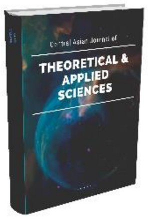

CENTRAL ASIAN JOURNAL OF THEORETICAL AND APPLIED SCIENCES

Volume: 05 Issue: 01 | Jan 2024 ISSN: 2660-5317
https://cajotas.centralasianstudies.org

A Review of the System for Filtering Particulate Matter Affected by Cement Factor

Steffi. R
Assistant Professor, Department of Electronics and Communication,
Vins Christian College of Engineering, Tamil Nadu, India.

Shynu T
Master of Engineering, Department of Biomedical Engineering,
Agni College of Technology, Chennai, Tamil Nadu, India.

S. Suman Rajest
Professor, Dhaanish Ahmed College of Engineering, Chennai, Tamil Nadu, India.

R. Regin
Assistant Professor, Department of Computer Science and Engineering,
SRM Institute of Science and Technology, Ramapuram, India.

Received 28th Nov 2023, Accepted 9th Dec 2023, Online 16h Jan 2024

Abstract: *Problems with breathing or acute lung pain caused by cement specks in the air are common, and the cement producing industry typically has a hard time keeping them under control. Emissions control strategies can focus on preventing dust from being released into the air or on removing dust that has already gotten airborne. Space optimization, duct run length, dust collection procedure, and filter and control equipment selection are some of the primary factors that shape the design and* *fabrication of dust control systems. Both the dust itself and the filtration process must be carefully considered in order for the dust collection system to be well-designed. Among the many advantages of a well-planned dust collection system are a dust-free workplace, which helps lower health risks for employees, increased productivity from different kinds of cement thanks to recycling the dust-free material, and, most importantly, the possibility of energy and cost savings from the filter system. By creating a model of the dust filter system and learning about its components—the exhaust duct, dust collector (sometimes called a "filter box"), and air blower (also called a "fan")—this project teaches us how to optimise the performance and energy efficiency of commercial dust collection systems. The primary goal of this project is to provide a framework for the design and fabrication of a prototype.*

Keywords: *System for Filtering; Particulate Matter Affected; Cement Factor; Filtration Procedure; Systems By Fabricating A Prototype; Dust-Free Environment.*

Introduction

The process of making cement produces a great deal of dust, which is then collected and reused. The issue occurs due to the fact that the dust produced by cement mills is difficult to eliminate [7]. The techno-economic advantages of the energy-saving dry system make it the preferable mode of exploitation for pre-heaters and pre-calciners, outweighing the wet technique in terms of both cost and environmental impact. Since carbon dioxide, sulphur dioxide, nitric oxide gas, and other dust emissions are major environmental concerns, cement companies' air emissions are taken into account [8]. Unlike many other furnacing operations, the dust that is typically produced in cement factories is typically found in the air [9]. They won't hurt plants or animals much, but they're a real pain to deal with, and factories eventually figured out how important it is to keep the inside and outside of the building spotless. This industry makes a number of attempts to control this type of emission, including adjusting the dirt removal system, increasing energy potency, and modifying the item [10]. The coal mill, oven, and cement mill all release dust into the air, which the bag filters trap either internally or outside. In order to clean the filter, a reverse air mechanism or air pulse is used. When particle sizes are between 1 and 5 metric linear unit fluctuate, this filter type is typically cost-effective [11].

The goal of dust collection is to eliminate health and safety hazards caused by airborne particulate matter by removing solid particles from moving air streams [12]. In addition to protecting users from harm, a well-designed system has many other benefits, including as less maintenance and cleanup costs, less wear and tear on equipment, and ongoing compliance with all applicable health regulations [13]. Following the principles of ventilation, dust collection systems divert the air stream that is already filled with dust from the source and direct it, via ductwork, to the collector. The air quality requirements and current regulations determine the dust system to be used [14-19]. When it comes to long-term management, mud assortment systems are dependable and cost-effective. One of the best ways to reduce dust emissions is using the dust collection system, which is also known as the native exhaust ventilation system [20-24]. The entire dust collection system is dependent on the dust collector's performance. First, a well-functioning dust collector can quickly remove airborne particles, clean itself, deposit solids into a hopper, and allow air to pass through its filter media at the correct pressure, all while keeping the system's conveyance velocities accurate and the fan running smoothly [25-31]. Dust collection and conveyance are rendered useless if the dust collector performs poorly, allowing particles to evade the filter, preventive and blocking measures, and well-reduced air flow.

The process of making cement could produce a waste product known as cement kiln dust (CKD). Despite sharing some similarities with partially calcined raw feed in terms of composition, the physical and chemical properties of a variable material can be greatly affected by variations in fuel, method form, dirt sorting systems, and product standards, among other factors[32-39]. Therefore, the material's radical categorization remains unfinished, and CKD's industrial applicability in company and goods is limited. Cement manufacturers are mostly hesitant to use CKD due to its relatively high essential content. Making integrated forms of cement using CKD is one efficient use of the material. Nevertheless, research on the importance of CKD and the material itself in concrete has been patchy at best. Results from previous studies on integrated cement types that use CKD as a partial replacement for cement and pulverised coarse blast-furnace scum and ash have been inconsistent and unpredictable. The results could have been affected immediately by the chemical makeup of the CKD utilised [40-45].

