

# IJHT

International Journal of

**HEAT**  
and  
**TECHNOLOGY**



**IIETA** International Information and  
Engineering Technology Association

*Advancing the World of Information and Engineering*

ISSN: 0392-8764

**International Journal of Heat and Technology (IJHT)** is an international, scholarly and peer-reviewed journal dedicated to providing scientists, engineers and technicians with the latest developments on heat transfer, fluid dynamics and thermodynamics, as well as their industrial applications. In addition to these focal points, the IJHT covers all kinds of subjects related to heat and technology, including but not limited to turbulence, combustion, cryogenics, porous media, multiphase flow, radiative transfer, heat and mass transfer, micro- and nanoscale systems, and thermophysical property measurement. The editorial board encourages the authors from all countries to submit papers on the relevant issues, especially those aimed at the practitioner as much as the academic. The papers should further our understanding of the said subjects, and make a significant original contribution to knowledge.

The IJHT is an open access journal. All contents are available for free, that is, users are entitled to read, download, duplicate, distribute, print, search or link to the full texts of the articles in this journal without prior consent from the publisher or the author.

### **Focus and Scope**

The IJHT welcomes original research papers, technical notes and review articles on the following disciplines:

- Heat transfer
- Fluid dynamics
- Thermodynamics

[Read More](#)

SCImago Journal Rank (SJR) 2020: **0.283**

Source Normalized Impact per Paper (SNIP) 2020: **0.540**



**START YOUR SUBSCRIPTION TODAY!**

Subscribe to IETA journals so that you always receive up-to-date achievements in information and engineering technology.

**Learn more >**

**IETA**

<http://www.ieta.org/Services/Subscription>

<http://www.ieta.org/Services/Subscription>

## Editorial Board

### EDITOR-IN-CHIEF

Prof. Enrico Lorenzini  
University of Bologna (Italy)

### ASSOCIATE EDITORS

Prof. Adrian Bejan Duke University (USA)	Prof. Satish G.Kandlikar Rochester Institute of Technology (USA)	Prof. Yasar Demirel University of Nebraska–Lincoln (USA)
Prof. Yogesh Jaluria Rutgers, the State University of New Jersey (USA)	Prof. Adriana Greco University of Naples (Italy)	

## EDITORIAL ADVISORY BOARD

Prof. Sylvie Lorente INSA, Univ. of Toulouse (France)	Prof. M. Cumo University of Rome (Italy)	Dr. Hong Hu University of Florida (USA)
Prof. G.F. Hewitt Imperial College London (UK)	Prof. Gauri Shanker Seth Indian School of Mines (India)	Prof. G. Lorenzini University of Parma (Italy)
Prof. Adel Benchabane Université de Biskra (Algeria)	Prof. L.A. Rocha Univ. Porto Alegre (Brazil)	Prof. Seyed Ehsan Rafiee Urmia University of Technology (Iran)
Dr. Adnane Labeled Université de Biskra (Algeria)	Dr. Mohammad Mansur Rahman Sultan Qaboos University (Oman)	Associate Prof. Mohammad Ferdows University of Dhaka (Bangladesh)
Dr. Mohsen Sheikholeslami Babol University of Technology (Iran)	Dr. Mohammad Reza Hajmohammadi Amirkabir University of Technology (Iran)	Dr. Toufik BOUSHAKI University of Orleans (France)
Dr. Vivek Krishnan INTECSEA Inc. (US)	Prof. Myriam Lazard Université de Poitiers (France)	

## Editorial Office

Phone: + 1780 218 9926  
 Fax: +1 780 341 0600  
 Email: editor.ijht@iieta.org

Username

Password

Remember me

LOGIN

## Journal Content

All ▾

Search

### Browse


- By Issue (<http://www.iieta.org/ojs/index.php/ijht/issue/archive>)
- By Title (<http://www.iieta.org/ojs/index.php/ijht/issue/archive>)
- By Author (<http://www.iieta.org/ojs/index.php/ijht/issue/archive>)
- Other Journals (<http://www.iieta.org/ojs>)

No. 2, April


No. 1, February

**Vol. 40, No. 2, April 2022****Feasibility of Using Phase Change Material in Photovoltaic Panels Solar Tracking**[\(/journals/ijht/paper/10.18280/ijht.400201\)](/journals/ijht/paper/10.18280/ijht.400201)**Roy J. Issa, Emad Manla**<https://doi.org/10.18280/ijht.400201>


Page 359-365

PDF Full-text (</pdf-viewer/11154>) | [HTML Full-text](#)  
(</journals/ijht/paper/10.18280/ijht.400201>) | [Citation](#) [DOWNLOAD PDF \(/download/file/fid/75525\)](/download/file/fid/75525) OPEN ACCESS**Comparison of Turbulent Flow and Heat Transfer in a Rectangular Channel with Delta Wing and Winglet Type Longitudinal Vortex Generators**[\(/journals/ijht/paper/10.18280/ijht.400202\)](/journals/ijht/paper/10.18280/ijht.400202)**Hugo Fuentes, Alvaro Valencia**<https://doi.org/10.18280/ijht.400202>


Page 366-374

PDF Full-text (</pdf-viewer/11167>) | [HTML Full-text](#)  
(</journals/ijht/paper/10.18280/ijht.400202>) | [Citation](#) [DOWNLOAD PDF \(/download/file/fid/75526\)](/download/file/fid/75526) OPEN ACCESS**Numerical Analysis of Concentrated Beam Solar Circular Receivers**[\(/journals/ijht/paper/10.18280/ijht.400203\)](/journals/ijht/paper/10.18280/ijht.400203)**Kaustubh G. Kulkarni, Sanjay N. Havaladar, Harsh V. Malapur**<https://doi.org/10.18280/ijht.400203>

Page 375-382

PDF Full-text (</pdf-viewer/11173>) | [HTML Full-text](#)  
(</journals/ijht/paper/10.18280/ijht.400203>) | [Citation](#) [DOWNLOAD PDF \(/download/file/fid/75527\)](/download/file/fid/75527) OPEN ACCESS**Analysis on Hydraulic Fracturing of Concrete in Super-High Arch Dam Based on the Thermodynamic Principle of Minimum Energy Consumption Rate**[\(/journals/ijht/paper/10.18280/ijht.400204\)](/journals/ijht/paper/10.18280/ijht.400204)**Jianhua Zhang, Fei Song, Lingchao Zhang, Juan Wang, Changjun Liu**<https://doi.org/10.18280/ijht.400204>

Page 383-389

PDF Full-text (</pdf-viewer/11180>) | [HTML Full-text](#)  
(</journals/ijht/paper/10.18280/ijht.400204>) | [Citation](#) [DOWNLOAD PDF \(/download/file/fid/75528\)](/download/file/fid/75528) OPEN ACCESS


Experimental Investigation of Using Liquid Suction Heat Exchanger with Condensed Cold-Water on the Performance of Air Conditioning System  
(/journals/ijht/paper/10.18280/ijht.400205)

**Phairoj Homon, Preeda Chantawong, Joseph Khedari**

<https://doi.org/10.18280/ijht.400205>

Page 390-396

[PDF Full-text \(/pdf-viewer/11150\)](#) | [HTML Full-text \(/journals/ijht/paper/10.18280/ijht.400205\)](#) | [Citation](#)

 [DOWNLOAD PDF \(/download/file/fid/75521\)](#)

