Innovative Saw-dust wall tiles for Thermal Insulation of Buildings

Riyaz Ahmad Qasab[1], Misba Gul[2]

[1]Assistant Professor Department of Civil Engineering, Islamic University Of Science & Technology, Awantipora,Kashmir,India

[2]Assistant Professor Department of Civil Engineering, Islamic University Of Science & Technology,Awantipora,Kashmir,India

ABSTRACT

Thermal comfort in buildings is a priority in the regions of extreme climatic conditions. The buildings in such severe climatic zones can be thermally insulated which may on one hand optimally help in minimising the annual energy cost by curtailing the requirement of air conditioning systems or on the other hand contribute by reducing the emission of carbon dioxide into the environment resulting from the traditional methods of heating like burning of fire wood, charcoal, and coal in harsh cold winters. Owing to its low thermal conductivity and high R-value, saw-dust which is a by-product resulting from sawing of timber from sawmills, has been experimented with to discover its feasibility as a material for thermal insulation of buildings. This study investigates the potential of innovative wall tiles developed from saw-dust as a means of thermal-insulation material to prevent heat loss or heat gain by conduction through masonry walls.

Keywords: Thermal insulation, sawdust tiles, thermal conductivity, R-value, economy.

1.INTRODUCTION

Thermal insulation of buildings has become a grave concern due to uneven variation of temperatures. Due to global warming the summers are becoming hotter and the winters are becoming colder. In order to optimize the conditions, more and more emphasis is laid on thermal insulation. So far various techniques have been devised by various researchers and scientists for improving the thermal insulation of buildings. To maintain a constant comfortable temperature, it is usually necessary to install conventional air-conditioning units. These units, besides consuming energy, usually aggravate the peak electricity load. Using good insulating material or using new concepts to achieve the same objective may reduce, or eliminate, the need for such units. Thermal insulation in buildings is an essential factor to achieve thermal comfort for its occupants. Thermal insulation reduces unwanted heat loss or heat gain and can decrease the energy demand of heating and cooling systems. Many of the materials used for the purpose deal with resistance to heat conduction and convection by the simple method of trapping large amounts of air (or other gas) in a way that result in a material that employs the low thermal conductivity of small pockets of gas, rather than the much higher conductivity of typical solids. Thermal insulation systems and materials aim at reducing the transmission of heat flow. The thermal conductivity and thermal resistance (R-values) are generally used to define the insulation properties in steady state. Thermal conductivity often referred to as the 'k' or 'λ' (lambda) value, is a constant for any given material, and is measured in W/mK (watts per Kelvin meter). The higher the λ value, the better the thermal conductivity. Good insulators will have as low a value as possible. Steel and concrete have very high thermal conductivity and therefore very low thermal resistance. This makes them poor insulators. The thermal resistance- R-value is a measure of the thermal resistance of a material of specific thickness, that is, its resistance to the transfer of heat across the material. The higher the R-value of a material, the more effective it is as an insulator. The R-values can be used as part of a labelling system to enable comparison of the thermal performance of different materials, such as thermal insulation or as part of the calculation of heat transfer across the fabric of a building. R-values can be determined by dividing the thickness of a material (in metres) by its thermal conductivity and is expressed in the units of m^2K/W (square metre kelvin per watt).In recent years, many research works have been carried out on various materials such as sheep wool[1], cellulose[2], glass wool[3], rock wool[4], expanded polystyrene[5], hemp fibres[6],cattail fibres[7],and vacuum insulation panels[8] for use as thermal insulation materials. The thermal conductivity values for sheep wool (0.038 W/mK), cellulose(0.035-0.038 W/mK), glass wool(0.034-0.038 W/mK), rock wool(0.032-0.044 W/mK), expanded polystyrene (0.038 W/mK), hemp fibres