Dust specks represent particles with sizes ranging from 1 to 400 μm, while particles larger than 100 μm sink towards the formation's source. Massive particles, fines, and radical fines are the three terms used to describe particles in the size range of less than one micrometre, particles between twenty and one micrometre, and particles larger than twenty micrometres [46-51]. This graphic depicts the typical particle size distribution of crushed rock. It should be mentioned that smaller particles tend to remain in suspension more significantly, making it more difficult to separate them from the air stream.

Baghouse dust filters are a type of air filter that uses cloth to remove dust and other pollutants. For the purpose of controlling pollution, baghouses are material filter systems that are utilised on an industrial scale. Because of their low price, high efficiency, and relative simplicity of operation, baghouses are among the most popular dust cleaning devices. Cement producers gain from baghouse systems because they collect, contain, and filter airborne dust and particle matter [52-57].

A baghouse is a vertically mounted sheet metal structure that uses cloth or pleated filters that are grouped in rows. They take up air pollution from fugitive or method sources, filter it, and then release clean air. A duct system typically carries the polluted air stream into the baghouse from an associate-elicited air blower [58-61]. Particles remain on the surface of the filter medium while the air stream passes past them, effectively separating them from the air. A variety of cleaning technologies are routinely used to remove the dust from filters as it accumulates and forms a cake on the surface of the filters over time. The type of baghouse determines how it is cleaned. Shaker, pulse-jet, and reverse-air are the three main types of baghouse cleaning systems. We are utilising a reverse air mechanism throughout this project effort [62-71].

Two varieties of reverse air baghouses are available. A spherical reverse air collector, in which dirt accumulates outside the bags or filters, could be the one flecked with cement process dust. A revolving arm processes the bags with reverse air from the instrumentation fan or medium-pressure blower in order to remove debris during cleanup. The atmospheric pressure generated by this type of reverse air baghouse is lower during cleanup compared to the compressed air pulses produced by a pulse jet [72-79]. A low-pressure, high-volume online cleaning system is what it is described as. This kinder cleaning approach reduces bag wear and tear and compressed air value. The benefit of compressed gas comes at a cost, though, in the form of the horsepower needed to operate the reverse air blower and the need of repairs for its moving parts [80].

Oblong housing and several compartments are typical of an older form of baghouse, which is also called reverse air. Like a shaker, the bag traps dirt inside as air flows upwards. In order to make improvements to these types of reverse air baghouses, they are often divided into compartments and cleaned one area at a time. Typically, a system fan is used in the opposite direction of filtration to pressurise an entire compartment [81-85]. The filter bag significantly collapses once activated due to the pressure of the reverse flow of air. In order to prevent these types of reverse air bags from completely collapsing or "pancakeing" when being washed, they have stiff rings that are sewed into the fabric. The need for offline improvement necessitates an oversized reverse air baghouse to accommodate the portion that will be offline during cleaning. Consequently, this type is more expensive than a pulse jet [86-91].

Literature Review

According to research by Purnomo et al. [1], air pollutants from the cement industry pose serious threats to the environment, including dust, sulphur dioxide, nitric oxide, and carbon dioxide. In order to decrease dust emissions, the cement industry uses two main gas cleaning systems: electrostatic precipitator (EP) and bag filter (BF). The electric power required of an EP system is high. Particulate characteristics, including size and resistivity, as well as operating circumstances, including gas temperature, flow velocity, and dust content, significantly impact the operation's performance. Gas temperature and chemical composition both influence particle resistance. Dust will be more difficult to separate by negatively charged electrodes at higher working temperatures because resistance increases with temperature. Cement facilities are well-known for using the BF system because of the strict rules and environmental norms that apply to them. To ensure this system's great efficiency, a specific fabric is used for separation reasons.

According to Abdul Jabbar et al. [2], a study conducted by researchers from Peking University (China) and the University of Connecticut (USA) has shown that air pollution-related health problems may be the cause of one out of fifteen miscarriages in South Asia. An examination of more than 34,000 women's medical records pertaining to miscarriages in Bangladesh, India, and Pakistan formed the basis of the report. Researchers mainly looked at the atmospheric concentration of PM2.5, or particulate matter smaller than 2.5 microns, to gauge the level of air pollution. Airborne solid particles, even at small sizes, pose a serious threat to the cardiovascular system and the respiratory system if they penetrate deeply enough. PM2.5 levels skyrocketed, surpassing the permissible limit by more than five times, at 500 micrograms per cubic metre. In addition, unregulated sectors, like cement mills and coal-fired power stations, release thousands of tonnes of particulate matter and other harmful pollutants into the air every day.

For ultra-low emission, Liu et al. [3] analyse baghouse filter performance in relation to filter pore size and fibre diameter. This study examined the static and dynamic filtration performance of four different types of polyester filters: three types of conventional filters (depth filtration media), and two types of polyester filters coated with polytetrafluoroethylene membranes. The filters tested had different filter pore sizes and fibre diameters. Filtration accuracy (for small particles, such PM2.5) of the fabric structure is enhanced with decreasing pore size of all five filter media. On the other hand, the surface filtration media's dynamic filtration resistance and efficiency were affected by the filter pore size, which in turn affected the dust-blocking rate in the membrane microspores.