 OPEN ACCESS


Experimental, Analytical and ANSYS Computation of Novel Cascade Solar Desalination Still  
(/journals/ijht/paper/10.18280/ijht.400206)

**Nidal Mouhsin, Mariam Bouzaid, Mourad Taha-Janani**

<https://doi.org/10.18280/ijht.400206>

Page 397-404

[PDF Full-text \(/pdf-viewer/11161\)](#) | [HTML Full-text \(/journals/ijht/paper/10.18280/ijht.400206\)](#) | [Citation](#)

 [DOWNLOAD PDF \(/download/file/fid/75522\)](#)

 OPEN ACCESS


Geochemical Characteristics of Fluid Inclusions and Isotopes in Zhazixi Sb-W Deposit  
(/journals/ijht/paper/10.18280/ijht.400207)

**Liangliang Jia, Huazhang Li, Li Wang, Dexian Zhang**

<https://doi.org/10.18280/ijht.400207>

Page 405-414

[PDF Full-text \(/pdf-viewer/11171\)](#) | [HTML Full-text \(/journals/ijht/paper/10.18280/ijht.400207\)](#) | [Citation](#)

 [DOWNLOAD PDF \(/download/file/fid/75518\)](#)

 OPEN ACCESS


Investigation of Thermal Collector Nanofluids to Increase the Efficiency of Photovoltaic Solar Cells  
(/journals/ijht/paper/10.18280/ijht.400208)

**Singgih Dwi Prasetyo, Aditya Rio Prabowo, Zainal Arifin**

<https://doi.org/10.18280/ijht.400208>

Page 415-422

[PDF Full-text \(/pdf-viewer/11178\)](#) | [HTML Full-text \(/journals/ijht/paper/10.18280/ijht.400208\)](#) | [Citation](#)

 [DOWNLOAD PDF \(/download/file/fid/75523\)](#)

 OPEN ACCESS



## Thermal Efficiencies of Photovoltaic Thermal (PVT) with Bi-Fluid Cooling System


(/journals/ijht/paper/10.18280/ijht.400209)

**Nurul Shahirah Binti Rukman, Ahmad Fudholi, Wahidin Nuriana, Ghalya Pikra, Henny Sudiby, Ridwan Arief Subekti, Anjar Susatyo, Yusuf Suryo Utomo, Edy Riyanto, Yadi Radiansah, Arief Heru Kuncoro, Haznan Abimanyu**

<https://doi.org/10.18280/ijht.400209>

Page 423-428

[PDF Full-text \(/pdf-viewer/11160\)](#) | [HTML Full-text \(/journals/ijht/paper/10.18280/ijht.400209\)](#) | [Citation](#)

 [DOWNLOAD PDF \(/download/file/fid/75489\)](#)

 OPEN ACCESS


## Evaluation and Improvement of the Comprehensive Cost-Benefit of Investment and Operation of New Energy Heating System (/journals/ijht/paper/10.18280/ijht.400210)

**Meng Zhang**

<https://doi.org/10.18280/ijht.400210>

Page 429-435

[PDF Full-text \(/pdf-viewer/11172\)](#) | [HTML Full-text \(/journals/ijht/paper/10.18280/ijht.400210\)](#) | [Citation](#)

 [DOWNLOAD PDF \(/download/file/fid/75492\)](#)

 OPEN ACCESS


## Influence of Internal Fins and Nanoparticles on Heat Transfer Enhancement Through a Parabolic Trough Solar Collector (/journals/ijht/paper/10.18280/ijht.400211)

**Mujahid K. Badr, Farooq H. Ali, M. Sheikholeslami**

<https://doi.org/10.18280/ijht.400211>

Page 436-448

[PDF Full-text \(/pdf-viewer/11179\)](#) | [HTML Full-text \(/journals/ijht/paper/10.18280/ijht.400211\)](#) | [Citation](#)

 [DOWNLOAD PDF \(/download/file/fid/75494\)](#)

 OPEN ACCESS


## Experimental Investigation of Performance of Conventional Vapor Compression Refrigeration Cycle Using Geothermal Cooling in Extreme Hot Weather Conditions (/journals/ijht/paper/10.18280/ijht.400212)

**Mays Alaa Ismael, Samir Gh. Yahya, Itimad D.J. Azzawi**

<https://doi.org/10.18280/ijht.400212>

Page 449-456

[PDF Full-text \(/pdf-viewer/11185\)](#) | [HTML Full-text \(/journals/ijht/paper/10.18280/ijht.400212\)](#) | [Citation](#)

 [DOWNLOAD PDF \(/download/file/fid/75497\)](#)

 OPEN ACCESS




### Steady-State Solution of MHD Heat and Mass Transfer Fluid Flow over a Semi-Infinite Vertical Plate in a Rotating System Dipped in a Porous Medium with Hall Current, Thermal Radiation, Heat Generation/Absorption and Joule Heating (/journals/ijht/paper/10.18280/ijht.400213)

**Saykat Poddar, Muhammad Minarul Islam, Jannatul Ferdouse, Md. Mahmud Alam**

<https://doi.org/10.18280/ijht.400213>

Page 457-467

[PDF Full-text \(/pdf-viewer/11186\)](#) | [HTML Full-text \(/journals/ijht/paper/10.18280/ijht.400213\)](#) | [Citation](#)

 [DOWNLOAD PDF \(/download/file/fid/75498\)](#)

 OPEN ACCESS


### Heat Index Estimation of Ventilating Air-Conditioning Heating Area Considering Thermal Comfort (/journals/ijht/paper/10.18280/ijht.400214)

**Zhibin Luo**

<https://doi.org/10.18280/ijht.400214>

Page 468-474

[PDF Full-text \(/pdf-viewer/11152\)](#) | [HTML Full-text \(/journals/ijht/paper/10.18280/ijht.400214\)](#) | [Citation](#)

 [DOWNLOAD PDF \(/download/file/fid/75499\)](#)

 OPEN ACCESS

### MHD Mixed Convective Heat Transfer of Cu-Al<sub>2</sub>O<sub>3</sub> Water Hybrid Nanofluid over a Stretching Wedge with Ohmic Heating


(/journals/ijht/paper/10.18280/ijht.400215)

**AbdElNasser S. Mahdy, Taghreed H. Al-Arabi, Ahmed M. Rashad, Wafaa Saad**

<https://doi.org/10.18280/ijht.400215>

Page 475-481

[PDF Full-text \(/pdf-viewer/11157\)](#) | [HTML Full-text \(/journals/ijht/paper/10.18280/ijht.400215\)](#) | [Citation](#)

 [DOWNLOAD PDF \(/download/file/fid/75503\)](#)

 OPEN ACCESS


### Stress of ZrN-Coated Cutting Tools under High Temperature Friction (/journals/ijht/paper/10.18280/ijht.400216)

**Min Niu**

<https://doi.org/10.18280/ijht.400216>

Page 482-488

[PDF Full-text \(/pdf-viewer/11162\)](#) | [HTML Full-text \(/journals/ijht/paper/10.18280/ijht.400216\)](#) | [Citation](#)

 [DOWNLOAD PDF \(/download/file/fid/75510\)](#)

 OPEN ACCESS






## Heat Transfer from a Hybrid Pulsating and Swirling Air Jet Impingement (</journals/ijht/paper/10.18280/ijht.400217>)

**Abhay Gudi, Vijaykumar Hindsageri**

<https://doi.org/10.18280/ijht.400217>

Page 489-496

[PDF Full-text \(/pdf-viewer/11165\)](/pdf-viewer/11165) | [HTML Full-text \(/journals/ijht/paper/10.18280/ijht.400217\)](#) | [Citation](#)

