

ISSN 1757-8991

IOP Conference Series

Materials Science and Engineering

2nd International Conference
on Robotics and Mechantronics

517

VOLUME 517 – 2019

8–11 November 2018
Singapore

EDITOR
Meng Joo Gi

The open access journal for conference proceedings

iopscience.org/jpcos

IOP Publishing

PAPER • OPEN ACCESS

ICEAT 2017 Committee

To cite this article: 2018 *IOP Conf. Ser.: Mater. Sci. Eng.* **403** 011002

View the [article online](#) for updates and enhancements.

ICEAT 2017 Committee

Steering Committee

- Moehamad Aman (Universitas Muhammadiyah Magelang, Indonesia)
- Eko Budi Leksono (Universitas Muhammadiyah Gresik, Indonesia)
- M. Taufiq Tamam (Universitas Muhammadiyah Purwokerto, Indonesia)
- Sri Sunarjono (Universitas Muhammadiyah Surakarta, Indonesia)
- Hamzah Al Imran (Universitas Muhammadiyah Makasar, Indonesia)
- Jazaul Ikhsan (Universitas Muhammadiyah Yogyakarta, Indonesia)
- Kartika Firdausy (Universitas Ahmad Dahlan, Indonesia)
- Yun Arifatul Fatimah (Universitas Muhammadiyah Magelang, Indonesia)
- Sudarman (Universitas Muhammadiyah Malang, Indonesia)

Organizing Committee

Honorary Board

- Majelis DIKTI LITBANG PP Muhammadiyah
- Mustamin H. Idris (Rector of Universitas Muhammadiyah Mataram, Indonesia)

Executive Board

- Isfanari (Universitas Muhammadiyah Mataram, Indonesia)
- Anwar Ma'ruf (Universitas Muhammadiyah Purwokerto, Indonesia)

General Chair

- Tole Sutikno (Universitas Ahmad Dahlan, Indonesia)

General Co-Chair

- Herry Purnama (Universitas Muhammadiyah Surakarta, Indonesia)

Chairman

- Joni Safaat Ardiansyah (Universitas Muhammadiyah Mataram, Indonesia)

Secretary

- Ima Rahmawati (Universitas Muhammadiyah Mataram, Indonesia)

Treasury

- Diah Rahmawati (Universitas Muhammadiyah Mataram, Indonesia)

Local Committee

- Titik Wahyuningsih (Universitas Muhammadiyah Mataram, Indonesia)
- Salahudin (Universitas Muhammadiyah Mataram, Indonesia)
- Humaira (Universitas Muhammadiyah Mataram, Indonesia)



- Sri Hardiningsih (Universitas Muhammadiyah Mataram, Indonesia)
- M. Ghazali (Universitas Muhammadiyah Mataram, Indonesia)
- Sarman (Universitas Muhammadiyah Mataram, Indonesia)
- Muslihin (Universitas Muhammadiyah Mataram, Indonesia)
- Nuraini (Universitas Muhammadiyah Mataram, Indonesia)
- Sri Maryati (Universitas Muhammadiyah Mataram, Indonesia)
- Alpiana (Universitas Muhammadiyah Mataram, Indonesia)
- Bedy Fara Aga Matrani (Universitas Muhammadiyah Mataram, Indonesia)
- Rifqi Anra Wijaya (Universitas Muhammadiyah Mataram, Indonesia)
- Fariz Primadi Hirsan (Universitas Muhammadiyah Mataram, Indonesia)
- Agus Kurniawan (Universitas Muhammadiyah Mataram, Indonesia)
- Rudy Razak (Universitas Muhammadiyah Mataram, Indonesia)
- Nurul Qiyaam (Universitas Muhammadiyah Mataram, Indonesia)
- Maria Ulfa (Universitas Muhammadiyah Mataram, Indonesia)
- M. Ramdhani (Universitas Muhammadiyah Mataram, Indonesia)
- Rasyid Ridha (Universitas Muhammadiyah Mataram, Indonesia)
- Maya Saridewi Pascanawati (Universitas Muhammadiyah Mataram, Indonesia)
- Hidayati (Universitas Muhammadiyah Mataram, Indonesia)

Technical Program Committee

General

- Dwi Winarti
- M. Islamy Rusyda (Universitas Muhammadiyah Mataram, Indonesia)
- Tole Sutikno (Universitas Ahmad Dahlan, Indonesia)
- Aris Widyo Nugroho (Universitas Muhammadiyah Yogyakarta, Indonesia)
- Andri Pranolo (Universitas Ahmad Dahlan, Indonesia)
- Adhi Prahara (Universitas Ahmad Dahlan, Indonesia)
- Ahmad Azhari (Universitas Ahmad Dahlan, Indonesia)
- Herry Purnama (Universitas Muhammadiyah Surakarta, Indonesia)
- Tri Widayatno (Universitas Muhammadiyah Surakarta, Indonesia)

Technical

- Slamet Riyadi (Universitas Muhammadiyah Yogyakarta, Indonesia)
- Husni Thamrin (Universitas Muhammadiyah Surakarta, Indonesia)
- Gunawan Ariyanto (Universitas Muhammadiyah Surakarta, Indonesia)
- Andri Pranolo (Universitas Ahmad Dahlan, Indonesia)
- Zulfatman (Universitas Muhammadiyah Malang, Indonesia)
- Yun Arifatul Fatimah (Universitas Muhammadiyah Magelang, Indonesia)
- Hari Prasetyo (Universitas Muhammadiyah Surakarta, Indonesia)
- Eko Setiawan (Universitas Muhammadiyah Surakarta, Indonesia)
- Ilyas Mas'udin (Universitas Muhammadiyah Malang, Indonesia)
- Siti Mahsanah (Universitas Ahmad Dahlan, Indonesia)

