ABSTRACT

On the east and west orientations of window glazing in the tropics, where the solar altitude is low, solar energy transmittance cannot be effectively controlled by shading. The appropriate solution leads to the control of total solar energy transmittance by exploiting the potential of recycled elements in such tropical countries combined with low cost glazing. The Sustainable Glazed Water Film (SGWF) was suggested as an alternative solar control and was experimentally investigated on glazed facades of west orientation in the University of Malaya’s campus. The experiments involved a study of three parameters, namely, water flow rate, types of glazing, and the solar radiation intensity. The effect of water film thickness was also discussed. Two full-scale rooms were used, one as a reference room with a fixed configuration, and the other as a test room, which could be configured in different ways. It was found that the flowing water film on the glazed facades lowers the glazing surface temperature by 7.2 to 14°C (average) and absorbs a portion of the solar energy, thus, resulting in a decrease in the indoor temperature by 2.2 to 4.1°C (average). On the other hand, because the water film acts as an anti-reflective coat, the transmittance of the visible light increased compared to dry glass.

FINDINGS

Part I: SGWF thermal performance
Surface temperature: SGWF lowers the glazing surface temperature by 7.2 to 14°C (average).
Indoor temperature: SGWF lowers the glass surface temperature and absorbs a portion of the solar energy resulting in decreasing indoor temperature by 2.2 to 4.1°C (average).
Heat flux Through SGWF
SGWF cools down the outer surface of the glazing, resulting in maximizing the heat loss to the outside, and limiting the heat flux indoors.

Part II: SGWF solar transmittance

CONTRIBUTION

From the study it can be summarised that significant energy could be saved by adopting the SGWF facade. It was observed that, (a) a reduction of 24.6% of the total energy cooling could be achieved as compared to an identical system without water film; (b) the reduction in glass surface temperatures contributed to the reduction of surrounding temperature (heat island effects) that affects the indoor environment; and (c) the increase in the visible light transmittance resulted in the reduction of the energy required for artificial lighting.

METHODS

An experimental investigation of a glazed facade oriented west has been conducted utilising the Sustainable Glazed Water Film SGWF. Two full-scale rooms were used, one as a reference room, with a fixed configuration, and the other as a test room, which could be configured in different ways.

Applying “superhydrophobic” nano-coat of TiO2. It is to increase the wet-ability of the glazing and act as self-cleaning coat.

Setting up the data logger and carrying out the experiment