Proceedings of the Virtual International Conference on Energy and Heat Transfer (V-ICEHT'26)
May 2026 | Virtual Conference
DOI: 10.11159/iceht26.004

Thermal Characterization of Fungal Colonies

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Abstract

Fungi have significant relevance in various industrial and healthcare applications. Detecting contamination by these microorganisms is essential to prevent food intoxication in humans and domesticated mammals. Such intoxication occurs when mycotoxins, secondary metabolites produced by fungi during metabolization, are present in food. In some cases, detecting mycotoxins is expensive and more time-consuming than identifying the fungi themselves. Developing a methodology for early-stage fungal detection using thermography is one of several approaches that can be employed to achieve this objective. The objective of this study was to estimate the thermophysical properties of *Aspergillus brasiliensis*, a filamentous fungus frequently found in diverse environments. A Bayesian framework was considered for the inverse problem solutions, involving the estimation of the volumetric heat capacity and thermal conductivity of this fungus under different growth stages. A Petri dish containing the fungus was heated in a biological furnace and allowed to cool down to ambient temperature, while surface temperature measurements of the fungus were obtained using an infrared camera. Different heat conduction problems and their associated inverse problems were addressed and the parameters of interest were estimated using a Markov Chain Monte Carlo (MCMC) method. A statistical analysis was performed to assess the quality of the estimations, examine the influence of experimental factors, and evaluate the consistency of the results obtained with different samples.