- Aris Widyo Nugroho (Universitas Muhammadiyah Yogyakarta, Indonesia)
- Sudarisman (Universitas Muhammadiyah Yogyakarta, Indonesia)
- Muji Setiyo (Universitas Muhammadiyah Magelang, Indonesia)
- Marwan Effendy (Universitas Muhammadiyah Surakarta, Indonesia)
- Tri Widayatno (Universitas Muhammadiyah Surakarta, Indonesia)
- Denny Vitasari (Universitas Muhammadiyah Surakarta, Indonesia)
- Haryanto (Universitas Muhammadiyah Purwokerto, Indonesia)
- Nurul H Fitriyah (Universitas Muhammadiyah Jakarta, Indonesia)
- Jazaul Ikhsan (Universitas Muhammadiyah Yogyakarta, Indonesia)
- Agus Setyo Munthohar (Universitas Muhammadiyah Yogyakarta, Indonesia)
- Sri Sunarjono (Universitas Muhammadiyah Surakarta, Indonesia)
- Nurul Hidayati (Universitas Muhammadiyah Surakarta, Indonesia)
- Samin (Universitas Muhammadiyah Malang, Indonesia)
- Wisnu Setiawan (Universitas Muhammadiyah Surakarta, Indonesia)
- Gunawan (Universitas Muhammadiyah Surabaya, Indonesia)

OPEN ACCESS

Study comparative of stability performance between PVC fishing boat and wooden traditional fishing boat

D Chrismianto, P Manik and G Rindo

[Open abstract](#)

[View article](#)

[PDF](#)

OPEN ACCESS

Estimating methane emission from solid waste landfill using various different methods

012005

R Mahful and S Managi

[Open abstract](#)

[View article](#)

[PDF](#)

OPEN ACCESS

Development of porous ceramic membrane from natural zeolite – clay for microfiltration

012006

A Ma'ruf and M A S Al Fathoni

[Open abstract](#)

[View article](#)

[PDF](#)

OPEN ACCESS

The characterization of Merapi volcanic ash as adsorbent for dyes removal from batik wastewater

012007

S Salamah and E T Wahyuni

[Open abstract](#)

[View article](#)

[PDF](#)

OPEN ACCESS

Consumer's valuation of the traditional fish handling practices using importance-performance analysis

012008

T Juwitaningtyas, W Supartono and I W F Aziz

[Open abstract](#)

[View article](#)

[PDF](#)

OPEN ACCESS

Recovery of oryzanol from rice bran oil by silica-based batch adsorption: Radial diffusivity inside particle

012009

A D Susanti, W B Sediawan, S K Wirawan and Budhijanto

[Open abstract](#)

[View article](#)

[PDF](#)

OPEN ACCESS

Grafted flocculant based on the modified taro starch varied by length of polyacrylamide chain

012010

M Kaavessina, S Distantina, Fadilah and Margono

[Open abstract](#)

[View article](#)

[PDF](#)

OPEN ACCESS

Optimization of biodiesel production by various plant sources and micro-reactor simulation

012011

R Fatoni, M M Rahman and A Elkamel

[Open abstract](#)

[View article](#)

[PDF](#)

OPEN ACCESS

Evaluation of moisture content in drying of grated coconut meat using grain moisture meter

012012

E Sulistiawati, I Santosa and A Aktawan

[Open abstract](#)

[View article](#)

[PDF](#)

OPEN ACCESS

Formulation process making of *Aloe vera* mask with variable percentage of *Aloe vera* gel extract

012013

T Y Hendrawati, R A Nugrahani, S Utomo and A I Ramadhan

[Open abstract](#)

[View article](#)

[PDF](#)

OPEN ACCESS

Hydrogel film of polyethylene oxide-polypropylene glycol diacrylate for wound dressing application

012014

Haryanto and A N Aini

[Open abstract](#)

[View article](#)

[PDF](#)

OPEN ACCESS

012015

The effect of flow velocity on local scaling around hexagonal pillars (laboratory model test)

H Al Imran and Nenny

[Open abstract](#)[View article](#)[PDF](#)**OPEN ACCESS**

012016

Shear behavior of slender geometry RC coupling beams in seismic response

Y Nurchasanah, M Ujjianto and F M Annas

[Open abstract](#)[View article](#)[PDF](#)**OPEN ACCESS**

012017

Street vendor sustainable policy by learning characteristics of distribution model location in Losari beach line, Makassar

R Mahful, Ihsan and I Sastrawati

[Open abstract](#)[View article](#)[PDF](#)**OPEN ACCESS**

012018

Economic and environment feasibility of landfill gas project in Indonesia

R Mahful and S Managi

[Open abstract](#)[View article](#)[PDF](#)**OPEN ACCESS**

012019

Bearing capacity of circular skirted footing on clay soil

A B Listyawan, Renaningsih and N Kusumaningtyas

[Open abstract](#)[View article](#)[PDF](#)**OPEN ACCESS**

012020

Mode technology assessment of mass transport master plan in Greater Jakarta (Jabodetabek)

Alvinsyah and E Hadian

[Open abstract](#)[View article](#)[PDF](#)**OPEN ACCESS**

012021

The optimum bus route selection for sustainable operation (case study: Tangerang bus lane)

Alvinsyah and U Halim

[Open abstract](#)[View article](#)[PDF](#)**OPEN ACCESS**

012022

Seismic ground motion induced lateral earth pressures on basement walls

R Berangkat and W A Prakoso

[Open abstract](#)[View article](#)[PDF](#)**OPEN ACCESS**

012023

Resilient modulus of porous asphalt using oil palm fiber

T Syammaun and H A Rani

[Open abstract](#)[View article](#)[PDF](#)**OPEN ACCESS**

012024

Evaluation of thin square bending plate using IGA Galerkin

I Katili, K Octavianus, I J Maknun and J I Rastandi

[Open abstract](#)[View article](#)[PDF](#)**OPEN ACCESS**

012026

Optimization of superplasticizer MasterGlenium SKY 8614 with added materials fly ash, steel slag, and silica fume for high strength concrete

