chromatograph

Mass methods of disinfection

ETOXEN technology in National Archives in Prague

Tunnel for removing of ethyleneoxide

Mass methods of disinfection

ETOXEN technology in National Archives in Prague

Tunnel for removing of ethyleneoxide

Mass methods of disinfection

ETOXEN technology in National Archives in Prague

24 hour measurement of ethylenoxide´s residues

Mass methods of disinfection

PHYSICAL DISINFECTANTS γ-radiation

- Physical disinfectants act through increased intensity of some physical parameter, leading to a subsequent devitalization reaction

- Satisfactory results have been obtained in the synergic effect of heat and γ-radiation

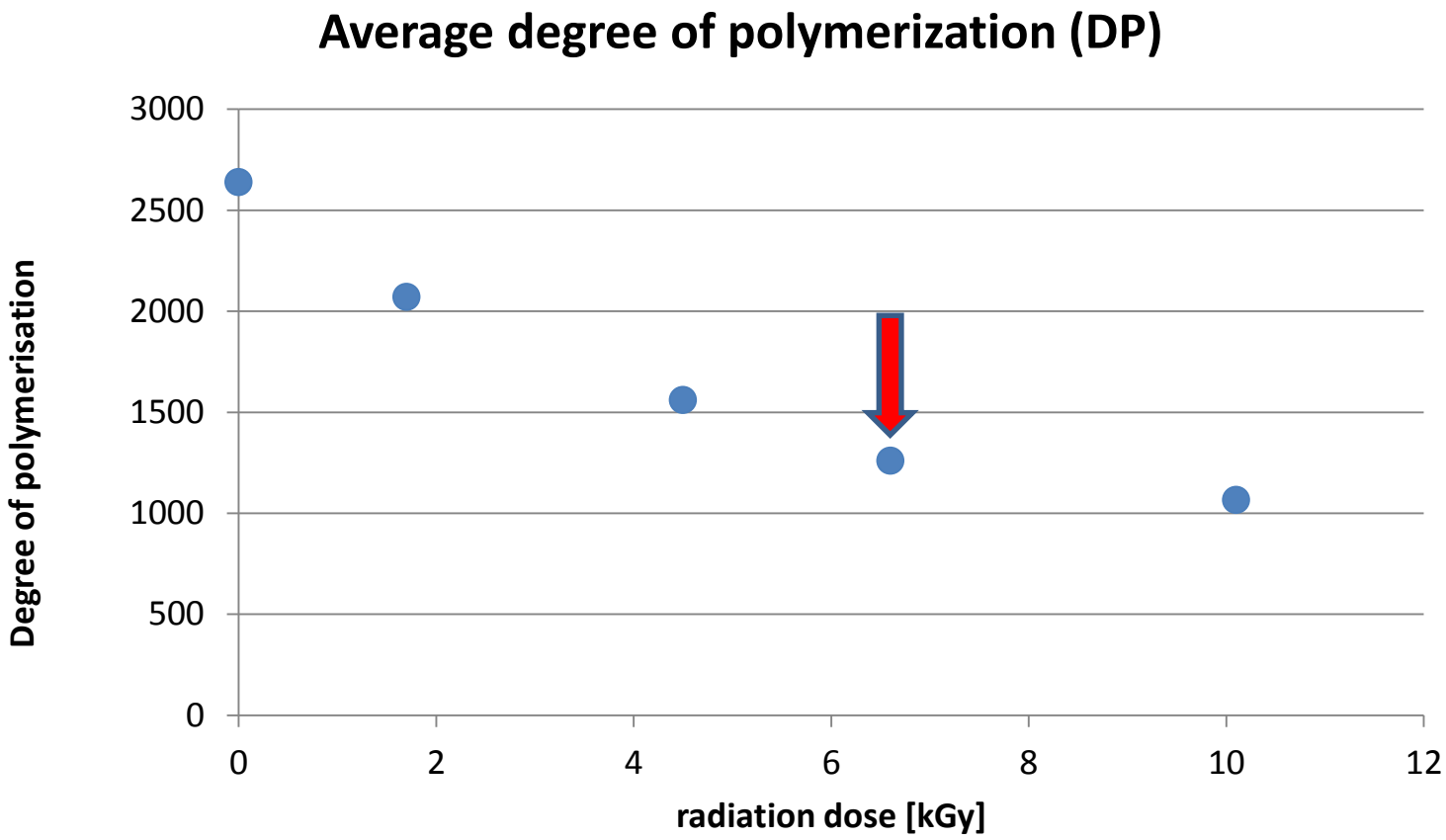
- But γ-radiation is harmfulness to health and to the archival documents!

