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ABSTRACT BOOK

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Numerical Simulation and Optimization of Heat Transfer in Solar Box Cookers: A Pathway to Sustainable Cooking

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Abstract:

Solar box cookers offer a sustainable and eco-friendly alternative to conventional cooking methods, harnessing solar energy to generate heat for food preparation. A solar box cooker consists of an insulated box with a transparent cover that allows sunlight to enter, where it is then trapped and converted into heat, similar to the greenhouse effect. This simple yet effective design can reach sufficient temperatures to cook meals without the need for fossil fuels or electricity. Box solar cookers are especially beneficial in regions with abundant sunlight, as they provide a cost-effective, renewable way to cook food while reducing greenhouse gas emissions and dependence on non-renewable energy sources. In this study, a comprehensive mathematical model was developed for a solar box cooker equipped with multi-step inner reflectors, aimed at simulating its thermal performance. The model incorporates various heat transfer mechanisms, including conduction, convection, and radiation, across key components such as the double-glazed cover and reflectors positioned at specific angles (30°, 45°, and 75°). By solving a system of nonlinear differential equations, the temperature distribution across the cooker's components was predicted over time. A statistical surface design was also applied to assess and optimize critical factors, including reflector angles, material properties, and ambient conditions, revealing key variables that enhance the cooker's overall performance. The findings highlight the potential of this design to improve the efficiency of solar cooking systems and promote their use as a viable solution for sustainable food preparation, particularly in sun-rich regions.

Development of Cultivated Meat: Drawing Lessons from Tissue Engineering and Polymer Processing

Tan Lay Poh

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Abstract:

Cultivated meat also known as cultured meat or lab-grown meat has garnered a lot of interest in recent years as an alternative protein source. While it is not the answer to all problems faced in animal agriculture, it has the potential to alleviate its drawbacks, and provide an alternative to the growing meat demand. In general, cultivated meat is produced by first taking a biopsy of the targeted animal, so that these starter cells are fed with culture medium for proliferation. Once there are sufficient cells, biochemical substances are added to differentiate stem cells towards skeletal muscle cells, which makes up most of a meat product. To produce cultivated meat with texture, scaffolds can be utilized such that higher order of muscle tissue structure can be achieved. Scaffolds are usually used in conjunction during the differentiation of stem cells. This aids in bridging the difference in structural and textural properties between cultured meat and traditional meat products. The high cost of cultivated meat is still a key challenge. One of the cost-drivers is the cell culture and differentiation media. In our laboratory we try to circumvent the use of the costly differentiation media by using biophysical induction methods for differentiation. In departure from tradition, our lab introduced an innovative single-step process that integrates scaffold fabrication and stem cell seeding, effectively eliminating the cumbersome multi-stage process of the current status of producing cultivated meat.