M Ujianto, E L Ardiansyah, G O Ilokana and M F Falah

[Open abstract](#)[View article](#)[PDF](#)**OPEN ACCESS**

Mixture design consideration for foamed asphalt using RAP materials

012027

S Sunarjono and N Hidayati

[Open abstract](#)[View article](#)[PDF](#)**OPEN ACCESS**

The utilization of fly ash in mix proportion of self-consolidation concrete

012028

M Solikin, K O M Oraibi and Y Nurchasanah

[Open abstract](#)[View article](#)[PDF](#)**OPEN ACCESS**

Analysis of pipe diameter variation in axial pumps for reducing head loss

012029

E Widodo and R Y Pradhana

[Open abstract](#)[View article](#)[PDF](#)**OPEN ACCESS**

An analysis of intelligent LED emergency lamp with voltage and resistance activated sensor

012030

E N Budisusila and J P Hapsari

[Open abstract](#)[View article](#)[PDF](#)**OPEN ACCESS**

Prototype of online expert system for electrical energy audit with benchmarking method

012031

A Solichan and L Assaffat

[Open abstract](#)[View article](#)[PDF](#)**OPEN ACCESS**

Flex sensors and MPU6050 sensors responses on smart glove for sign language translation

012032

A Yudhana, J Rahmawan and C U P Negara

[Open abstract](#)[View article](#)[PDF](#)**OPEN ACCESS**

Comparative study of magnetic fields measurements with logger lite and Arduino on electronic devices

012033

S D Fatmaryanti, Y Al Hakim and Ashari

[Open abstract](#)[View article](#)[PDF](#)**OPEN ACCESS**

Simplified design of low speed electric permanent magnet generator for small wind power plant

012034

M Irfan, E A Hakim, D Suhardi, N Kasan, M Effendy, A Faruq and M C Anam

[Open abstract](#)[View article](#)[PDF](#)**OPEN ACCESS**

Irigation distribution automatization based on scheduling system

012035

Sunardi, S A Akbar, F Noviyanto, E Wibowo and R Naufal

[Open abstract](#)[View article](#)[PDF](#)**OPEN ACCESS**

Preliminary study plate capacitor as a Plethysmometer sensor

012036

W S Aji

[Open abstract](#)[View article](#)[PDF](#)**OPEN ACCESS**

An excellent system in palmprint recognition

012037

Muhammad Kusban, Aris Budiman and Bambang Hari P.

[Open abstract](#)[View article](#)[PDF](#)**OPEN ACCESS**

012038

Design a system of measurement of heart rate, oxygen saturation in blood and body temperature with non-invasive method

M T Tamam, A J Taufiq and A Kusumawati

[Open abstract](#)

[View article](#)

[PDF](#)

OPEN ACCESS

012039

Analysis of integration flow control valve and electronic load controller for micro hydro power plant frequency regulation

R Mulyadi, M Effendy, I Pakaya and Zulfatman

[Open abstract](#)

[View article](#)

[PDF](#)

OPEN ACCESS

012040

A study on electrical characteristics of Pentacene based MOS diodes and transistors

Fadlioni, Budiyanto and H Muchtar

[Open abstract](#)

[View article](#)

[PDF](#)

OPEN ACCESS

012041

Robust ball tracking scheme for soccer robot under various illuminations and occlusions

R D Puriyanto and A Prahara

[Open abstract](#)

[View article](#)

[PDF](#)

OPEN ACCESS

012042

Water quality monitoring at paddies farming based on android

A Yudhana and A C Kusuma

[Open abstract](#)

[View article](#)

[PDF](#)

OPEN ACCESS

012043

Neural network simulation for obstacle avoidance and wall follower robot as a helping tool for teaching-learning process in classroom

T Dewi, P Risma, Y Oktarina and M Nawawi

[Open abstract](#)

[View article](#)

[PDF](#)

OPEN ACCESS

Market risk assessment on poultry industry using Monte Carlo simulation

012044

R Purwaningsih, M Arief, N U Handayani, D Rahmawati and A Mustikasari

[Open abstract](#)

[View article](#)

[PDF](#)

OPEN ACCESS

Solving CCVRPTW using biased random key genetic algorithm (BRKGA) with multiple parent

012045

H Prasetyo, M Qoyyimah and G Fauza

[Open abstract](#)

[View article](#)

[PDF](#)

OPEN ACCESS

Key performance indicators (KPIs) on Vannamei shrimp supply chain performance (a preliminary research)

012046

D Widyaningrum

[Open abstract](#)

[View article](#)

[PDF](#)

OPEN ACCESS

Theorizing of spirit 212 in predicting Muslim behavioral intentions: A hypothesized model

012047

W S Jatiningrum and A Y Astuti

[Open abstract](#)

[View article](#)

[PDF](#)

OPEN ACCESS

Coordinated stock pre-positioning model to support emergency relief response

012049

P F Opit

[Open abstract](#)

[View article](#)

[PDF](#)

OPEN ACCESS

012050

Development of an integrated production-inventory model for food products considering exponential perceived value loss

G Fauza, H Prasetyo and B S Amanto

[Open abstract](#)[View article](#)[PDF](#)**OPEN ACCESS**

012051

Optimization of storage temperatures to maintain Lycopene content of tomato from moderate water stress irrigated greenhouse

A N Khairi, M A F Falah, A P Pamungkas and N Takahashi

[Open abstract](#)[View article](#)[PDF](#)**OPEN ACCESS**

012052

Stability analysis of trawls type traditional fishing boat with modification of eco-friendly fishing-gear on the north coast of Central Java

Kiryanto, M Ridwan, B A Adietya and D Chrismianto

[Open abstract](#)[View article](#)[PDF](#)**OPEN ACCESS**

012053

The use of importance-performance analysis for Indonesian smoked fish production strategy

H Mastrisiswadi, D N Izzhati and T Talitha

[Open abstract](#)[View article](#)[PDF](#)**OPEN ACCESS**

012054

Muslim and non-muslim perceptions on Halal Meat Logistics (HML)