Source radiation in The Museum of Central Bohemia in Roztoky near Prague
Radionuclide ^{60}Co (half-life 5.3 years; radiant energy 1.173 MeV)

Microbiological testing

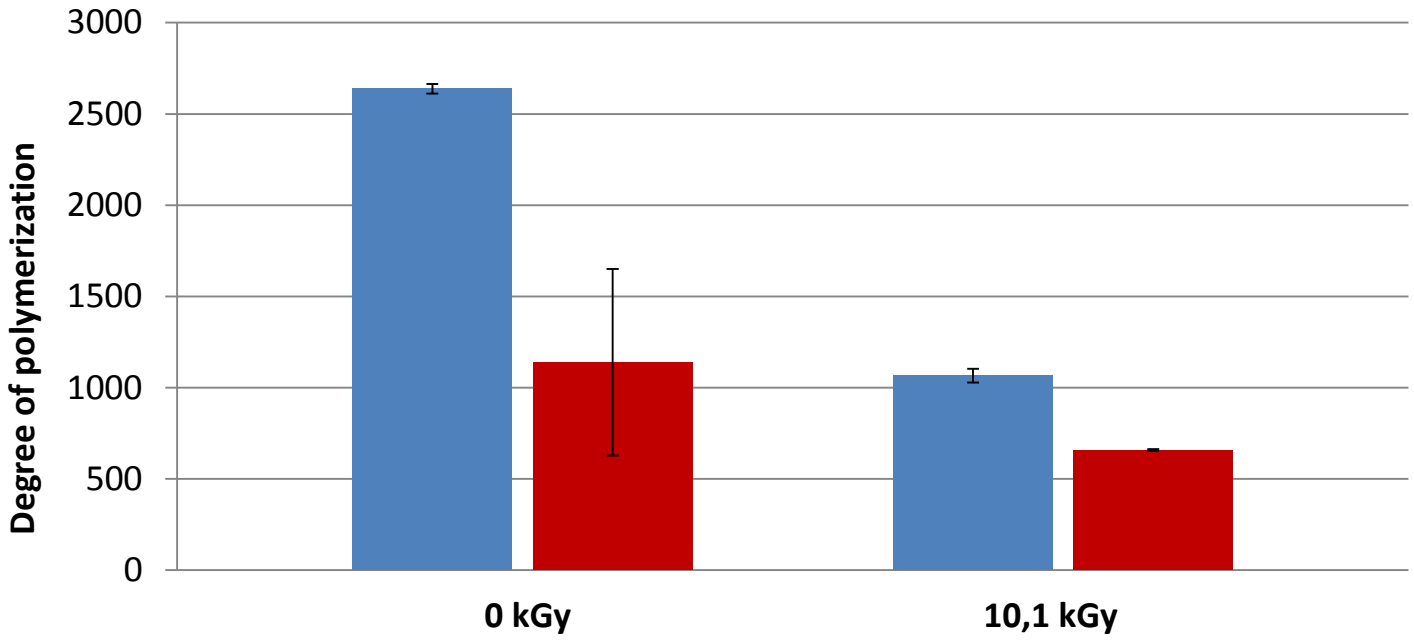
Minimal lethal dose for all of the studied fungal species	
Fungal Species	Minimal lethal dose [kGy]
Aspergillus niger	4,5
Penicillium aurantiogriseum	4,5
Rhizopus nigricans	4,5
Cladosporium herbarum	**6,6**

Mass methods of disinfection



Effect of the radiation dose on the **average degree of polymerization** of Whatman paper

Average degree of polymerization (DP)



Change in the average **degree of polymerization** of the Whatman paper after irradiation with the highest tested dose ■ and artificial ageing ■

Thank you for your attention