

## 冷藏库内气体流场数值模拟与验证

### Numerical simulation and verification of airflow in cold-store

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中文摘要:

计算流体力学(CFD)在各种与流体相关的领域内广泛应用,并取得了很好的效果。合理的气体流场才能保证均匀的温度场,这对冷藏库内货物的降温速率和贮藏质量起着至关重要的作用,而常规设计方法很难得到合理的气体流场。本研究以一个(长×宽×高)4.5 m×3.3 m×2.5 m的实验冷库为对象,建立了二维紊流数值计算模型,并采用了SIMPLE算法和交错网格技术进行了求解计算。实验验证表明模型与实际吻合较好。模拟研究揭示整个冷库的流场存在一个中心大回流区、流场主流贴附边界流动、流场在拐角处速度减小。在此基础上,还对可能影响冷藏库内气流组织的多个设计参数(冷风机出口风速,拐角挡板,货物等)进行了模拟研究,研究表明这些参数对冷藏库内流场和温度场都有巨大的影响,进一步说明CFD工具在冷藏库设计和优化设计过程中的重要作用和意义。

英文摘要:

Recently, computational fluid dynamics (CFD) has been applied in many fields relating to fluid flow more frequently. It was testified that CFD was useful in these fields. It is important for the cooling rate and quality of foodstuffs in the cold store with the uniform flow and temperature field. But the flow field designed by using the original methods is not good enough. In this paper, a two-dimensional physical and turbulence mathematics model inside a minitype constructional cold store (4.5 m(l)×3.3 m(w)×2.5 m(h)) was established and a related computer program with SIMPLE algorithm and intervein girding technique was developed. The simulation results reflected the characteristics of airflow and temperature distribution. By simulation, there was a large circumfluence in flow field, which was harmful to cold storage of foodstuffs. The mainstream of flow field had the trend of closing to the wall. The velocity of mainstream had the trend of decreasing near the corner. After that, several design parameters (corner baffle, the stack mode of foodstuffs, etc) which would affect the flow field in the cold store were analyzed in this paper. The results of simulation indicates that all these design parameters especially the stack mode of foodstuffs have affected the flow field and temperature field inside the cold store greatly. It was found that CFD was a powerful tool to design and optimize the flow field in the cold store.

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