 [DOWNLOAD PDF \(/download/file/fid/75506\)](/download/file/fid/75506)

 OPEN ACCESS


## Improvement of Heat Transfer by Using Porous Media, Nanofluid, and Fins: A Review (</journals/ijht/paper/10.18280/ijht.400218>)

**Abbas Fadhil Khalaf, Ali Basem, Hasan Qahtan Hussein, Ali Kadhim Jasim, Karrar A. Hammoodi, Ammar M. Al-Tajer, Ihab Omer, Mujtaba A. Flayyih**

<https://doi.org/10.18280/ijht.400218>

Page 497-521

[PDF Full-text \(/pdf-viewer/11151\)](/pdf-viewer/11151) | [HTML Full-text \(/journals/ijht/paper/10.18280/ijht.400218\)](#) | [Citation](#)

 [DOWNLOAD PDF \(/download/file/fid/75509\)](/download/file/fid/75509)

 OPEN ACCESS


## Experimental Analysis and Performance Investigation of Immiscible Super-Critical CO<sub>2</sub> Flooding Processes in Tight Oil Reservoir (</journals/ijht/paper/10.18280/ijht.400219>)

**Yunzhu Zhou, Tianyang Liu, Guoqiang Sang, Hengyu Lyu, Xiuqin Lyu, Binhui Li**

<https://doi.org/10.18280/ijht.400219>

Page 522-526

[PDF Full-text \(/pdf-viewer/11177\)](/pdf-viewer/11177) | [HTML Full-text \(/journals/ijht/paper/10.18280/ijht.400219\)](#) | [Citation](#)

 [DOWNLOAD PDF \(/download/file/fid/75508\)](/download/file/fid/75508)

 OPEN ACCESS


## Effect of Swirl on Temperature Decay Function in Straight Blade Liquid Fuel Swirl Burner (</journals/ijht/paper/10.18280/ijht.400220>)

**Olanrewaju Miracle Oyewola, Ademola Samuel Akinwonmi, Olusegun Olufemi Ajide, Tajudeen Ogunniyi Abiola Salau**

<https://doi.org/10.18280/ijht.400220>

Page 527-534

[PDF Full-text \(/pdf-viewer/11181\)](/pdf-viewer/11181) | [HTML Full-text \(/journals/ijht/paper/10.18280/ijht.400220\)](#) | [Citation](#)

 [DOWNLOAD PDF \(/download/file/fid/75507\)](/download/file/fid/75507)

 OPEN ACCESS



### Effect of Heat Input and Filling Ratio on Raise in Temperature of the Oscillating Heat Pipe with Different Working Fluids Using ANN Model


(/journals/ijht/paper/10.18280/ijht.400221)

**M. Prashanth, D. Madhu, K. Ramanarasimh, R Suresh**

<https://doi.org/10.18280/ijht.400221>

Page 535-542

[PDF Full-text \(/pdf-viewer/11183\)](#) | [HTML Full-text \(/journals/ijht/paper/10.18280/ijht.400221\)](#) | [Citation](#)

 [DOWNLOAD PDF \(/download/file/fid/75511\)](/download/file/fid/75511)

 OPEN ACCESS

### Heat Flow Field Analysis on Heat Dissipation Features of High-Wattage Power Cabinets


(/journals/ijht/paper/10.18280/ijht.400222)

**Yongfang Lu**

<https://doi.org/10.18280/ijht.400222>

Page 543-548

[PDF Full-text \(/pdf-viewer/11148\)](#) | [HTML Full-text \(/journals/ijht/paper/10.18280/ijht.400222\)](#) | [Citation](#)

 [DOWNLOAD PDF \(/download/file/fid/75512\)](/download/file/fid/75512)

 OPEN ACCESS


### Soret-Driven Convection of Non-Newtonian Binary Fluids in a Shallow Cavity Uniformly Heated from Below: Case of Opposing Flows (/journals/ijht/paper/10.18280/ijht.400223)

**Khadija Bihiche, Mohamed Lamsaadi**

<https://doi.org/10.18280/ijht.400223>

Page 549-560

[PDF Full-text \(/pdf-viewer/11182\)](#) | [HTML Full-text \(/journals/ijht/paper/10.18280/ijht.400223\)](#) | [Citation](#)

 [DOWNLOAD PDF \(/download/file/fid/75513\)](/download/file/fid/75513)

 OPEN ACCESS

### Design-Based Response Surface Methodology in Optimizing the Dry Washing Purification Process of Biodiesel from Waste Cooking Oil


(/journals/ijht/paper/10.18280/ijht.400224)

**Bayu Rudiyanto, Muhamad Andrianto, Bambang Piluharto, Miftah Hijriawan**

<https://doi.org/10.18280/ijht.400224>

Page 561-568

[PDF Full-text \(/pdf-viewer/11159\)](#) | [HTML Full-text \(/journals/ijht/paper/10.18280/ijht.400224\)](#) | [Citation](#)

 [DOWNLOAD PDF \(/download/file/fid/75514\)](/download/file/fid/75514)

 OPEN ACCESS




### The Influence of Air Curtains on Fire Smoke in Tunnels (/journals/ijht/paper/10.18280/ijht.400225)

**Xiaohua Jin, Jiankun Gong, Zhihao Lin, Shunheng Hua**

<https://doi.org/10.18280/ijht.400225>

Page 569-576

[PDF Full-text \(/pdf-viewer/11168\)](#) | [HTML Full-text \(/journals/ijht/paper/10.18280/ijht.400225\)](#) | [Citation](#)

 [DOWNLOAD PDF \(/download/file/fid/75515\)](/download/file/fid/75515)

 OPEN ACCESS


### Identifying of Unsteady Performance of Oil to Water Heat Exchanger Integrated with Process (/journals/ijht/paper/10.18280/ijht.400226)

**Johain J. Faraj, Fawizea M. Hussein, Ahmed J. Hamad**

<https://doi.org/10.18280/ijht.400226>

Page 577-582

[PDF Full-text \(/pdf-viewer/11147\)](#) | [HTML Full-text \(/journals/ijht/paper/10.18280/ijht.400226\)](#) | [Citation](#)

 [DOWNLOAD PDF \(/download/file/fid/75500\)](/download/file/fid/75500)

 OPEN ACCESS


### Tilt Angle Optimization and Investigation of the Behavior of a Flat Plate Solar Collector Using MATLAB for Kurdistan Climate Conditions-Iraq (/journals/ijht/paper/10.18280/ijht.400227)

**Kamran K.F. Rashid, Idres I.A. Hamakhan, Chalng C.H. Mohammed**

<https://doi.org/10.18280/ijht.400227>

Page 583-591

[PDF Full-text \(/pdf-viewer/11155\)](#) | [HTML Full-text \(/journals/ijht/paper/10.18280/ijht.400227\)](#) | [Citation](#)

 [DOWNLOAD PDF \(/download/file/fid/75529\)](/download/file/fid/75529)

 OPEN ACCESS


### Regional Construction and Differences of Thermal Environment in Vernacular Buildings (/journals/ijht/paper/10.18280/ijht.400228)