I Masudin, F W Fernanda, F Jie, H Djajadikerta and Widayat

[Open abstract](#)[View article](#)[PDF](#)**OPEN ACCESS**

012055

Remanufacturing sustainability indicators: An Indonesian small and medium enterprise case study

Y A Fatimah and M Aman

[Open abstract](#)

[View article](#)

[PDF](#)

OPEN ACCESS

Collaboration of multi agent systems and web service in temperature data collecting process

012056

E S J Atmadji, H Y Riskiawan and D P S Setyohadi

[Open abstract](#)

[View article](#)

[PDF](#)

OPEN ACCESS

Application of fuzzy selection method of accompany computer laboratory assistant recommendation

012057

Cholifia and Yulmaini

[Open abstract](#)

[View article](#)

[PDF](#)

OPEN ACCESS

Evaluation QOS and energy consumption for DSDV and DSR in MANET (Mobile ad hoc network)

012058

H A Sidharta, Sidharta and C Huda

[Open abstract](#)

[View article](#)

[PDF](#)

OPEN ACCESS

Discriminant independent component analysis for hyperspectral image classification

012059

Murinto and N R D P Astuti

[Open abstract](#)

[View article](#)

[PDF](#)

OPEN ACCESS

Development of monitoring and hospital patient alert systems using smartwatch application

012060

K Yuantoro, M Rosmiati and Y Siradj

[Open abstract](#)[View article](#)[PDF](#)**OPEN ACCESS**

012061

Comparative analysis of three MCMC methods for estimating GARCH models

D B Nugroho

[Open abstract](#)[View article](#)[PDF](#)**OPEN ACCESS**

012062

The development of road databases and analysis of traffic accident-prone section (blacksite) based on Geographic Information System (GIS)

M E Bolla and B S Djahi

[Open abstract](#)[View article](#)[PDF](#)**OPEN ACCESS**

012063

E-commerce development using AngularJS framework and RESTful API

A Hidayati and R Nabila

[Open abstract](#)[View article](#)[PDF](#)**OPEN ACCESS**

012064

An investigation of external factors for technological acceptance model of nurses in Indonesia

D B Setyohadi and N W Purnawati

[Open abstract](#)[View article](#)[PDF](#)**OPEN ACCESS**

012065

Designing enterprise architecture based on TOGAF 9.1 framework

H Qurratuaini

[Open abstract](#)[View article](#)[PDF](#)

OPEN ACCESS

012066

Design of flood detection system based on velocity and water level sensor in Arduino with SWOD application on Kalimati-Kretek Gantung DAM Banyuwangi

H Yuliandoko, Subono, V A Wardhany, S H Pramono and P Siwindarto

[Open abstract](#)[View article](#)[PDF](#)**OPEN ACCESS**

012067

Named entity recognition model for Indonesian tweet using CRF classifier

Y Munarko, M S Sutrisno, W A I Mahardika, I Nuryasin and Y Azhar

[Open abstract](#)[View article](#)[PDF](#)**OPEN ACCESS**

012068

Expert system diagnose disease dermatitis using web based certainty factor

Y Findawati and A I Afrina

[Open abstract](#)[View article](#)[PDF](#)**OPEN ACCESS**

012069

Classification of heart signal using wavelet haar and backpropagation neural network

H Hindarto, I Anshory and A Efiyanti

[Open abstract](#)[View article](#)[PDF](#)**OPEN ACCESS**

012070

Very short term load forecasting peak load time using fuzzy logic

J Jamaaluddin, D Hadidjaja, I Sulistiyowati, EA Suprayitno, I Anshory and S Syahririni

[Open abstract](#)[View article](#)[PDF](#)**OPEN ACCESS**

012071

Android based Tarjih Muhammadiyah information systems

M Iqbal and Suyono

[Open abstract](#)

[View article](#)

[PDF](#)

OPEN ACCESS

User participation in building language repository: the case of Google Translate

012072

H Thamrin, G Ariyanto, E W Pamungkas and Y Sulistyono

[Open abstract](#)

[View article](#)

[PDF](#)

OPEN ACCESS

Prediction of population growth using Sugeno and Adaptive Neuro-Fuzzy Inference System (ANFIS)

012073

A H S Jones, A Pranolo, A Dianto and S Winiarti

[Open abstract](#)

[View article](#)

[PDF](#)

OPEN ACCESS

Similarity measurement algorithms of writing and image for plagiarism on Facebook's social media

012074

M A Kurniawan and K Surendro

[Open abstract](#)

[View article](#)

[PDF](#)

OPEN ACCESS

Customer trust of online shopping using social media

012075

V E Mariana, A P Wibawa, J Hammad, R Herdianto and Haviluddin

[Open abstract](#)

[View article](#)

[PDF](#)

OPEN ACCESS

Mobile CRM student-parent information system

012076

A Setiawan and R Widaryanto

[Open abstract](#)

[View article](#)

[PDF](#)

OPEN ACCESS

012077

Achievement of quality management system ISO 9001:2015 strategy in Vocational High School

R Irsyada, S Isbiyantoro, A P Wibawa, M F Teng, A F O Gaffar, R Herdianto and A R Witarsa

[Open abstract](#)

[View article](#)

[PDF](#)

OPEN ACCESS

012078

Development of knowledge management system for determining organizational culture in micro, small and medium enterprises using organizational culture assessment instrument

R Z A Aziz, M F Azima and S Y Irianto

[Open abstract](#)

[View article](#)

[PDF](#)

OPEN ACCESS

012079

Analytical hierarchy process for mode choice model at Perumnas Palur, Karanganyar

N Hidayati, S Sunarjono and A Putri

[Open abstract](#)

[View article](#)

[PDF](#)

OPEN ACCESS

012080

Lack of knowledge matching algorithms using distance measurements on brainwave features

A Azhari and DP Ismi

[Open abstract](#)

[View article](#)

[PDF](#)