(Park et al., [4]) Bag houses are commonly used in many sectors to control particle matter and recover precious materials. The bag house system would not be complete without a bag filter. For this reason, perfecting high-quality filter media and pinpointing the ideal settings for a bag house system are of the utmost importance. Particle penetrations in a bag house system were the subject of this investigation. It looked at how pressure drops across the filter media relate to dust blockage and dust penetration. At the initial stage of filtration, the results demonstrated a collection efficiency of at least 80% for particles with a size of 0.45 μm. Despite this, it bounced back fast and maintained a pressure drop of nearly 20 mmH2O using a recently created porous filter (air permeability = 5.78 × 10−11 m2). Particle size also has a significant impact on the recovery time. At the beginning of the filtration process, it was inversely proportional to the particle size. However, when the filter was cleaned, it became uniform and did not exhibit any change for particles larger than 0.725 μm.

A growing number of nanoparticles, as a result of advances in nanotechnology, have the ability to harm both humans and the environment, according to Liu et al. [5]. One way to keep nanoparticles under control is with a membrane filter. This research looked into three filters that have a polytetrafluoroethylene (PTFE) membrane covering. For particle sizes ranging from 10 to 300 nm, the efficiency drops as the face velocity rises. To show how the filtration efficiency changes with particle size and face velocity, we offer the data in a unique three-dimensional graph. Two layers—a fibrous one and a membrane one—come together to form the membrane-coated filter. We combine the two layer models to create a new model for filtration efficiency. There is good agreement between the experimental data and the model calculation results. Contributing to the decrease of air pollution caused by quickly developing nanoparticles, the study can aid in optimising the filter product and determining the operational parameters of filters. This paper addresses the gaps in research on dust control and reduction technology in fully mechanised mining faces. Using data from the 20106 fully mechanised mining face in Wangjialing Coal Mine, it investigates the theory of long-pressure ventilation and dust control as well as the matching process of short-pumping and dust removal technical parameters. The results offer theoretical guidance for selecting dust control and removal technology technical parameters in the long-pressure short-pumping system in fully mechanised mining faces. By improving the system's efficiency and effectiveness, reducing dust hazards in the fully mechanised mining face, protecting operator health, and eliminating dust explosions, this paper aims to address these shortcomings.

The purpose of the study by Tanabe et al. [6] was to determine the experimental adhesive force of filter cakes in fabric filters and to examine particle deposition in three different kinds of synthetic fabric filters using scanning electron microscopy (SEM). Polyester, polypropylene, and acrylic were the materials utilised. This material was phosphate rock in particle form. During ten cycles, the particles were deposited into the filters at a superficial filtration velocity of 0.10 m/s and a maximum pressure drop across the filter of 980 Pa. Vacuum cleaning with reverse airflow at a speed of 0.12 m/s was employed. Particle deposition depth was found to be lower in the polypropylene filter compared to the polyester and acrylic filters, according to the results. Despite this, the polypropylene had the greatest residual pressure drop at the start of the filtration tests because of its properties and the fact that particles accumulated more significantly on its surface. It was also noted that the polypropylene filter had a larger adhesion force compared to the other filters, which made it more difficult to remove the filter cake from that particular filter.

Problem Definition

The recently developed filtration system known as the Electronic Precipitator is typically used by the tiny cement manufacturers (EP). Since EP technology requires less pressure drop and is easy to operate and maintain, it has seen extensive application. This dust-cleaning device was standard equipment in most early cement factories due to its established technology [92-97]. Because the anode and cathode must be charged in an EP system, a large amount of electric power is required. Gas temperature, air flow rate, dust concentration, particle size, and dust resistivity are some of the operational parameters that have a significant impact on performance. At the same time, hazardous chemicals and gas temperature influence particle resistance. Dust will be more difficult to separate by negatively charged electrodes at higher working temperatures because resistance increases with temperature [98-101].

Here we have an issue because EP uses a lot of power but doesn't deliver good results. Therefore, the most tried-and-true approach to this issue is the Bag Filtering System (BS). Nowadays, cement companies are known for using the BF system because of the strict laws and environmental norms. Using a one-of-a-kind fabric cloth material for specific separation functions allows this system to attain its high efficiency [102-107]. Therefore, the time-honored technique known as the bag filtering system is the way to go for this issue's resolution (BS). The BF system is rising to prominence for cement plants as a result of strict environmental norms and regulations. To ensure this system's great efficiency, a specific fabric is used for separation reasons. We collaborated to plan, design, and manufacture a model of a bag filter house as the Mini Cement plants are investing heavily in EP. More than 90% efficiency, air filtration, and clean air output are all features of our prototype.

Objective

The overarching goal of this project is to improve upon the existing dust-catching systems in cement factories by creating a system that can capture more dust particles than typical dust cleaning systems.

Working Principle

One of the most important steps in making cement is releasing dust into the air. Due to a lack of funding, mini-cement firms will be unable to purchase or equip themselves with technologically sophisticated machinery. Consequently, we intended to create a model of the apparatus that would not contain compressed air but would instead have pressure gauges, valves, and pumps linked to it. Our filtration system, as depicted in the design, includes inlet/outlet pipes, polypropylene bag filters rated at 5-micron and 1-micron, as well as gaskets made of rubber, cork, and fridge gas, as well as silicone sealants (to arrest the air leakage). Cement and other dust particles will be drawn into the machinery via the inlet pipe by means of an air blower (which acts as the inlet dust feeding duct system). Once it was in, we split the machine in half to improve the air-to-cloth ratio, which we used to determine the machine's efficacy in filtering cement dust specks.