**Juan Chen, Jianrong Yang**

<https://doi.org/10.18280/ijht.400228>

Page 592-598

[PDF Full-text \(/pdf-viewer/11170\)](#) | [HTML Full-text \(/journals/ijht/paper/10.18280/ijht.400228\)](#) | [Citation](#)

 [DOWNLOAD PDF \(/download/file/fid/75502\)](/download/file/fid/75502)

 OPEN ACCESS


### An Effect of Zeolite Size on Performance of Dry Scrubber in Tar Removal of Biomass Derived Syngas (/journals/ijht/paper/10.18280/ijht.400229)

**Sudarsono, Anak A.P. Susastriawan, Yuli Purwanto, La Astamu**

<https://doi.org/10.18280/ijht.400229>

Page 599-603

[PDF Full-text \(/pdf-viewer/11175\)](#) | [HTML Full-text \(/journals/ijht/paper/10.18280/ijht.400229\)](#) | [Citation](#)

 [DOWNLOAD PDF \(/download/file/fid/75504\)](/download/file/fid/75504)

 OPEN ACCESS


### Thermal Fault Detection and Severity Analysis of Mechanical and Electrical Automation Equipment (/journals/ijht/paper/10.18280/ijht.400230)

**Yan Cheng**

<https://doi.org/10.18280/ijht.400230>

Page 604-610

[PDF Full-text \(/pdf-viewer/11158\)](#) | [HTML Full-text \(/journals/ijht/paper/10.18280/ijht.400230\)](#) | [Citation](#)

 [DOWNLOAD PDF \(/download/file/fid/75487\)](#)

 OPEN ACCESS


### Influence of Evaporator Superheating and Pressure on the Performance ORC with R134a (/journals/ijht/paper/10.18280/ijht.400231)

**Dhae H. Al-Badri, Ali A.F. Al-Hamadani, Ahmed H. Al-Hassani**

<https://doi.org/10.18280/ijht.400231>

Page 611-618

[PDF Full-text \(/pdf-viewer/11169\)](#) | [HTML Full-text \(/journals/ijht/paper/10.18280/ijht.400231\)](#) | [Citation](#)

 [DOWNLOAD PDF \(/download/file/fid/75490\)](#)

 OPEN ACCESS


### Dynamic Characteristics Analysis of Tri-Stable Cantilever Piezoelectric Energy Harvester with a Novel-type Dynamic Amplifier (/journals/ijht/paper/10.18280/ijht.400232)

**Dawei Man, Huaiming Xu, Gaozheng Xu, Deheng Xu, Liping Tang, Qinghu Xu**

<https://doi.org/10.18280/ijht.400232>

Page 619-626

[PDF Full-text \(/pdf-viewer/11174\)](#) | [HTML Full-text \(/journals/ijht/paper/10.18280/ijht.400232\)](#) | [Citation](#)

 [DOWNLOAD PDF \(/download/file/fid/75493\)](#)

 OPEN ACCESS


### CFD Evaluation of Air Conditioning on the Distribution and Dispersion of COVID-19 Virus in a Room (/journals/ijht/paper/10.18280/ijht.400233)

**Wajeeh Kamal Hasan, Mohammed Mousa Al-azzawi, Atheer Raheem Abdullah, Laith Jaafer Habeeb**

<https://doi.org/10.18280/ijht.400233>

Page 627-633

[PDF Full-text \(/pdf-viewer/11176\)](#) | [HTML Full-text \(/journals/ijht/paper/10.18280/ijht.400233\)](#) | [Citation](#)

 [DOWNLOAD PDF \(/download/file/fid/75496\)](#)

 OPEN ACCESS


### Thermomechanical Coupling Analysis of the Lining Structure of the Tunnel Entrance in Cold Regions Based on Peridynamics (/journals/ijht/paper/10.18280/ijht.400234)

**Yunfeng Ma, Linsheng Xu, Ximei Shi**

<https://doi.org/10.18280/ijht.400234>

Page 634-640

[PDF Full-text \(/pdf-viewer/11149\)](#) | [HTML Full-text \(/journals/ijht/paper/10.18280/ijht.400234\)](#) | [Citation](#)

 [DOWNLOAD PDF \(/download/file/fid/75516\)](#)

 OPEN ACCESS




## Design and Construction Solar Oven Sterilizer (/journals/ijht/paper/10.18280/ijht.400235)

**Mohammed Mohsen Jassim, Mohammed Hassan Abbood, Farhan Lafta Rashid**

<https://doi.org/10.18280/ijht.400235>

Page 641-645

[PDF Full-text \(/pdf-viewer/11156\)](#) | [HTML Full-text \(/journals/ijht/paper/10.18280/ijht.400235\)](#) | [Citation](#)

 [DOWNLOAD PDF \(/download/file/fid/75517\)](#)

 OPEN ACCESS


## Analysis of Thermal Interactions in the Slag Pots for Transporting Copper Slags (/journals/ijht/paper/10.18280/ijht.400236)

**Adam Szklarz, Adam W. Bydalek, Piotr Migas, Andrzej Pytel, Krzysztof Jaśkowiec, Adam Bitka, Michał Wójcicki, Stanisław Pysz, Robert Żuczek**

<https://doi.org/10.18280/ijht.400236>

Page 646-652

[PDF Full-text \(/pdf-viewer/11184\)](#) | [HTML Full-text \(/journals/ijht/paper/10.18280/ijht.400236\)](#) | [Citation](#)

 [DOWNLOAD PDF \(/download/file/fid/75520\)](#)

 OPEN ACCESS


## Battery Thermal Management and Health State Assessment of New Energy Vehicles (/journals/ijht/paper/10.18280/ijht.400237)

**Bin Zhang, Donghui Su**

<https://doi.org/10.18280/ijht.400237>

Page 653-659

[PDF Full-text \(/pdf-viewer/11166\)](#) | [HTML Full-text \(/journals/ijht/paper/10.18280/ijht.400237\)](#) | [Citation](#)

 [DOWNLOAD PDF \(/download/file/fid/75519\)](#)

 OPEN ACCESS



## An Effect of Zeolite Size on Performance of Dry Scrubber in Tar Removal of Biomass Derived Syngas

Sударsono<sup>1,2</sup>, Anak A.P. Susastriawan<sup>1\*</sup>, Yuli Purwanto<sup>1</sup>, La Astamu<sup>1</sup>

<sup>1</sup> Dept. of Mechanical Engineering, Institut Sains dan Teknologi AKPRIND, Jl. Kalisahak No 28, Yogyakarta 55222, Indonesia

<sup>2</sup> Dept. of Environmental Engineering, Institut Sains dan Teknologi AKPRIND, Jl. Kalisahak No 28, Yogyakarta 55222, Indonesia

Corresponding Author Email: [agung589E@akprind.ac.id](mailto:agung589E@akprind.ac.id)

<https://doi.org/10.18280/ijht.400229>

### ABSTRACT

**Received:** 15 January 2022

**Accepted:** 23 March 2022

**Keywords:**

*effectiveness, gasification, scrubber, tar, zeolite*

Increasing attention on the use of biomass derived syngas as internal combustion engine fuel, impacts on rising the demand of the scrubber for tar removal of the syngas. Wet scrubber is been used widely for this purpose. However, the liquid adsorbent containing tar may harmful when exposes to the environment. Thus to encounter the problem, the present work proposes the use of dry scrubber with zeolite as an adsorbent. The work aims to develop a simple and low cost zeolite scrubber and investigate and effect of zeolite size on performance of the scrubber for tar removal of syngas from biomass gasification. The result shows that zeolite size is proportional to specific area, heat transfer rate, and scrubber's effectiveness. The highest scrubber's effectiveness of 0.25 is obtained for the smallest zeolite size, i.e. 30 mm.

