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Study on Solar KANG Heating System for Cold Areas

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Abstract

The current rural traditional heated kang cannot meet people's increasing requirements of comfort and environmental protection. This paper propose solar kang heating system in cold regions. System performance and heating effect were analyzed. We selected two typical rooms. One was set in traditional kang, and the other one was solar Kang type. Using temperature recording instrument and 64 roads inspection instrument and other instruments, we test the indoor temperature and the kang surface temperature of two rooms. Solar kang thermal resistance, heat storage, heat dissipation and heating effect were analyzed and compared. The results of the study show this system have the smaller fluctuation, more comfort while alleviating the kang surface overheat or super-cooling problem. It satisfied the requirements of indoor thermal comfort. The warming rate is 5.17 ℃/h, and the cooling rate is 3.01 ℃/h. These are slower than traditional Huokang speed. It improved the heat storage capacity of kang body with surface heat dissipation 1237W. Average temperature of the solar kang heating room was improved 3.28℃. It gets the smaller indoor temperature fluctuation. PMV values are concentrated about -0.5, and this basically meet the requirements of the user comfort.

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Keywords: Solar kang; Capillary network; thermal comfort; energy-saving emission reduction.

1. Introduction

With the rapid development of rural economy, rural energy saving has become a serious content of national energy-saving and emission reduction. At present, the winter heating is the main rural energy consumption[1]. Traditional heated kang as the main facility of rural heating, which burn the straw as heat source, has a few disadvantages like

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fuel consumption, low thermal efficiency and heavy environmental pollution. In order to fundamentally solve these problems existing in traditional Kang, the most important is to use the new clean energy, so enhancing thermal performance of the kang body and reducing pollution has become a hot spot in the research of rural kang[3].

2. The Experimental System Structure

Solar kang heating system is comprised of solar collectors, mixing tank, the end of the heating system, automatic control system, auxiliary heating device, circulating pump, and connecting pipes. The principle of solar kang heating system is shown in Figure 1.

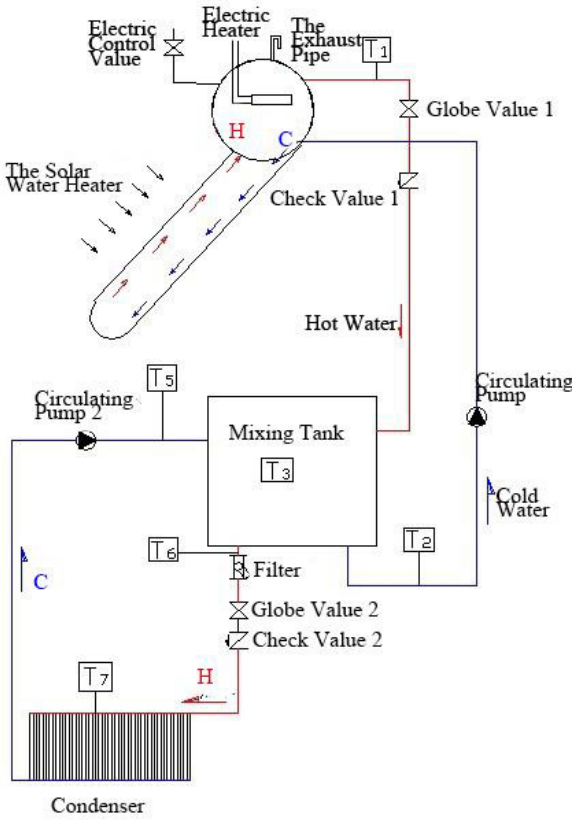

Fig. 1.Solar kang heating system

3. Test

In order to investigate the effect of the application of solar kang heating system, the comparison test was compiled in two adjoining rooms. One room was installed with solar kang heating system, and the other room was the traditional kang. Experiment location was in Dandong City, a farmers. Room space dimensions are as follows. Length is 5.3 m. Width is 3.8 m and height is 3 m. Kang was heated with the same amount of firewood in two rooms. Heating time lasted 60 minutes every time, 3 times a day. Time span was from 7:30 am to 8:30, 11:30 noon to 12:30 and 17:30 pm to 18:30. The indoor test points were listed as Figure 2. The kang face test points were listed as Figure 3.