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Model-Based Analysis of Effective Inactivation of Aspergillus Brasiliensis by Non-thermal Atmospheric Plasma

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Extended Abstract

Indoor mould growth is becoming a more prevalent issue, negatively impacting both building materials and the health of residents. The genus Aspergillus includes hundreds of species present in different climates and can cause a range of diseases such as asthma, ear and nose infections and invasive pulmonary aspergillosis, especially in people with weakened immune systems. Aspergillus brasiliensis is a member of Aspergillus section Nigri (i.e. black Aspergillus), the mould species that produce enormous amounts of melanin pigmented spores within short time periods and are present in the air and indoor environment. Melanin supports resistance to a range of environmental stressors (e.g. UV irradiation) and contributes to the survival of mould [1], [2].

The aim of this study was to present a new environmentally friendly method (non-thermal atmospheric plasma treatment) for the inactivation of moulds which should lead to a reduction in the risk of airborne infections and the improvement of indoor environments contaminated with mould spores [3], [4]. A non-thermal plasma generated by diffusion coplanar surface barrier discharge was used to treat culture media inoculated with different spore concentrations and at different stages of mould growth. The percentage of surface coverage by mould was determined by image analysis. The growth of Aspergillus sp. hyphae and mycelia exposed to non-thermal atmospheric pressure plasma was reduced or arrested compared to mycelial formation in untreated samples. The non-thermal plasma treatment also caused a color change in A. brasiliensis colonies from black to brown. This study demonstrated that non-thermal atmospheric pressure plasma is a more effective in inactivation of mould spores than inactivation of higher stages of micromycetes on malt extra agar [5].

In this research, modified logistic equations were used to model the inactivation of microscopic filamentous fungi (moulds). The model is formulated using a logistic equation with an inactivation term. If the inactivation rate from an external source exceeds the maximum natural growth rate of the mycelium, the fungal colony is inactivated. The theoretical growth curves generated by our model were validated with experimental data for Aspergillus brasiliensis inactivated by non-thermal plasma [6].

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