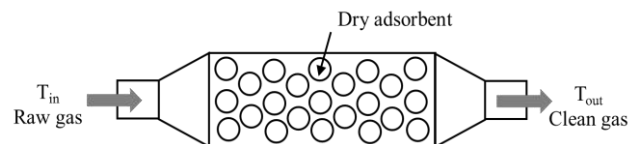
### 1. INTRODUCTION

In order to be used as a fuel of internal combustion engine, a syngas from biomass gasification has to be cleaned. The solid particle and tar content in the producer should be removed [1-3]. Tar content in the syngas should be less than 100 mg/Nm<sup>3</sup> [4] when the gas is intended for internal combustion engine application. Tar reduction can be performed either by primary method and/or secondary method. In the primary method, tar removal process occurs inside the gasifier. Meanwhile in secondary method, tar removal process takes place at downstream of the gasifier exit [5, 6]. Due to simplicity, mechanical technique is widely selected in secondary method, such as wet scrubber and dry scrubber. The scrubbing liquids have been used in wet scrubber are water [7, 8], waste palm oil [9], vegetable oil [7, 10] and diesel fuel, biodiesel fuel, and engine oil [10].

Generally, the after used liquid adsorbent, such as water, is required treatment before disposing to the environment. Tar is water soluble and create issues with waste water remediation in water [11]. The treatment of liquid adsorbent such as water need additional cost in producer gas clean-up process [12]. Thus, dry scrubber with solid adsorbent is developed and tested. Several materials have been used as dry adsorbent, such as bio-char [13] and a catalytic filter candle [14]. The concept of dry scrubber is similar to bed filter where solid material is used as filter bed. Bed filter is promising technology for hot gas clean-up which can be operated either in fixed bed, moving bed, or fluidized bed [15]. Due to low cost filter media and have constant pressure drop, granular bed filters are more attractive, especially when the filter is operated as a moving bed [16, 17].

Based on the concept of fixed bed filter, the process that occur in the fixed bed scrubber is illustrated by a schematic

diagram in Figure 1. The scrubber is filled with solid adsorbent. The adsorbent acts as a coolant and an absorber of condensate tar. Syngas containing tar vapor (raw gas) enter the scrubber at high temperature ( $T_{in}$ ). The syngas and tar vapor pass through the solid adsorbent whose temperature is lower than the gas temperature. Cooling of the gas occurs, heat from the gas is adsorbed by the adsorbent. The temperature of the syngas and tar vapor reduces, in some extend reaches tar condensation temperature. Tar vapor condenses into liquid tar which is adsorbed by the adsorbent. The syngas with less tar content (clean gas) exit the gasifier at low temperature ( $T_{out}$ ). High temperature producer gas actually may impact the structure of the zeolite. However, this effect is not discussed in the present work, since the limitations of zeolite composition before and after used.



**Figure 1.** Schematic diagram of dry scrubber

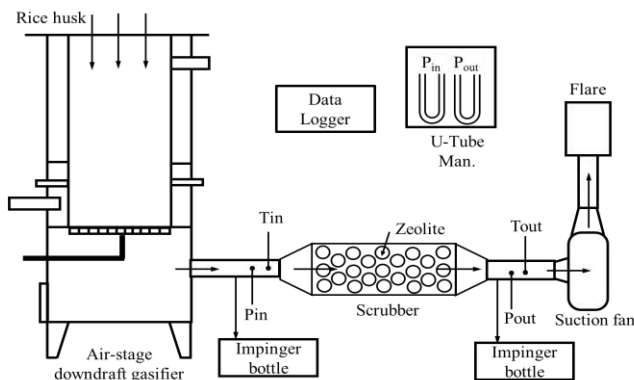
#### Novelty statement:

The present work proposes a zeolite dry scrubber for tar removal of syngas from biomass gasification. The work aims to develop a low cost and an effective natural zeolite scrubber and to investigate and effect of zeolite diameter on performance of the scrubber. The innovation and novelty of the present work is the use of natural zeolite for tar removal of a producer gas from rice husk gasification. No previous works have been reported on the use of zeolite scrubber in the area of gasification so far.

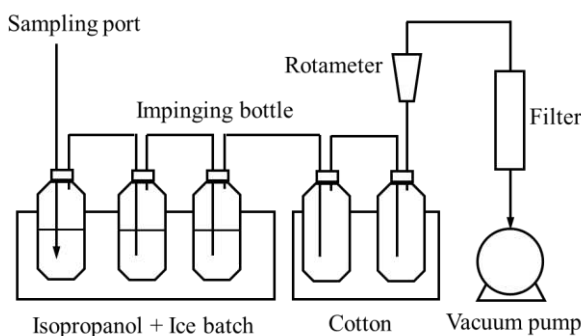
## 2. METHOD

### 2.1 Data collection

Figure 2 presents the schematic diagram of the experimental setup in the present study. The zeolite scrubber is attached at downstream of the downdraft gasifier. The scrubber shell is made from PVC pipe. The tests are conducted by variation in zeolite diameter, i.e. 30, 40, and 50 mm. For each test, the mass of the zeolite filled to the scrubber is 2.3 kg. The temperature and pressure are measured at the inlet and the outlet of the scrubber. K-type thermocouples and u-tube manometers are used to measure the temperature and the pressure. Temperature data are logged into GraphTech 240 data logger. Meanwhile to figure out tar content before and after scrubbing, the impinging bottle method is adopted. The unit of the impinging bottle is shown in Figure 3. The gas is by-passed to the series of bottle filled with Isopropanol at inlet and outlet of the scrubber using a vacuum pump. The gas flow rate to the impinging bottles is measured using rotameter. The isopropanol containing tar is collected from the bottle and oven it at temperature of 50°C for 2 hours. Isopropanol evaporates and tar remains. The remaining tar is then weighted to obtain tar gravimetric. During the investigation, it is assumed no losses of the producer gas flow from the reactor exit to the impinging bottle.



**Figure 2.** Schematic diagram of the experimental setup



**Figure 3.** Tar sampling unit of the impinging bottle

### 2.2 Data analysis

Once data of temperatures, pressure, and tar gravimetric are obtained, the performance of the zeolite scrubber is analyzed in terms of heat transfer rate, pressure drop along the scrubber, tar content of the syngas, and effectiveness of the scrubber. Assuming no heat loss through the scrubber's shell, heat

transfer rate from the syngas to the zeolite is calculated using Eq. (1):

$$Q = \frac{m \times c_{p,g} \times (T_{in} - T_{out})}{t} \quad (1)$$

where,  $Q$  is the heat transfer rate from the syngas to the zeolite (kW),  $m$  is the mass of syngas (kg),  $c_{p,g}$  is the specific heat of syngas (is assumed to be 4.18 kJ/kg.K),  $(T_{in}-T_{out})$  is the temperature difference at inlet and outlet of the scrubber ( $^{\circ}\text{C}$ ), and  $t$  is the duration of the test (s). The mass of the syngas is estimated from the mass balance of the 3 kg rice husk gasification using air at equivalence ratio of 0.3 which is estimated to be 4.68 kg.