OPEN ACCESS

012081

A profile analysis of blacksmith in Desa Limbang Jaya I Kecamatan Tanjung Batu Kabupaten Ogan Ilir - Indonesia

Irmeilyana, Ngudiantoro and A. Desiani

[Open abstract](#)

[View article](#)

[PDF](#)

OPEN ACCESS

012082

A rule-based method for living organisms classification

A Desiani, M Arhami, Firdaus and S I Maiyanti

[Open abstract](#)[View article](#)[PDF](#)**OPEN ACCESS**

Planting time determination for food crops using decision tree

012083

T Setiadi, A Tarmuji, B Suhendra, F Noviyanto and S L Khasbullah

[Open abstract](#)[View article](#)[PDF](#)**OPEN ACCESS**

Grouping the community health center patients based on the disease characteristics using C4.5 decision tree

012084

N Anwar, A Pranolo and R Kurnaiwan

[Open abstract](#)[View article](#)[PDF](#)**OPEN ACCESS**

Implementation of use case point as software effort estimation in Scrum Framework

012085

H Yuliansyah, S N Qudsiah, L Zahrotun and I Arfiani

[Open abstract](#)[View article](#)[PDF](#)**OPEN ACCESS**

Fracture toughness characterization of polymers-based composites using essential work of fracture method

012086

Purnomo, P H Setyarini and D Cahyandari

[Open abstract](#)[View article](#)[PDF](#)**OPEN ACCESS**

Refrigeration effect and energy efficiency ratio (EER) calculation of 1/2 cycle refrigeration system on LPG-fueled vehicles

012087

M Setiyo, B C Purnomo, B Waluyo, D R B Syaka and N Hamidi

[Open abstract](#)[View article](#)[PDF](#)**OPEN ACCESS**

Donut mixer using bevel gears transmissions with 18 kg/hour in capacity

012088

F Maghfurah and Windarta

[Open abstract](#)[View article](#)[PDF](#)**OPEN ACCESS**

Comparison of plastic and stainless-steel as solar still material

012089

D Mugisidi, O Heriyani and H Fathurahman

[Open abstract](#)[View article](#)[PDF](#)**OPEN ACCESS**

The effect of the ball size on the product characteristics of shaker HEM to produce nano particle from bamboo charcoal

012090

Supriyono, Ngafwan and J W Joharwan

[Open abstract](#)[View article](#)[PDF](#)**OPEN ACCESS**

Variation of sitting and standing position at beverage packing factories

012091

R Septiari, Pratikto, B S Purnomo and P T Ishardita

[Open abstract](#)[View article](#)[PDF](#)**OPEN ACCESS**

Design and experimental test for solar chimney power plant: case study in Riau Province, Indonesia

012092

A Ridwan, H Hafizh and M R Fauzi

[Open abstract](#)[View article](#)[PDF](#)**OPEN ACCESS**

Potential of 1/2 cycle refrigeration system for food transport application

012093

M Setiyo, B Waluyo, B C Purnomo, D W Karmiadji and I C Setiawan

[Open abstract](#)[View article](#)[PDF](#)**OPEN ACCESS**

012094

Application of cold dry cutting and coated carbide tool on high speed turning process against tool wear and surface roughness of Brass MS58

T Sugiarto, B Sugiantoro, N Supriyana, K Setyawan and Y Praharto

[Open abstract](#)[View article](#)[PDF](#)**OPEN ACCESS**

012095

Continuous and uncontinuous gasification systems of rice husk using variation modification of burner

Subroto, Wijianto, Sarjito and D A Himawanto

[Open abstract](#)[View article](#)[PDF](#)**OPEN ACCESS**

012096

Fabrication and characterization of the porous titanium alloy by argon filled pore expansion technique

A W Nugroho, G Leadbeater and I J Davies

[Open abstract](#)[View article](#)[PDF](#)**OPEN ACCESS**

012097

The effect of variation number of holes on burner cap of TLUD gasification stove

Wijianto, Sarjito, Subroto and D A Himawanto

[Open abstract](#)[View article](#)[PDF](#)**OPEN ACCESS**

012098

Performance evaluation of using water and bio oil-based nanocutting fluids under minimum quantity lubrication with compressed cold air during milling operations of steel

B Sugiantoro, Sakuri and Sutarno

[Open abstract](#)[View article](#)[PDF](#)

OPEN ACCESS

012099

Application pin-on-disc method for wear rate prediction on interaction between rail and wheel

Windarta

[Open abstract](#)[View article](#)[PDF](#)

OPEN ACCESS

012100

Use of bamboo fiber as a brake pad lining material and the influence of its portion on hardness and durability

P I Purboputro, M A Hendrawan and A Hariyanto

[Open abstract](#)[View article](#)[PDF](#)

PAPER • OPEN ACCESS

Comparison of plastic and stainless-steel as solar still material

To cite this article: D Mugisidi *et al* 2018 *IOP Conf. Ser.: Mater. Sci. Eng.* **403** 012089

View the [article online](#) for updates and enhancements.

Comparison of plastic and stainless-steel as solar still material

D Mugisidi¹, O Heriyani² and H Fathurahman¹

¹Mechanical Engineering Department, ²Electrical Engineering Department
University of Muhammadiyah Prof. Dr. HAMKA, Jl. Tanah Merdeka no 6 Kampung
Rambutan Ciracas Jakarta Timur, Indonesia

dan.mugisidi@uhamka.ac.id

Abstract. The purpose of this study was to select the most suitable material to be used as solar still material. Materials compared in this study were plastic and stainless-steel because of their resistance to corrosion. The tested material was utilized as a container to accommodate sea water to be evaporated. The experiment carried out in Jakarta, Indonesia. Material temperature profile similar with the ambient temperature profile. When the sun is shining brightly, the material temperature is higher than the ambient temperature but in the afternoon and night the material temperature falls to ambient temperature. Therefore, it can be said that plastic and stainless-steel materials do not store heat. As a material for solar still, stainless-steel has higher evaporation rate than plastic, which is 7.66 ml/h for stainless-steel and 7.09 ml/h for plastics. So, based on this research, it can be concluded that stainless-steel is better to be used as a solar still material.

