Alternative Energy

Edited by

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Table of Contents

Table of Contents v
Preface viii
Chapter 1
The Impact of energy utilization on environment 1
M.N.A. Hawlader
Chapter 2
Desalination of Seawater to provide fresh water 9
M.N.A. Hawlader
Chapter 3
A solar assisted desalination system using heat pump 16
M.N.A. Hawlader, Leong Chiing Yang
Chapter 4
An experimental study of a phase change storage system 23
M.N.A. Hawlader and Smita Panga
Chapter 5
Moisture migration in a grain column subjected to drying 30
M.N.A. Hawlader and Md. Shafique J. Chowdhury
Chapter 6
Solar Drying of Guavas, Papayas and Apples 38
M.N.A. Hawlader and Lee Hwee Peng
Chapter 7
Drying under inert environment: the quality of Mango and Rockmelon 47
M.N.A. Hawlader and Pan Jiahe
Chapter 8
A low temperature flat plate solar collector 53
M.N.A. Hawlader, M. Zakir Ullah and Maung Than Htut
Chapter 9
Optimization of an integrated solar heat-pump system 60
M N A Hawlader and Ye Shaochun
Chapter 10
Comparative study of performance characteristics using *Jatropha* Oil Methyl Esters Biodiesel and Diesel 69
A.K.M. Mohiuddin and Azan Mohd
Chapter 11
Comparative Study of Emission Characteristics using Jatropha Oil Methyl Esters Biodiesel and Diesel 74
A.K.M. Mohiuddin and Azan Mohd
Chapter 12
Waste Cooking Oil Utilization for Biodiesel Production 79
A.K.M. Mohiuddin and Nabeel Adeyemi
Chapter 13
Flow Characteristic of Mixing Impeller for Liquid-Liquid Mixing 85
A.K.M. Mohiuddin and Nabeel Adeyemi
Chapter 14
Solar Energy Management for Poverty Alleviation and Income Generating Activities 91
A.K.M. Mohiuddin

Chapter 15
Turbulence model for axial mixing impeller in unbaffled vessel 97
A.K.M. Mohiuddin, Nabeel Adeyemi and Muhamad Husaini
Chapter 16
Optimization and economic analysis of a solar assisted heat pump drying system..... 103
M.N.A. Hawlader, S. M. A. Rahman and K.A. Jahangeer
Chapter 17
A solar heat pump water heater for rural hospitals 117
M.N.A. Hawlader and M. Zakir Ullah
Chapter 18
A solar heat-pump system for air-conditioning, water heating and drying 126
M N A Hawlader, K A Jahangeer, Ye Shaochun and Choy Tack Hoon
Chapter 19
Engineering design – An approach to the development of creativity 132
M.N.A. Hawlader
Chapter 20
Analysis of Engine Performance with NGV 140
Sany Izan Ihsan, Nabila Sulaiman, AKM Mohiuddin and Maizirwan Mel
Chapter 21
Analysis of Engine Performance with Enhanced Fuel..... 147
Sany Izan Ihsan, Khairussani Farid, Maizirwan Mel, and AKM Mohiuddin
Chapter 22
CFD analysis of an evacuated solar still..... 156
Ahmad F. Ismail, Mirghani I. Ahmed, Yousif A. Abakr
Chapter 23
Developments on Solar Operated Water Desalination..... 163
Mirghani I. Ahmed, Yousif A. Abakr and Ahmad F. Ismail
Chapter 24
Theoretical and experimental evaluation of LPG as refrigerant for domestic refrigerators and freezers 169
M.M. El-Awad, M.I. Ahmed
Chapter 25
Preliminary investigation of biodiesel reactor optimization using combine CFD-Taguchi method 179
A.K.M. Mohiuddin and Nabeel A Adeyemi
Chapter 26
Alternative mixing strategy for biodiesel production: mixed flow impeller characterization 188
A.K.M. Mohiuddin and Nabeel Adeyemi
Chapter 27
Experimental Investigation of a Multistage Evacuated Solar Still 197
Yousif. A. Abakr, Ahmad F. Ismaill and Mirghani I. Ahmed
Chapter 28
Modelling of electronics heat sink – Influence of the wake function generation on the accuracy of CFD analysis 203
M. I. Ahmed, A. F. Ismail, Y. A. Abakr
Chapter 29
The effect of the operating conditions on the apparent viscosity of crude palm oil during separation 213

Sulaiman Al-Zuhair, Yousif A. Abakr and Mirghani I. Ahmed
Chapter 30
Thermal analysis of a micro device used for detection of colorectal cancer..... 220
Mirghani I. Ahmed, Meftah Hrairi

Chapter 31
Performance of different photovoltaic cells operating under the meteorological conditions of Singapore..... 229
M.N.A Hawlader, Lee Poh Seng and Chua Kok Kiang
Chapter 32
Analyses of motion and drag coefficient of water droplets in a natural draught cooling tower..... 240
Liu Baomin and M. N. A. Hawlader
Chapter 33
A solar assisted heat pump system for desalination..... 252
Zakaria Mohd. Amin, M N A Hawlader and Azharul Karim
Chapter 34
Comparative study of combustion characteristics using Jatropha oil methyl esters biodiesel and diesel..... 261
A.K.M. Mohiuddin and Azan Mohd
Chapter 35
Performance of evaporator collector and air collector in a solar assisted heat pump dryer. 269
S. M. A. Rahman and M. N. A. Hawlader

Chapter 35

Performance of evaporator collector and air collector in a solar assisted heat pump dryer.

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Abstract

A solar assisted heat pump dryer has been designed, fabricated and tested. This paper presents the performance of evaporator-collector and air collector, when operated under same meteorological conditions. ASHRAE standard procedure of collector testing has been followed. The absorber plate of the evaporator-collector is made of copper plate painted black without any glazing. At the bottom of the absorber plate, a tube has been soldered in serpentine form. Areas of the evaporator-collector and air collector are 1.5 m^2 and 1.24 m^2, respectively. The evaporator-collector of the heat pump is acting directly as the solar collector and the temperature of refrigerant at the inlet to the evaporator-collector always remained below the ambient temperature. Due to rejection of sensible and latent heat of air at the de-humidifier, the temperature at the inlet to the air collector is lower than the ambient air. Hence, the thermal efficiency of the air collector also increases due to a reduction of losses from the collector. The efficiency of evaporator-collector and air collector varied between 0.8 - 0.86 and 0.7 - 0.75, respectively.

Keywords: Heat pump, solar drying, Evaporator-collector, Air collector, and Performance of collectors.

INTRODUCTION

In view of the growing global energy needs and concern for environmental degradation, numerous research and development activities have taken place to identify reliable and economically feasible alternate energy sources. The choices for the alternate energy sources are: energy from sun, wave, wind and geothermal etc. In order to collect and harness energy from the sun, a solar collector is essential. A solar collector is a special kind of heat exchanger that transforms solar radiant energy into heat. Solar collectors have a wide range of applications, such as, drying of agriculture product, space heating, air conditioning and industrial processes heating (textile, paper, etc.). Improving their performance is essential for commercial acceptance of their use in such applications. Many studies have been made on the enhancement of thermal performance of the solar collectors, using diverse materials of various shapes and different dimensions and layouts. In the literature, various collector designs have been postulated and tested with the objective of meeting these requirements [1-6]. Omer et al. [5] found the efficiency of a