The pressure drop is obtained by the data of water level difference in the u-tube manometers at inlet and outlet of the scrubber and calculated using Eq. (2):

$$\Delta P = (mmH_2O)_{in} - (mmH_2O)_{out} \quad (2)$$

Meanwhile, tar content before and after scrubbing and effectiveness of the scrubber are evaluated using Eq. (3) and Eq. (4), respectively.

$$TC = \frac{m_T}{\dot{V}_g \times t} \quad (3)$$

$$\varepsilon = \frac{TC_{in} - TC_{out}}{TC_{in}} \quad (4)$$

where,  $TC$  is tar content of the syngas (g tar/ $\text{Nm}^3$  gas),  $m_T$  is the tar gravimetric (kg),  $\dot{V}_g$  is the volume flow rate of the syngas to the impinging bottle ( $\text{m}^3/\text{s}$ ),  $t$  is the test duration (s),  $\varepsilon$  is the scrubber's effectiveness, subscripts in and out refer before and after the scrubber.

## 3. RESULTS AND DISCUSSION

Figure 4 reveals temperature profile of the syngas entering and leaving the scrubber of 30, 40, and 50 mm zeolite diameter, respectively. The profile temperatures of the inlet and outlet syngas are similar for the scrubber with 30, 40, and 50 mm zeolite diameter. The temperatures increase as gasification proceeds longer. After passing the scrubber, the temperature of the syngas reduces, i.e.  $T_{in} < T_{out}$ . Heat transfer occurs from the syngas to the zeolite. Temperature of the syngas reduces and temperature of the zeolite steps-up. An average temperature difference ( $\Delta T$ ) of the syngas at inlet and outlet of the scrubber is given in Figure 5. The graph in Figure 5 shows the average temperature difference ( $\Delta T$ ) declines as zeolite diameter expands. Specific contact area of heat transfer between syngas and the zeolite reduces as increasing diameter of the zeolite, thus heat transfer rate also decreasing as increasing diameter of the zeolite as shown in Figure 5. The average temperature difference of the syngas at inlet and outlet of the scrubber are 23.7, 19.6, and 17.3 $^{\circ}\text{C}$  for zeolite diameter of 30, 40, and 50 mm, accordingly. The temperature difference of the producer gas at inlet and exit of the scrubber is relatively small. This is due to the diameter of the zeolite investigated in the present work is relatively large. Thus, low heat transfer contact area between zeolite and producer gas, in turns low heat transfer rate. As can be seen in Figure 6, the values of heat transfer are 15.5, 13.6, and 12.5 kW.

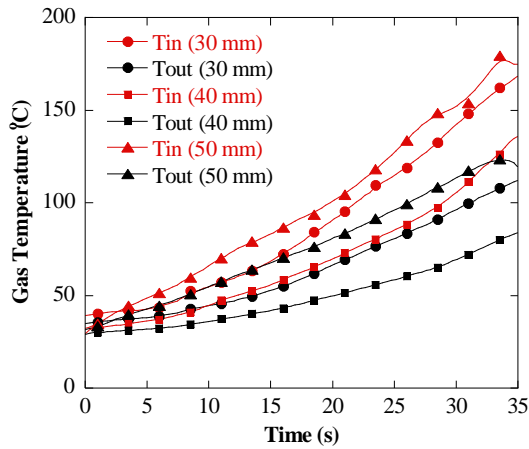


Figure 4. Temperature of the producer gas at inlet and outlet of the scrubber

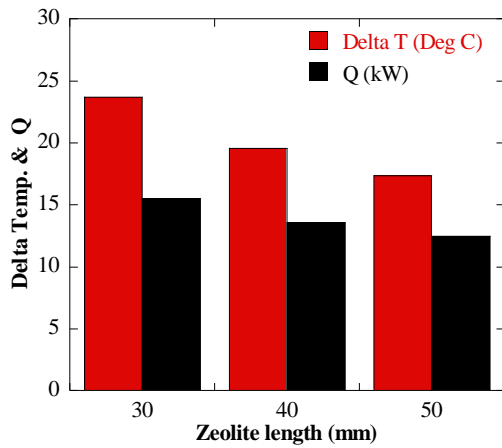


Figure 5. Temperature difference and heat rate

Meanwhile, Figure 6 displays an effect of zeolite diameter on tar content after scrubbing and effectiveness of the scrubber. Tar reduction after scrubbing can be observed by comparing tar content before scrubber (TC1) and after scrubber (TC2). It can be interpreted that the highest tar reduction is achieved at zeolite diameter of 30 mm. The difference between TC1 and TC2 is the largest for the use of 30 mm zeolite. The tar reduction decreases as zeolite diameter expands. This trend of decreasing tar reduction as increasing zeolite diameter impacts a similar trend on effectiveness of the scrubber. Regardless the effect of inlet temperature of the producer gas, the effectiveness of the scrubber declines significantly as diameter of the zeolite goes up from 30 mm to 50 mm. For the use of zeolite diameter of 30, 40, and 50 mm, the values of the effectiveness are 0.25, 0.17, and 0.13, respectively. However, more accurate result could be obtained by maintaining the same inlet temperatures of the producer gas for all zeolite diameter investigation. As diameter of the zeolite moves up, the heat transfer area between syngas and the zeolite reduces, in turns heat transfer rate from the syngas to the zeolite reduces (Figure 5). It means that cooling process becomes slower with larger zeolite diameter. This results in condensing rate of the tar is also slower, hence less tar vapor condenses when a larger zeolite is used. In order to increase effectiveness of the scrubber, additional filter layer could be attached in after scrubber outlet.

In the present work, very small pressure drop is noticed. The size of the zeolite observed in the present work is in order of mm which is relatively large compared than general granular bed filter. The resistance of syngas flow in the scrubber due to zeolite bed is very small, since the size of the zeolite is large.

Thus, no significant pressure different between syngas inlet and syngas outlet occurs in the present study. Theoretically, the pressure drop increases as zeolite size reduces. The specific contact area steps-up as reducing zeolite size, hence affect in increasing flow resistance to the syngas, hence pressure drop increases. Particle size of the filter gave more affect to pressure drop than to its filtration efficiency [18].

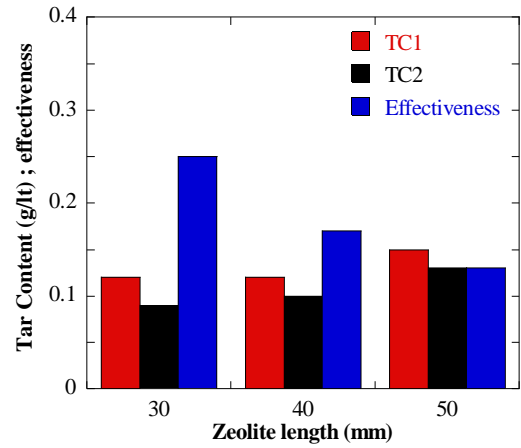


Figure 6. Tar content and effectiveness

The finding of the present work proves that diameter size for given mass of the zeolite adsorbent affects the specific contact area, heat transfer rate, and tar removal effectiveness of the scrubber. The size of the zeolite is proportional to specific area, heat transfer rate, and scrubber's effectiveness as shown in Figure 7. When the zeolite size coarser, its specific contact area become smaller, hence heat transfer rate decreases in which reduces the condensation rate of the tar vapor that leads decreasing tar removal effectiveness of the scrubber. Ma et al. [19] found that Ca/S molar ratio. It can be seen that SO<sub>2</sub> removal efficiency increases with decrease in particle size. When the sorbent is finer, its specific surface area becomes larger, which leads to higher contact efficiency.