First, the cement dust specks hit the first two 5-micron filters as soon as they reach the first chamber; after that, the oversized dust particles fall on the slider plate. With the airflow complete, the dust will exit the first half via the two attached filters and enter the second half via a pipe that connects the two chambers. Dust particles made of cement will press down on two 1-micron filters in the second chamber. At last, the exit pipe starts releasing pure air.

Result and Discussion

In addition, the bag filtration system does not incorporate three additional processes that we have incorporated. Here they are: -1) Mechanism with a sliding plate Method No. 2 for Cleaning the System 3. Indicator for the air filter

The main functions of the slider plate mechanism are to keep the airflow inside the system and to assist in cleaning the dust particles that have become trapped in the hopper walls.

A system cleaning mechanism is designed and introduced to ensure that dust and other particulate matter that has been attracted to the filter system's walls and the hopper is blown out of the hopper and collected in a collecting bin. This is achieved by inserting the air blower into its separate mouth and directing the air through a pipe system that connects the two chambers.

One easy-to-use tool for keeping tabs on the air induction system's filter restriction is the air filter service indicator. It tells you to change the filters if the dust particles have hardened or stayed in the bag filters. Even though you should double-check it carefully, the filter service indicator will let you know when it's time to replace the filter. Using Solidworks, we created our filter system. It is from the 3D model that the 2D drawing is based. (Figures 1 to 3).

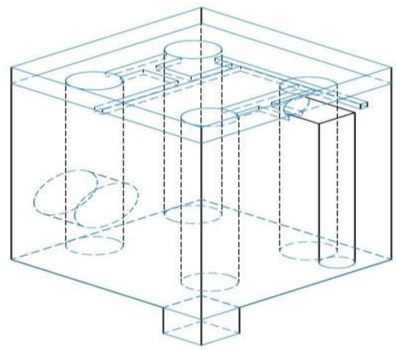

Figure 1: Isometric View

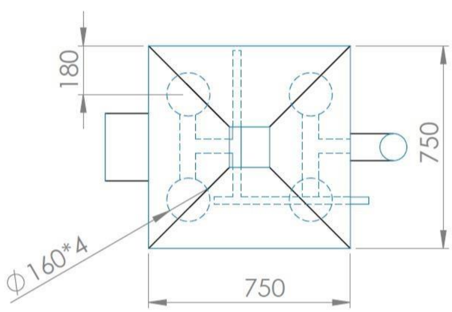

Figure 2: Top View

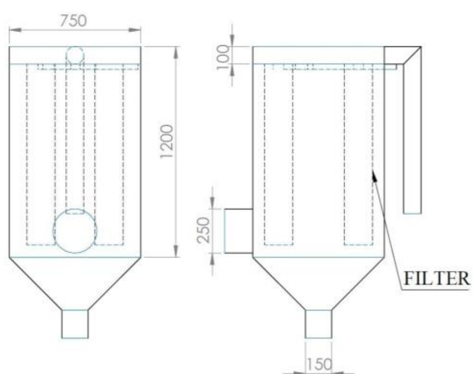

Figure 3: Left Side View and Right-Side View

We learn a lot about how to keep people safe from dust in this project. Particles in the air can hurt people badly. Compared to the cleaning systems typically used in cement mills, this solution can reduce dust emissions by around 96%. This project provides a detailed picture of the inner workings of a dust prevention system and how it collects and prevents dust; this system will be future technology that helps minimise factors like time, money, electricity, noise, etc. Most effective is the conversational approach, which uses the bag filter system. Creating a working model of the filter system was our way of proving it.

Conclusion

Air pollution control and collection systems rely on the principles of fluid flow in their design. The most efficient filtering system is the one that uses conventional methods. The Bag House Filtration system has proven time and time again that it is more efficient than 95% (leaks included), in contrast to the inefficient and costly updated Electric Precipitator system. Furthermore, the filter materials are crucial in removing dust particles, and the filters that we have fitted are of excellent quality. Filters like these can easily last longer than the norm. The mini-cement factories will benefit in the long run from our model's ability to reduce dust and cement speck emissions when applied on a big scale. It is possible to expand this created prototype into a filter system for large-scale applications. Air pollution sensor, which can identify dust particles as small as 2.5 microns and as large as 10 microns, can still be a part of this. The number of dust particles that bypass the filtration system can be determined with the help of this sensor. If we want to build a filter system for cement companies, we have to install a pressure regulator. We can also upgrade the intake and exit ducting to keep the compressed air at a constant temperature and flow rate.

References

1. C. W. Purnomo, W. Budhijanto, M. Alfisyah, and Triyono, “Improvement of cement plant dust emission by bag filter system,” IOP Conf. Ser. Mater. Sci. Eng., vol. 316, p. 012031, 2018.
2. S. Abdul Jabbar et al., “Air quality, pollution, and sustainability trends in South Asia: A population-based study,” Int. J. Environ. Res. Public Health, vol. 19, no. 12, p. 7534, 2022.
3. X. Liu, H. Shen, and X. Nie, “Study on the filtration performance of the baghouse filters for ultra-low emission as a function of filter pore size and fiber diameter,” Int. J. Environ. Res. Public Health, vol. 16, no. 2, p. 247, 2019.
4. B. H. Park, S. B. Kim, Y. M. Jo, and M.-H. Lee, “Filtration characteristics of fine particulate matters in a PTFE/glass composite bag filter,” Aerosol Air Qual. Res., vol. 12, no. 5, pp. 1030–1036, 2012.
5. J. Liu, D. Y. H. Pui, and J. Wang, “Removal of airborne nanoparticles by membrane coated filters,” Sci. Total Environ., vol. 409, no. 22, pp. 4868–4874, 2011.
6. E. H. Tanabe, P. M. Barros, K. B. Rodrigues, and M. L. Aguiar, “Experimental investigation of deposition and removal of particles during gas filtration with various fabric filters,” Sep. Purif. Technol., vol. 80, no. 2, pp. 187–195, 2011.

