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Abstract

基于COMSOL的仓储粮堆内部自然对流和热湿传递的模拟研究
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摘 要 本文基于仓储粮堆内部自然对流、热湿耦合传递的数学模型，采用COMSOL模拟的方法，探讨了仓储粮堆内部自然对流、热量传递和水分迁移过程的相互关系。提出了判断粮堆内部自然对流强弱的瑞利数及其影响因素，分析了仓型结构、粮种对粮堆内部自然对流、热量传递和水分迁移的影响。 结果表明，数学分析方法是分析仓储粮堆内部自然对流、热量传递和水分迁移过程的一种有效途径，数学分析的结果可以为仓型设计、储粮生态系统的模拟、仓储技术管理提供借鉴。
关键词 数值模拟 粮堆 自然对流 热量传递 水分迁移

Simulation analysis of natural convective heat and moisture transfer in grain bulk during sealed storage
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Abstract In present paper, the relationship between natural convection, heat and moisture transfer were examined by the method of numerical simulation. The simulation analysis shows that for small cereal grains such as wheat, heat and moisture transfer is dominated by heat conduction and diffusion, but for larger particles the effect of convection is more important. The effect of natural convection is significant in stored bulk grain when the ratio of height to radii of bin or warehouse is larger. The moisture transfers that occur in storage have little effect on the average temperature of the stored bulk grain. However, heat conduction and natural convection dominates the moisture transport process. Respiration has an effect on temperature in stored bulk grain. The effect of natural convection is significant in stored bulk grain when the ratio of height to radii of bin or warehouse is larger.
Key words numerical simulation, stored bulk grain, natural convection, heat conduction, moisture transfer

Figures used in the abstract

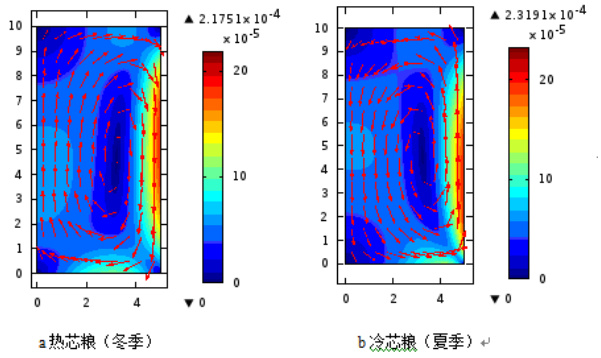

Figure 1: 图1王远成等[9-10]模拟的近似冬季和夏季储藏150天时浅圆仓内小麦的流场分布