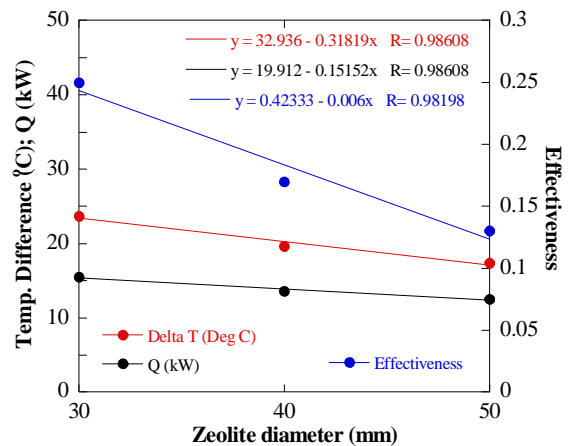


Figure 7. Relation between  $d_p$ ,  $\Delta T$ ,  $Q$ , and  $\epsilon$

Meanwhile, Figure 8 displays photograph of the zeolite before and after being used. It is observed that zeolite surface color turns from white color before being used to brown color after being used. The tar condensate sticks to the surface of the zeolite, tar deposits on the zeolite surface and causes grey color of the zeolite after being used as adsorbent of the dry scrubber. From Figure 8, it can be stated cooling and scrubbing



of the syngas occur less effective during the test. Several zeolite is still in white color after being used which indicated that cooling and scrubbing syngas is non-uniform in the scrubber. This may be caused by the syngas flows only over the top layer of the zeolite, thus the cooling and scrubbing occurs only on that layer. To overcome this phenomenon, the pressure of the syngas entering the scrubber should be increased, such “non-uniform” phenomenon shouldn’t appear, it should be relatively uniform.



**Figure 8.** Photograph of the zeolite before and after being used

#### 4. CONCLUSIONS

The zeolite scrubber is fabricated and attached at downstream of the downdraft gasifier. The scrubber performance of the scrubber is evaluated by varying diameter of the zeolite such that 30, 40, and 50 mm. It can be concluded that diameter size of the zeolite affect specific contact area, heat transfer rate, and effectiveness of the scrubber. The contact area, heat transfer rate, and effectiveness of the scrubber rise-up as zeolite size becomes smaller. The highest effectiveness of the scrubber of 0.25 for the use of 30 mm zeolite adsorbent. In the future work, more accurate result could be obtained by maintaining the same inlet temperatures of the producer gas for all zeolite diameter investigation.

#### ACKNOWLEDGMENT

The authors would like to thank Department of Mechanical Engineering, Institut Sains dan Teknologi AKPRIND for supporting the laboratory facility during the work.

#### REFERENCES

[1] Du, X., Li, Y. (2019). Experimental comparison and optimization on granular bed filters with three types of filling schemes. *Applied Energy*, 253: 113563. <https://doi.org/10.1016/j.apenergy.2019.113563>

[2] Tuomi, S., Kurkela, E., Simell, P., Reinikainen, M. (2015). Behaviour of tars on the filter in high temperature filtration of biomass-based gasification gas. *Fuel*, 139: 220-231. <https://doi.org/10.1016/j.fuel.2014.08.051>

[3] Nakamura, S., Kitano, S., Yoshikawa, K. (2016). Biomass gasification process with the tar removal technologies utilizing bio-oil scrubber and char bed. *Applied Energy*, 170: 186-192.

<http://dx.doi.org/10.1016/j.apenergy.2016.02.113>

[4] Milne, T.A., Evans, R.J., Abatzoglou, N. (1998). Biomass gasifier “tars”: Their nature, formation, and conversion. National Renewable Energy Laboratory Report NREL/TP-570-23357.

[5] Anis, S., Zainal, Z.A. (2011). Tar reduction in biomass syngas via mechanical, catalytic and thermal methods: A review. *Renew. Sustain. Energy Rev.*, 15(5): 2355-2377. <https://doi.org/10.1016/j.rser.2011.02.018>

[6] Paethanom, A., Bartocci, P., Alessandro, B.D., Amico, M.D., Testarmata, F., Moriconi, N., Yoshikawa, K., Fantozzi, F. (2013). A low-cost pyrogas cleaning system for power generation: Scaling up from lab to pilot. *Applied Energy*, 111: 1080-1088. <http://dx.doi.org/10.1016/j.apenergy.2013.06.044>

[7] Phuphuakrat, T., Namioka, T., Yoshikawa, K. (2011). Absorptive removal of biomass tar using water and oily materials. *Bioresource Technology*, 102(2): 543-549 <http://doi.org/10.1016/j.biortech.2010.07.073>

[8] Bhave, A.G.A., Vyas, D.K., Patel, J.B. (2008). A wet packed bed scrubber-based syngas cooling–cleaning system. *Renewable Energy*, 33(7): 1716-1720. <http://doi.org/10.1016/j.renene.2007.08.014>

[9] Ahmad, N.A., Zainal, Z.A. (2016). Performance and chemical composition of waste palm cooking oil as scrubbing medium for tar removal from biomass syngas. *Journal of Natural Gas Science and Engineering*, 32: 256-261. <http://dx.doi.org/10.1016/j.jngse.2016.03.015>

[10] Unyaphan, S., Tarnpradab, T., Takahashi, F., Yoshikawa, K. (2017). Improvement of tar removal performance of oil scrubber by producing syngas microbubbles. *Applied Energy*, 205: 802-812. <http://dx.doi.org/10.1016/j.apenergy.2017.08.071>

[11] Woolcock, P.J., Brown, R.C. (2013). A review of cleaning technologies for biomass-derived syngas. *Biomass and Bioenergy*, 52: 54-84. <http://dx.doi.org/10.1016/j.biombioe.2013.02.036>

[12] Abdoulmoumine, N., Adhikari, A., Kulkarni, A. (2015). Chattanathan S. A review on biomass gasification syngas cleanup. *Applied Energy*, 155: 294-307. <http://dx.doi.org/10.1016/j.apenergy.2015.05.095>

[13] Shen, Y., Wang, J., Ge, X., Chen, M. (2016). By-products recycling for syngas cleanup in biomass pyrolysis – An overview. *Renew. Sustain. Energy Rev.*, 59: 1246-1268. <https://doi.org/10.1016/j.rser.2016.01.077>

[14] Rapagnà S., Gallucci K., Di Marcello M., Matt M., Nacken M., Heidenreich S., Foscolo P.U. (2010). Gas cleaning, gas conditioning and tar abatement by means of a catalytic filter candle in a biomass fluidized-bed gasifier. *Bioresource Technology*, 101: 7123–7130. <https://doi.org/10.1016/j.biortech.2010.03.139>

[15] Xiao, G., Wang, X., Zhang, J., Ni, M., Gao, X., Luo, Z., Cen, K. (2013). Granular bed filter: A promising technology for hot gas clean-up. *Powder Technology*, 244: 93-99. <https://doi.org/10.1016/j.powtec.2013.04.003>

[16] Smid, J., Haiou, S.S., Peng, C.Y., Lee, H.T. (2006). Hot gas cleanup: pilot testing of moving bed filters. *Filtration and Separation*, 43(4): 21-24. [https://doi.org/10.1016/S0015-1882\(06\)70864-3](https://doi.org/10.1016/S0015-1882(06)70864-3)