7. H. Bulut and R. F. Rashid , "The Zooplankton Of Some Streams Flow Into The Zab River, (Northern Iraq)", Ecological Life Sciences, vol. 15, no. 3, pp. 94-98, Jul. 2020
8. Rashid, R. F., Çalta, M., & Başusta, A. (2018). Length-Weight Relationship of Common Carp (Cyprinus carpio L., 1758) from Taqtaq Region of Little Zab River, Northern Iraq. Turkish Journal of Science and Technology, 13(2), 69-72.
9. Pala, G., Caglar, M., Faruq, R., & Selamoglu, Z. (2021). Chlorophyta algae of Keban Dam Lake Gülüşkür region with aquaculture criteria in Elazıg, Turkey. Iranian Journal of Aquatic Animal Health, 7(1), 32-46.
10. Rashid, R. F., & Basusta, N. (2021). Evaluation and comparison of different calcified structures for the ageing of cyprinid fish leuciscus vorax (heckel, 1843) from karakaya dam lake, turkey. Fresenius environmental bulletin, 30(1), 550-559.
11. Rashid, R. (2017). Karakaya Baraj Gölünde (Malatya-Türkiye) yaşayan aspius vorax'da yaş tespiti için en güvenilir kemiksi yapının belirlenmesi/Determination of most reliable bony structure for ageing of aspius vorax inhabiting Karakaya Dam Lake (Malatya-Turkey).
12. Gao, T., & Liu, J. (2021). Application of improved random forest algorithm and fuzzy mathematics in physical fitness of athletes. Journal of Intelligent & Fuzzy Systems, 40(2), 2041-2053.
13. Paudel, P. K., Bastola, R., Eigenbrode, S. D., Borzée, A., Thapa, S., Rad, D., ... & Adhikari, S. (2022). Perspectives of scholars on the origin, spread and consequences of COVID-19 are diverse but not polarized. Humanities and Social Sciences Communications, 9(1), 1-11.
14. Rad, D., Redeş, A., Roman, A., Ignat, S., Lile, R., Demeter, E., ... & Rad, G. (2022). Pathways to inclusive and equitable quality early childhood education for achieving SDG4 goal—a scoping review. Frontiers in Psychology, 4306.
15. Rad, D., Magulod Jr, G. C., Balas, E., Roman, A., Egerau, A., Maier, R., ... & Chis, R. (2022). A Radial Basis Function Neural Network Approach to Predict Preschool Teachers' Technology Acceptance Behavior. Frontiers in Psychology, 13.
16. Rad, D., Balas, V. E., Marineanu, V. D., Maier, R. (2021). Digital Wellbeing. Berlin, Germany: Peter Lang Verlag. Retrieved Mar 29, 2022.
17. Rad, D., Dughi, T., Maier, R., Egerău, A. (2022). Applied Research in Digital Wellbeing. Berlin, Germany: Peter Lang Verlag. Retrieved Mar 29, 2022, from 10.3726/b19309,
18. D. K. Srivastava and B. Roychoudhury, "Words are important: A textual content based identity resolution scheme across multiple online social networks," Knowl. Based Syst., vol. 195, no. 105624, p. 105624, 2020.
19. D. K. Srivastava and B. Roychoudhury, "Understanding the factors that influence adoption of privacy protection features in online social networks," J. Glob. Inf. Technol. Manag., vol. 24, no. 3, pp. 164–182, 2021.
20. O. Fabela, S. Patil, S. Chintamani, and B. H. Dennis, "Estimation of effective thermal conductivity of porous media utilizing inverse heat transfer analysis on cylindrical configuration," in Volume 8: Heat Transfer and Thermal Engineering, 2017.
21. S. Patil, S. Chintamani, B. H. Dennis, and R. Kumar, "Real time prediction of internal temperature of heat generating bodies using neural network," Therm. Sci. Eng. Prog., vol. 23, no. 100910, p.