1. Introduction

Water is the decisive material in life. Humans, plants, and most animals will not survive without water. Along with the growing population in the world, water consumption is increasing. The addition of human population as much as 15% will reduce the water source and increase the water shortage by 40% [1], while the amount of fresh water on the earth surface, only available 2.8% and the rest is sea water [2]. Therefore, sea water is a potential source of water.

Because of its enormous potential, various methods and research have been done to convert sea water into fresh water. Distillation is one of the most widely used methods. Evaporation processes that occur slowly make the contaminants left behind, so that the resulting water becomes pure. The distillation process becomes cheaper by utilizing solar energy, although the production is not high. The direct heating method with solar heat is the most suitable way to produce fresh water up to 200 m³/day [3].

The process of distillation by solar heating is generally done by using solar still. Various methods and materials are used to improve the performance of solar still. It seems that evaporation rate affected by its solar still. The use of Portland cement black-blackened, as heat storage, increase freshwater production by 39% [4]. Concave-shaped solar stills are used to increase evaporation by [5]. The perforated aluminum is mounted on the water's surface on the solar still to increase evaporation [6]. The use of plastics for easy cleaning of salt deposits is done by [7]. The tilted-wick was placed on the surface of the solar still spreading water to the entire surface of the wick through capillary fibers. So, the temperature becomes higher in the thin layer [8]. Five trays made of aluminum and stainless steel AISI 304 (polished, chrome plated, and non-polished) were tested to study its performance as a



function of different tray materials. The result showed that the aluminum tray had the highest desalinated water production, while the polished steel tray had the lowest production [9].

The performance of a solar still is proportional to distillate output and indicated by the internal heat transfer coefficient. There are three parameters based on internal heat transfer coefficients: convective heat transfer coefficient, radiative heat transfer coefficient and evaporative heat transfer coefficient [10]. The material that holds sea water also receives heat from solar energy. Some of the heat in material flows into the water and some loss to ambient. Beside that some material able to store heat and release it when the heat source is not available. Then the material becomes a contributing factor in the evaporation of sea water.

Sea water is a very corrosive substance, the material used in desalination process must be corrosive resistance material. So, it is necessary to conduct research to do experiment with material which has beneficial effect on evaporation rate, but corrosion resistance. Nevertheless, still no related research has examined the effect of material on evaporation of seawater in solar-still. Then, this research examines the plastic and stainless steel container material to evaporate the sea water and their heat storage ability is compared.

2. Material and methods

The experiment uses a pan made of plastic and stainless steel (SUS 316). The pan of plastics and stainless-steel has same shape and size. Five pieces pan for each type of material, filled with 250 ml sea water which taken from Ujung Kulon, Indonesia.

3. Results and discussion

In figure 1, it shows that the material and water temperature have the same profile as the ambient temperature. When the temperature is about 31° – 33°C, temperature of material is almost equal to the ambient temperature but in higher temperatures, temperature ambient about 37°C, the temperature of materials rises above the ambient temperature. Plastic has the highest temperatures because the slow propagation and release of heat. Plastic is non-metallic materials that do not have free electrons. Therefore, the heat distribution occurs with lattice vibration [11] so the heat distribution becomes slow and the thermal conductivity becomes low. The slow distribution of heat from the plastic surface causes heat accumulation and the heat become higher than stainless steel. Even though temperature of plastic is higher than stainless steel, the temperature of water inside the stainless-steel pan is higher than the water inside plastic pan.

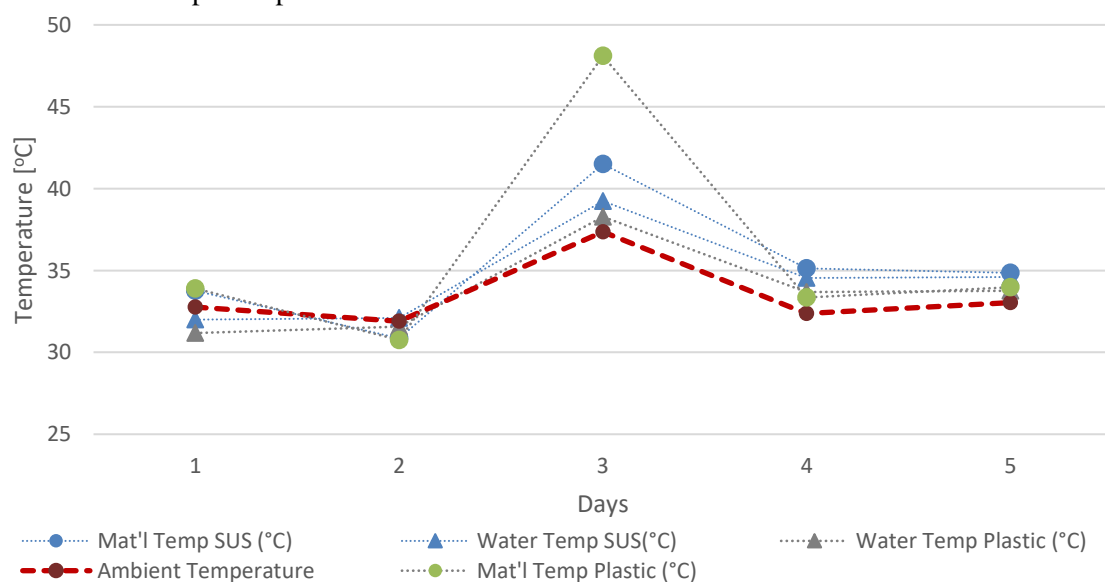


Figure 1. Temperature profile of material, water and ambient temperature during the experiment.