[17] Hadley, T.D., Lim, K.S., Orellana, J., Denke, R.R., Chiang, K., Burkeb, N.R. (2012). The capture of aerosol in a granular moving bed. *Chemical Engineering*

- Research and Design, 90(1): 52-62.  
<https://doi.org/10.1016/j.cherd.2011.07.010>
- [18] Yu, Y.S., Tao, Y.B., Ma, Z., He, Y.L. (2017). Experimental study and optimization on filtration and fluid flow performance of a granular bed filter. Powder Technology, 333: 449-457.  
<https://doi.org/10.1016/j.powtec.2018.04.019>
- [19] Ma, X., Kaneko, T., Tashimo, T., Yoshida, T., Kato, K. (2000). Use of limestone for SO<sub>2</sub> removal from flue gas in the semidry FGD process with a powder-particle spouted bed. Chemical Engineering Science, 55(20): 4643-4652.  
[https://doi.org/10.1016/S0009-2509\(00\)00090-7](https://doi.org/10.1016/S0009-2509(00)00090-7)



# Source details

## International Journal of Heat and Technology

Scopus coverage years: from 1983 to 1993, from 1995 to Present

Publisher: Edizioni ETS

ISSN: 0392-8764

Subject area: Engineering: Mechanical Engineering Chemical Engineering: Fluid Flow and Transfer Processes

Physics and Astronomy: Condensed Matter Physics

Source type: Journal

CiteScore 2021

1.9



SJR 2021

0.297



SNIP 2021

0.602



[View all documents >](#)

[Set document alert](#)

[Save to source list](#) [Source Homepage](#)

[CiteScore](#) [CiteScore rank & trend](#) [Scopus content coverage](#)

### i Improved CiteScore methodology



CiteScore 2021 counts the citations received in 2018-2021 to articles, reviews, conference papers, book chapters and data papers published in 2018-2021, and divides this by the number of publications published in 2018-2021. [Learn more >](#)

CiteScore 2021 ▼

$$1.9 = \frac{1,286 \text{ Citations 2018 - 2021}}{661 \text{ Documents 2018 - 2021}}$$

Calculated on 05 May, 2022

CiteScoreTracker 2022 ⓘ

$$1.4 = \frac{717 \text{ Citations to date}}{515 \text{ Documents to date}}$$

Last updated on 06 June, 2022 • Updated monthly

## CiteScore rank 2021 ⓘ

Category	Rank	Percentile
Engineering		
Mechanical Engineering	#351/601	41st
Chemical Engineering		
Fluid Flow and Transfer Processes	#55/87	37th

[View CiteScore methodology >](#) [CiteScore FAQ >](#) [Add CiteScore to your site](#)



[i](#) [x](#)

## DLMS-62056 source code library

DLMS UA attested ANSI C SCL

Fast GTM - support DLMS / COSEM within a very short time on your metering platform

kalkitech.com OPEN

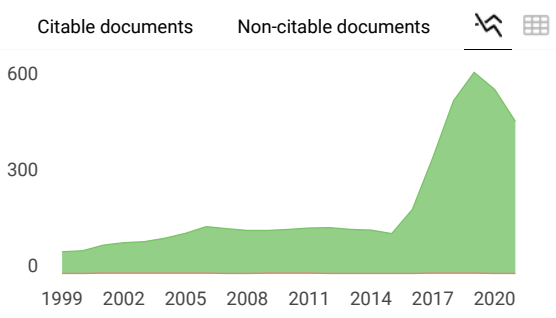
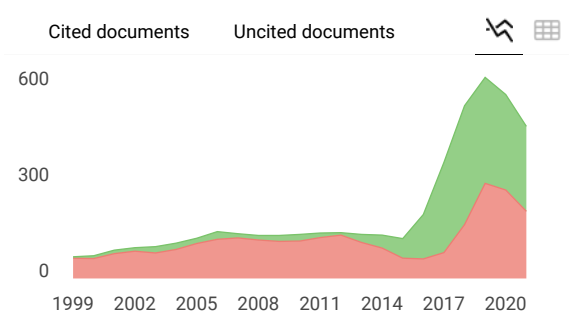
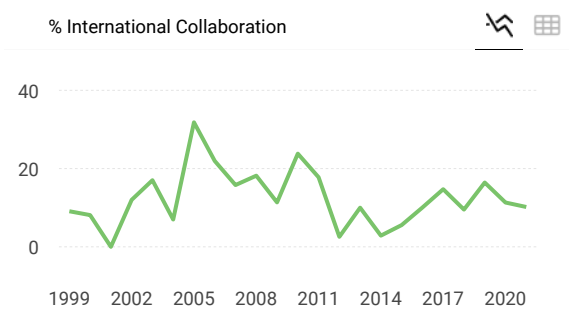
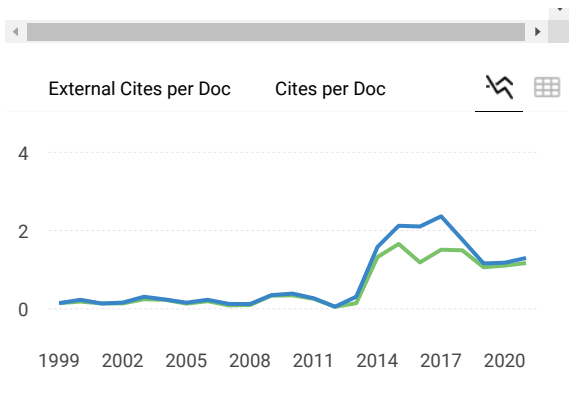
# International Journal of Heat and Technology

COUNTRY	SUBJECT AREA AND CATEGORY	PUBLISHER	H-INDEX
Italy  Universities and research institutions in Italy	Chemical Engineering Fluid Flow and Transfer Processes  Engineering Mechanical Engineering  Physics and Astronomy Condensed Matter Physics	Edizioni E.T.S.	<b>30</b>

PUBLICATION TYPE	ISSN	COVERAGE	INFORMATION
Journals	03928764	1983-1993, 1995-2021	<a href="#">Homepage</a>  <a href="#">How to publish in this journal</a>  <a href="mailto:editor.ijht@iieta.org">editor.ijht@iieta.org</a>

### SCOPE

The IJHT covers all kinds of subjects related to heat and technology, including but not limited to turbulence, combustion, cryogenics, porous media, multiphase flow, radiative transfer, heat and mass transfer, micro- and nanoscale systems, and thermophysical property measurement. The editorial board encourages the authors from all countries to submit papers on the relevant issues, especially those aimed at the practitioner as much as the academic. The papers should further our understanding of the said subjects, and make a significant original contribution to knowledge. The IJHT welcomes original research papers, technical notes and review articles on the following disciplines: -Heat transfer- Fluid dynamics-



**International Journal of Heat and Technology**

Q3 Condensed Matter Physics  
best quartile

SJR 2021 0.3

powered by scimagojr.com

← Show this widget in your own website

Just copy the code below and paste within your html code:

`<a href="https://www.scimag`

**SCImago Graphica**

Explore, visually communicate and make sense of data with our **new data visualization tool**.



Metrics based on Scopus® data as of April 2022

**khadija BIHICHE** 4 weeks ago

Scopus coverage years:from 1983 to 1993, from 1995 to 2021  
Is the journal no longer indexed in scopus?  
(It does not appear on scopus : from 1995 to present?)