100910, 2021.
22. S. Patil, S. Chintamani, J. Grisham, R. Kumar, and B. H. Dennis, "Inverse determination of temperature distribution in partially cooled heat generating cylinder," in Volume 8B: Heat Transfer and Thermal Engineering, 2015.
23. Haq, M. A., Baral, P., Yaragal, S., & Pradhan, B. (2021). Bulk processing of multi- temporal modis data, statistical analyses and machine learning algorithms to understand climate variables in the indian himalayan region. Sensors, 21(21).
24. Haq, M. A. (2021). Deep Learning Based Modeling of Groundwater Storage Change. Computers Materials and Continua, 70(3), 4599–4617.
25. Haq, M. A., Jain, K., & Menon, K. P. R. (2014). Modelling of Gangotri glacier thickness and volume using an artificial neural network. International Journal of Remote Sensing, 35(16), 6035–6042.
26. Haq, M. A., Baral, P., Yaragal, S., & Rahaman, G. (2020). Assessment of trends of land surface vegetation distribution, snow cover and temperature over entire Himachal Pradesh using MODIS datasets. Natural Resource Modeling, 33(2).
27. Haq, M. A., Rahaman, G., Baral, P., & Ghosh, A. (2020). Deep Learning Based Supervised Image Classification Using UAV Images for Forest Areas Classification. Journal of the Indian Society of Remote Sensing., 49.
28. Baral, P., & Haq, M. A. (2020). Spatial prediction of permafrost occurrence in Sikkim Himalayas using logistic regression, random forests, support vector machines and neural networks. Geomorphology, 371, 107331.
29. Kaur, L., & Shah, S. (2022). Production of bacterial cellulose by Acetobacter tropicalis isolated from decaying apple waste. Asian Journal of Chemistry, 34(2), 453–458.
30. Kaur, L., & Shah, S. (2022). Screening and characterization of cellulose-producing bacterial strains from decaying fruit waste. International Journal of Food and Nutritional Science, 11, 8–14.
31. Verma,S & Kaur,L. . (2018). Identification Of Waste Utilizing Bacteria From Fruit Waste. Global Journal for Research Analysis Volume-7(6, June)
32. Kaur, L., & Singh, N., Effect of mustard oil and process variables extrusion behavior of rice grits (2000). Journal Of Food Science And Technology. Mysore, 37, 656–660.
33. Thapar, Lakhvinder. (2017). Bulk And Nano-Zinc Oxide Particles Affecting Physio-Morphological Properties Of Pisum Sativum. International Journal Of Research In Engineering And Applied Sciences (IJREAS).
34. Mathew, Sneha & Thapar, Lakhvinder. (2019). Estimation of Protein Intake on the Basis of Urinary Urea Nitrogen in Patients with Non-Alcoholic Fatty Liver. International Journal for Research in Applied Science and Engineering Technology. 7. 2321-9653.
35. Thapar, Lakhvinder. (2017). Fermentation Potential Of Prebiotic Juice Obtained From Natural Sources. International Journal Of Advanced Research. 5. 1779-1785.
36. Mittal, Srishty & Thapar, Lakhvinder. (2019). Vitamin D Levels Between The Tuberculosis Infected And Non – Infected Subjects In 16-25 Years Of Age.
37. Praveen Kumar Sharma, Sushil Sharma, Common fixed point for weakly compatible maps in

intuitionistic fuzzy metric spaces using property (S-B)", Journal of Non-linear Analysis Optimization and Theory, Vol 5, No.2 (2014), 105-117.

38. Praveen Kumar Sharma, Sushil Sharma, Common fixed point theorem in intuitionistic fuzzy metric space under strict contractive conditions", Journal of Non-linear Analysis Optimization and Theory Vol 3 No.2 (2012), 161-169.
39. Praveen Kumar Sharma, Common fixed points for weakly compatible maps in intuitionistic fuzzy metric spaces using the property (CLRg)", International Knowledge Press, Asian Journal of Mathematics & Computer Research, Vol 6, No.2 (2015), 138-150.
40. Praveen Kumar Sharma, Shivram Sharma, Common Fixed Point Theorems for Six Self Maps in FM-Spaces Using Common Limit in Range Concerning Two Pairs of Products of Two Different Self-maps", Revista Geintec-Gestao Inovacao E Tecnologias, Vol 11, No. 4 (2021), 5634-5642.
41. Shivam Sharma, Praveen Kumar Sharma,A study of SIQR model with Holling type–II incidence rate", Malaya Journal of Matematik, Vol. 9, No. 1, 305-311.
42. Sharma, Praveen Kumar. "Some common fixed point theorems for sequence of self mappings in fuzzy metric space with property (CLRg)." J. Math. Comput. Sci., Vol.10, No.5 (2020): pp 1499-1509.
43. Sharma, Shivram, and Praveen Kumar Sharma. "On common α-fixed point theorems." J. Math. Comput. Sci., Vol.11, No.1 (2020): pp 87-108.
44. Sharma, Praveen Kumar. "Common fixed point theorem in intuitionistic fuzzy metric space using the property (CLRg)." Bangmod Int. J. Math. & Comp. Sci., Vol. 1, No.1 (2015): pp 83-95.
45. Sharma, Praveen Kumar, S. Chaudhary, and Kamal Wadhwa. "Common Fixed Points For Weak Compatible Maps In Fuzzy Metric Spaces." International Journal of Applied Mathematical Research, Vol.1, No. (2012): pp 159-177.
46. Sharma, Praveen Kumar, and Shivram Sharma. "Results on Complex-Valued Complete Fuzzy Metric Spaces." Great Britain Journals Press, London Journal of Research in Science: Natural and Formal, Vol 23, Issue 2 (2023), Page No. 57-64.
47. B. Nemade and D. Shah, "An IoT based efficient Air pollution prediction system using DLMNN classifier," Phys. Chem. Earth (2002), vol. 128, no. 103242, p. 103242, 2022.
48. B. Nemade and D. Shah, "An efficient IoT based prediction system for classification of water using novel adaptive incremental learning framework," J. King Saud Univ. - Comput. Inf. Sci., vol. 34, no. 8, pp. 5121–5131, 2022.
49. B. Nemade, "Automatic traffic surveillance using video tracking," Procedia Comput. Sci., vol. 79, pp. 402–409, 2016.
50. N. Kaur and S. D. Tiwari, "Role of particle size distribution and magnetic anisotropy on magnetization of antiferromagnetic nanoparticles," J. Phys. Chem. Solids, vol. 123, pp. 279–283, 2018.
51. N. Kaur and S. D. Tiwari, "Thermal decomposition of ferritin core," Appl. Phys. A Mater. Sci. Process., vol. 125, no. 11, 2019.
52. N. Kaur and S. D. Tiwari, "Role of wide particle size distribution on magnetization," Appl. Phys. A Mater. Sci. Process., vol. 126, no. 5, 2020.