As the result, evaporation of seawater inside the plastic pan is lower than stainless steel pan, as shown in figure 2. In figure 2, the evaporation of sea water in plastic pan is 28.36 ml and stainless-steel pan is 35.22 ml. The conductivity of the stainless steel ($16.95 \text{ W/m}^\circ\text{C}$) is higher than plastics ($0.15 \text{ W/m}^\circ\text{C}$). This result along with the result of [12] that the heat transfer increases with decrease in thickness and increase in thermal conductivity and thermal conductivity of the material has a significant effect on the convective heat transfer coefficient [13]. The heat from solar radiation is absorbed and accumulated by the material. Some of the heat of material flows into water and some of it flows to the ambient. Heat in the water, which come from material and sun radiation, balance with evaporation energy [14]. Since the heat propagation in stainless-steel is better than plastic, heat in stainless-steel flows into water and elevate the evaporation. Furthermore, thermal conductivity of material plays important role in evaporation.

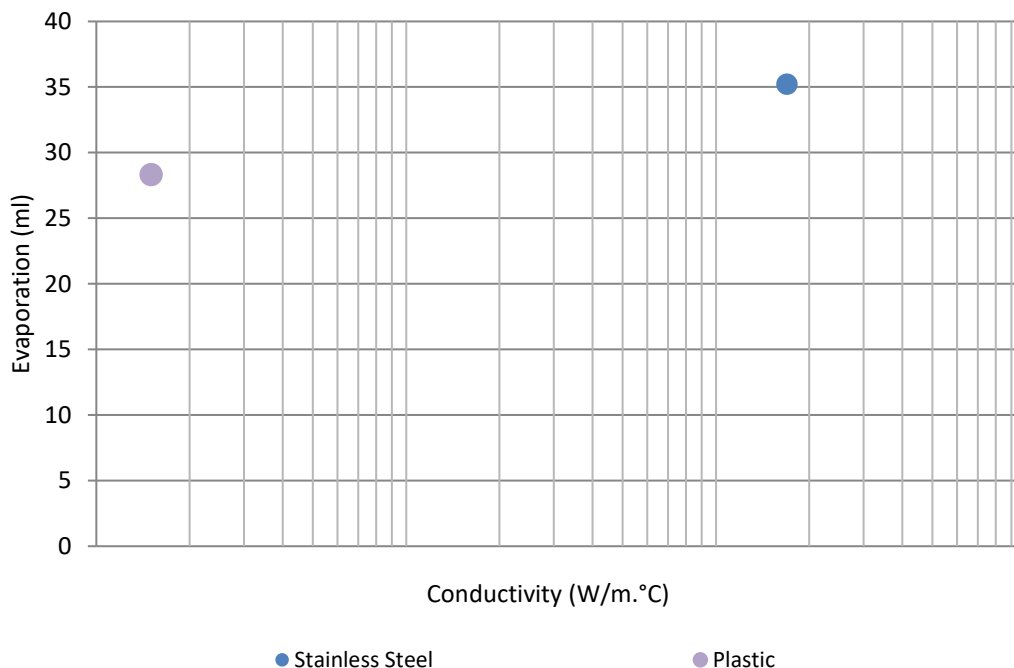


Figure 2. Effect of container material conductivity to evaporation.

In figure 3, as previously stated, the material temperature is higher than the ambient temperature in bright sunlight. In the afternoon, after 15:00, the material temperature falls below the ambient temperature. As the sun sets and the ambient temperature drops to 27°C , the temperature of stainless-steel and plastic, starts from 31°C , follow drops to about 27°C . When the ambient temperature is lower than material, heat flows from material to ambient. So that the material temperature drops to about ambient temperature. This proves that these materials do not have the ability to store heat. Nevertheless, through in the very small gap, temperature of stainless-steel is lower than temperature of plastic. Since conductivity of stainless steel is higher than plastics so the heat in stainless-steel release faster.

Figure 4 shows evaporation and evaporation rate in extended time. Horizontal axes show duration of evaporation. For example, 11-14 means that the time starts is at 11.00 AM and stop at 14.00 (2 PM). Evaporation is checked at 14.00 (2 PM). Evaporation of sea water in material stainless-steel and plastic in extended time shows that the evaporation in stainless steel is higher than in plastic. Even though evaporation increase as the time increase, evaporation rate decrease. Interestingly, rate of

evaporation in plastic material decrease slower than evaporation rate of stainless-steel, though still lower.

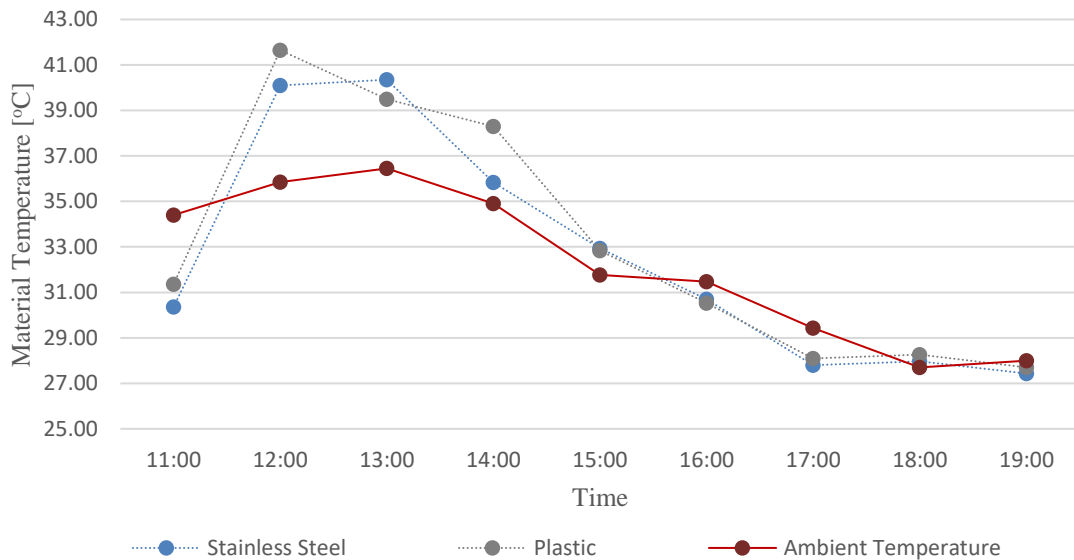


Figure 3. Ability of material to store the heat.

