柴油发电机驱动的热泵干燥系统开发与优化 Development and Optimization of a Heat Pump Drying System Driven by a Diesel Generator

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关键词： 热泵干燥 柴油发电机 流化床 余热回收

摘 要： 设计了柴油发电机驱动的移动式热泵干燥系统，该系统由蒸汽压缩式热泵(热泵工质为R134a)提供热量，以卧式多室流化床为干燥室。在风道中设置换热器回收柴油机冷却水和烟气余热，以提高系统一次能源利用率。针对该系统建立了流化床、热泵、柴油发电机组耦合为一体的综合数学模型。数学模型计算结果表明：干燥室入口空气温度在60～90℃时，干燥系统的除湿能耗比先升后降，在70 ℃附近存在一个最大值。样机实验表明：设备在设计工况下运行时，平均热泵性能系数为4.66，一次能源利用率为1.09，除湿能耗比可达3.08 kg/(kW?h)，模型计算与实验结果吻合良好，采用该装置进行谷物干燥节能效果明显。 A mobile heat pump drying system driven by a diesel generator was designed to meet the need of the agricultural mechanical harvest. A horizontal multi-room fluidized bed serves as the drying chamber, and a vapor compression heat pump (R134a as refrigerant) supplies heat for this system. Heat exchangers are installed along the air duct to recover the waste heat from the cooling water and flue gas in the diesel generator, which increased the primary energy ratio(PER).A mathematical model for the system composed of fluidized bed, heat pump and diesel generator was also presented. Modeled results showed that the value of drying system’s specific moisture extraction rate (SMER) was firstly up and then down, with air temperature in the range of 60～90℃, and reached a peak value around 70℃. Testing experiments of the prototype dryer showed that under the designed conditions, the mean coefficient of performance (COP) is 4.66, PER is 1.09 and SMER reaches 3.08 kg/(kW?h). The model is in good agreement with experimental results, and this grain dryer is significantly energy saving.

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