53. N. Kaur and S. D. Tiwari, “Evidence for spin-glass freezing in NiO nanoparticles by critical dynamic scaling,” J. Supercond. Nov. Magn., vol. 34, no. 5, pp. 1545–1549, 2021.
54. N. Kaur and S. D. Tiwari, “Estimation of magnetic anisotropy constant of magnetic nanoparticles,” in DAE Solid State Physics Symposium 2019, 2020.
55. K. Peddireddy, "Streamlining Enterprise Data Processing, Reporting and Realtime Alerting using Apache Kafka," 2023 11th International Symposium on Digital Forensics and Security (ISDFS), Chattanooga, TN, USA, 2023, pp. 1-4.
56. Kiran Peddireddy. Kafka-based Architecture in Building Data Lakes for Real-time Data Streams. International Journal of Computer Applications 185(9):1-3, May 2023.
57. Anitha Peddireddy, Kiran Peddireddy, "Next-Gen CRM Sales and Lead Generation with AI," International Journal of Computer Trends and Technology, vol. 71, no. 3, pp. 21-26, 2023.
58. Peddireddy, K., and D. Banga. "Enhancing Customer Experience through Kafka Data Steams for Driven Machine Learning for Complaint Management." International Journal of Computer Trends and Technology 71.3 (2023): 7-13.
59. K Peddireddy "Effective Usage of Machine Learning in Aero Engine test data using IoT based data driven predictive analysis ", IJARCCCE International Journal of Advanced Research in Computer and Communication Engineering, vol. 12, no. 10, pp. 18-25, 2023.
60. H.A.A. Alsultan and K. H. Awad "Sequence Stratigraphy of the Fatha Formation in Shaqlawa Area, Northern Iraq," Iraqi Journal of Science ,vol. 54, no.2F, p.13-21, 2021.
61. H.A.A. Alsultan , M.L. Hussein, , M.R.A. Al-Owaidi , A.J. Al-Khafaji and M.A. Menshed "Sequence Stratigraphy and Sedimentary Environment of the Shiranish Formation, Duhok region, Northern Iraq", Iraqi Journal of Science, vol.63, no.11, p.4861-4871, 2022.
62. H.A.A. Alsultan , F.H.H. Maziqa and M.R.A. Al-Owaidi "A stratigraphic analysis of the Khasib, Tanuma and Sa’di formations in the Majnoon oil field, southern Iraq," Bulletin of the Geological Society of Malaysia, vol. 73, p.163 – 169, 2022 .
63. I.I. Mohammed, and H. A. A. Alsultan "Facies Analysis and Depositional Environments of the Nahr Umr Formation in Rumaila Oil Field, Southern Iraq," Iraqi Geological Journal, vol.55, no.2A, p.79-92, 2022.
64. I.I. Mohammed, and H. A. A. Alsultan "Stratigraphy Analysis of the Nahr Umr Formation in Zubair oil field, Southern Iraq," Iraqi Journal of Science, vol. 64, no. 6, p. 2899-2912, 2023.
65. G. Aziz, S. Sarwar, R. Waheed, and M. S. Khan, “The significance of renewable energy, globalization, and agriculture on sustainable economic growth and green environment: Metaphorically, a two-sided blade,” Nat. Resour. Forum, no. April, pp. 1–21, 2023.
66. N. Elouaer, R. Waheed, S. Sarwar, and G. Aziz, “Does Gender Diversity and Experience Moderate the Impact of Tax Aggressiveness on Corporate Social Responsibility: A Study of UAE Listed Companies,” Sustainability, vol. 14, no. 21, p. 14348, Nov. 2022.
67. G. Aziz, S. Sarwar, R. Waheed, and M. S. Khan, “Significance of hydrogen energy to control the environmental gasses in light of COP26: A case of European Countries,” Resour. Policy, vol. 80, no. September 2022, p. 103240, 2023.
68. G. Aziz, R. Waheed, S. Sarwar, and M. S. Khan, “The Significance of Governance Indicators to

Achieve Carbon Neutrality: A New Insight of Life Expectancy," Sustainability, vol. 15, no. 1, pp. 1–20, 2023.