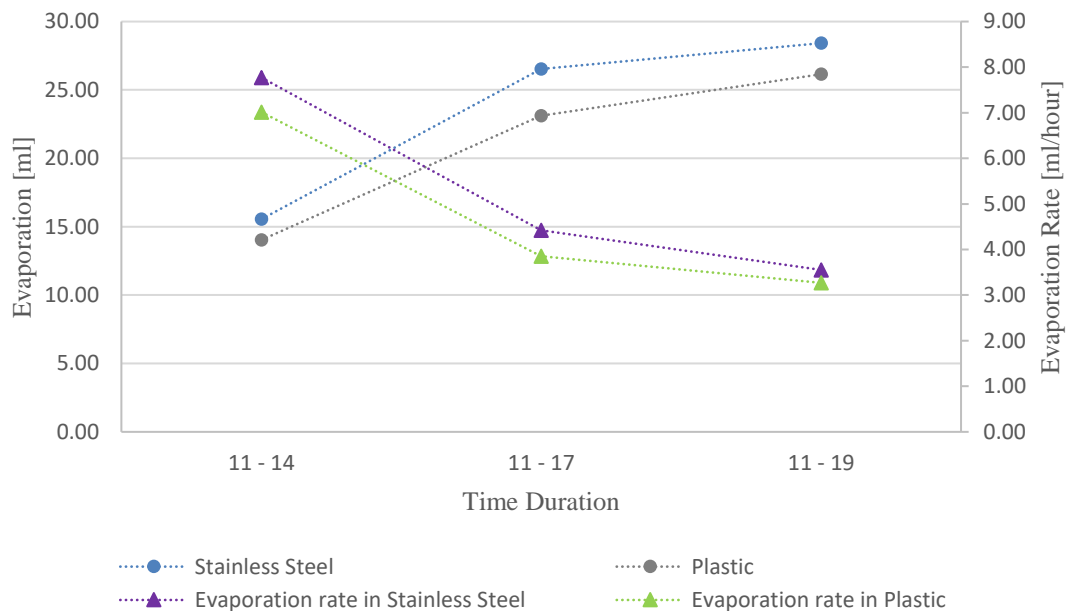


Figure 4. Evaporation and evaporation rate for extended time.

4. Conclusion

The experiment results show that the material affected the temperature of the water inside. Temperature of plastic is higher than the stainless steel but water temperature inside is lower. The temperature gap between water and its container affected by the conductivity of material. In the afternoon and night, the material temperature falls close to ambient temperature since the heat in materials flows into ambient. Therefore, it can be said that plastic and stainless-steel materials do not store heat. As a material for solar still, stainless-steel has higher evaporation rate than plastic, which is

7.66 ml/h for stainless-steel and 7.09 ml/h for plastics. It can be concluded that stainless-steel is better to be used as a solar still material than plastic, since ability of plastics to store heat can be neglected.

References

- [1] Schewe J, Heinke J, Gerten D, Haddeland I and Arnell N W 2014 Multimodel assessment of water scarcity under climate change *Proceedings of the National Academy of Sciences of the United States of America* vol 111 no 9 pp 3245-50
- [2] Belessiotis V, Kalogirou S and Delyannis E 2016 *Thermal solar desalination - methods and systems, 1st ed.* Academic Press Elsevier
- [3] García-Rodríguez L 2002 Seawater desalination driven by renewable energies: a review *Desalination* vol 143 issue 2 pp 103-113
- [4] Sellami M H, Guemari S, Touahir R and Loudiyi K 2016 Solar distillation using a blackened mixture of Portland cement and alluvial sand as a heat storage medium *Desalination* vol 394 pp 155-61
- [5] Kabeel A E 2008 Performance of solar still with a wick concave evaporation surface *Twelfth Int. Water Technol. Conference, IWTC12 2008* Alexandria, Egypt pp 1137-46
- [6] Valsaraj P 2002 An experimental study on solar distillation in a single slope basin still by surface heating the water mass *Renew. Energy* vol 25 issue 4 pp 607-12
- [7] Tarawneh M S K 2007 Effect of water depth on the performance evaluation of solar still *Jordan Journal of Mechanical and Industrial Engineering (JJMIE)* vol 1 no 1 pp 23-29
- [8] Al-Karaghoulis A, Renne D and Kazmerski L L 2009 Solar and wind opportunities for water desalination in the Arab regions *Renew. Sustain. Energy Rev.* vol 13 issue 9 pp 2397-407
- [9] Da Silva M E V, Schwarzer K, Pinheiro F N, Rocha P A C and De Andrade C F 2015 Experimental study of tray materials in a thermal desalination tower with controlled heat source *Desalination* vol 374 pp 38-46
- [10] Panchal H N and Shah P K 2011 Modelling and verification of single slope solar still using ANSYS-CFX *Int. J. Energy & Environ.* vol 2 issue 6 pp 985-98
- [11] Hahn D W and Özisik M N 2012 *Heat conduction*, 3rd ed. (John Wiley & Sons, Inc.)
- [12] Aboul-Enein S, El-Sebaei A A and El-Bialy E 1998 Investigation of a single-basin solar still with deep basins *Renew. Energy* vol 14 issue 1-4 pp 299-305
- [13] Tiwari A K and Tiwari G N 2005 Effect of the condensing cover's slope on internal heat and mass transfer in distillation: an indoor simulation *Desalination* vol 180 issue 1-3 pp 73-88
- [14] Qiblawey H M and Banat F 2008 Solar thermal desalination technologies *Desalination* vol 220 issue 1-3 pp 633-44