Paper title: **Mathematical-Based CFD Modelling and Simulation of Mushroom Drying in Tray Dryer**

Paper URL: https://www.hindawi.com/journals/mse/2023/6128517/

1. Summary:

1.1 Motivation/purpose/aims/hypothesis:

The motivation behind this study was to address the need for a comprehensive understanding of the drying process of mushrooms in a tray dryer. The purpose was to develop a mathematical-based computational fluid dynamics (CFD) model that could accurately simulate the interaction between moisture content and hot air flow during the drying process. The aim was to optimize the drying conditions for mushroom production, leading to improved efficiency and quality of the dried mushrooms.

1.2 Contribution:

The primary contribution of this study lies in the development of a sophisticated CFD model that captures the complex interplay between moisture content and hot air flow during mushroom drying. By incorporating source terms for moisture evaporation, viscous and inertial resistance, and continuous evaporative cooling, the model provides a detailed understanding of the drying process. The insights gained from this model can be utilized to optimize drying conditions, leading to enhanced efficiency and quality in mushroom production.

1.3 Methodology:

The methodology employed in this study involved the implementation of a mathematical-based CFD model to simulate the drying process of mushrooms in a tray dryer. The model was developed using ANSYS Fluent software, which allowed for the incorporation of the fundamental conservation principles of mass, momentum, and energy. Additionally, source terms for moisture evaporation and heat transfer were included in the model to accurately represent the drying process. The simulations were conducted to analyze the behavior of moisture and temperature variation during the drying process.

1.4 Conclusion:

The study concluded that the developed CFD model effectively captured the intricate dynamics of the drying process of mushrooms in a tray dryer. The model demonstrated the significant influence of the interaction between moisture content and hot air flow on the drying process. Furthermore, the optimization of drying conditions, informed by the CFD simulations, led to improved moisture removal and drying temperatures, thereby enhancing the overall efficiency of the drying process.

2. Limitations:

2.1 First Limitation/Critique:

One limitation of the study is its exclusive focus on the drying process of mushrooms in a tray dryer. While the developed CFD model provides valuable insights into this specific drying method, its applicability to other drying techniques, such as freeze-drying or sun-drying, remains unexplored. Therefore, the generalizability of the findings to alternative drying methods may be limited.

2.2 Second Limitation/Critique:

Another limitation of the study pertains to the specific drying conditions considered in the simulations. The study focused on a particular temperature and air flow rate for the drying process, potentially limiting the broader applicability of the findings to diverse drying conditions encountered in practical mushroom production settings.

3. Synthesis:

The findings of this study hold significant practical implications for the mushroom industry. By leveraging the insights gained from the developed CFD model, mushroom producers can optimize their drying processes to achieve improved product quality and extended shelf life. Furthermore, the mathematical-based CFD model can serve as a valuable tool for simulating and optimizing the drying process of mushrooms in a tray dryer. Looking ahead, there is potential to expand the scope of the model to encompass other drying methods and conditions, thereby enhancing the overall efficiency and effectiveness of mushroom production.