UTILIZATION OF HEAT STORED IN ASPHALT ROADS AS AN ENERGY SOURCE

Submitted By

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B.Sc. of (Mechanical Power Engineering), Faculty of Engineering,
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Master in Environmental Sciences, Institute of Environmental Studies and Research,
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A thesis submitted in Partial Fulfillment
Of
The Requirement for the Doctor of Philosophy Degree
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APPROVAL SHEET

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ABSTRACT

Thesis title " Utilization of heat stored in asphalt roads as an energy source" The diminution of fossil fuel inspired researches to look for renewable energy sources. Heat island and road accidents are due to tires explosions, which is a result of excessive asphalt heat, that might reach up to 70 ^{o}C. These problems oriented researchers to use asphalt as a heat collector. Recently researchers started to use some applications of asphalt solar collector (ASC). Majority of these applications used to heat water. In this research, the first ASC physical model was built outside the laboratory and using atmospheric air as a working fluid. The environmental parameters such as ambient temperature, variation of solar intensity and asphalt surface temperature were considered. This physical model consisted of buried pipes under asphalt layers with two opening ends, one end is connected to atmospheric air duct and the other ends connected to unplasticized poly vinyl chloride (UPVC) chimney. Compatibility has been found between the analytical model, which had been built up using computational fluid dynamics analysis system (CFD ANSYS 16) software program in the strong effect of the chimney height on the air flow velocity through the ASC. Moreover, this analytical model concluded that; the effect of environmental conditions at chimneys of heights equal to 2 and 4 meters, are relatively low; while it has significant impact at chimneys of heights equal to 6, 8 and 9 meters respectively. By using wind turbine equation; it was found that the average energy that can be reached from ASC physical model is 0.067 (W.hr/ m2/day). In addition, ASC contributes in reducing heat island effect. By using the empirical equations; it was concluded that; the increasing is up to 104 % for skid number using the smooth tire (SNs)

and up to 106.5 % for skid numbers using the ribbed tire as a result of asphalt surface temperature reduction.

Also, it can be concluded that the ASC physical model performance depends on physical model components in terms of chimney height, asphalt temperature and the environmental / atmospheric conditions in terms of ambient air temperature, ambient wind speed and solar intensity. Finally, ASC practical applications can be used only for low volume load trucks to ensure the reliability and durability of ASC.

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