69. S. Sarwar, R. Waheed, G. Aziz, and S. A. Apostu, "The Nexus of Energy, Green Economy, Blue Economy, and Carbon Neutrality Targets," Energies, vol. 15, no. 18, p. 6767, Sep. 2022.
70. S. Sarwar, G. Aziz, and D. Balsalobre-Lorente, "Forecasting Accuracy of Traditional Regression , Machine Learning , and Deep Learning : A Study of Environmental Emissions in Saudi Arabia," Sustainability, vol. 15, no. 20, p. 14957, 2023.
71. L. Lei, G. Aziz, S. Sarwar, R. Waheed, and A. K. Tiwari, "Spillover and portfolio analysis for oil and stock market: A new insight across financial crisis, COVID-19 and Russian-Ukraine war," Resour. Policy, vol. 85, p. 103645, Aug. 2023.
72. G. Aziz and S. Sarwar, "Revisit the role of governance indicators to achieve sustainable economic growth of Saudi Arabia–pre and post implementation of 2030 Vision," Struct. Chang. Econ. Dyn., vol. 66, pp. 213–227, 2023.
73. G. Aziz, S. Sarwar, M. W. Hussan, and A. Saeed, "The importance of extended-STIRPAT in responding to the environmental footprint: Inclusion of environmental technologies and environmental taxation," Energy Strateg. Rev., vol. 50, no. May, p. 101216, 2023.
74. G. Aziz, S. Sarwar, M. Shahbaz, M. N. Malik, and R. Waheed, "Empirical relationship between creativity and carbon intensity: a case of OPEC countries," Environ. Sci. Pollut. Res., vol. 30, no. 13, pp. 38886–38897, Mar. 2023.
75. D. Cai, G. Aziz, S. Sarwar, M. I. Alsaggaf, and A. Sinha, "Applicability of denoising based artificial intelligence to forecast the environmental externalities," Geosci. Front., p. 101740, 2023.
76. G. Aziz, S. Sarwar, K. Nawaz, R. Waheed, and M. S. Khan, "Influence of tech-industry, natural resources, renewable energy and urbanization towards environment footprints: A fresh evidence of Saudi Arabia," Resour. Policy, vol. 83, p. 103553, Jun. 2023.
77. A. Qadeer, M. Wasim, H. Ghazala, A. Rida, and W. Suleman, "Emerging trends of green hydrogen and sustainable environment in the case of Australia," Environ. Sci. Pollut. Res., 2023, 2.
78. L. Qin, G. Aziz, M. W. Hussan, A. Qadeer, and S. Sarwar, "Empirical evidence of fintech and green environment: Using the green finance as a mediating variable," Int. Rev. Econ. Financ., vol. 89, no. PA, pp. 33–49, 2023.
79. S. Sarwar, G. Aziz, and A. Kumar Tiwari, "Implication of machine learning techniques to forecast the electricity price and carbon emission: Evidence from a hot region," Geosci. Front., no. xxxx, p. 101647, 2023.
80. G. Aziz and S. Sarwar, "Empirical Evidence of Environmental Technologies , Renewable Energy and Tourism to Minimize the Environmental Damages : Implication of Advanced Panel Analysis," Int. J. Environ. Res. Public Health, vol. 20, no. 6, p. 5118, 2023.
81. Y. Cui, G. Aziz, S. Sarwar, R. Waheed, Z. Mighri, and U. Shahzad, "Reinvestigate the significance of STRIPAT and extended STRIPAT: An inclusion of renewable energy and trade for gulf council countries," Energy Environ., p. 0958305X231181671, Jun. 2023.
82. Praveen Barmavatu, Mihir Kumar Das, Rathod Subhash, Banoth Sravanthi, Radhamanohar Aepuru, R Venkat reddy, Yalagandala akshay kumar "Designing an Effective Plate Fin Heat Exchanger and

Prediction of Thermal Performance Operated Under Different Water Blends Using Machine Learning", Journal of Thermal Sciences and Engineering Applications, ASME Publications, Vol-15/issue-4/pp: 041001-041022, 2023.

83. Praveen Barmavatu, S A Deshmukh, Mihir Kumar Das, Radhamanohar Aepuru, R Venkat reddy, Banoth Sravanthi "Synthesis and experimental investigation of glass fiber epoxy/saw dust composites for flexural & tensile strength", Materiale Plastice, vol-59/issue-02/pp:73-81/June 2022.
84. U.B. Vishwanatha, Y. Dharmendar Reddy, Praveen Barmavatu, B. Shankar Goud "Insights into stretching ratio and velocity slip on MHD rotating flow of Maxwell nanofluid over a stretching sheet: Semi-analytical technique OHAM", Journal of the Indian Chemical Society, Elsevier Publishers, Vol-100/issue-3/pp: 100937-10, 2023.
85. Darapu Kiran Sagar Reddy, Praveen Barmavatu, Mihir Kumar Das, Radhamanohar Aepuru "Mechanical properties evaluation and microstructural analysis study of ceramic-coated IC engine cylinder liner", Elsevier material today proceedings, /Vol-76/Part-3, pp: 518-523, 2023.
86. Darapu Kiran Sagar Reddy, Praveen Barmavatu, Mihir Kumar Das, Radhamanohar "Aepuru Experimental analysis of coated engine cylinder liners", AIP Conference Proceedings, Vol 2786/ Paper ID: 030002, 2023.
87. Sonali Anant Deshmukh, Praveen Barmavatu, Mihir Kumar Das, Bukke Kiran Naik, Radhamanohar Aepuru "Heat Transfer Analysis in Liquid Jet Impingement for Graphene/Water Nano Fluid", Springer Lecture Notes in Mechanical Engineering (LNME), ICETMIE-2022, pp: 1079–1090.
88. Barmavatu Praveen, Madan mohan reddy Nune, Yalagandala akshay kumar, Rathod Subhash, "Investigating the Effect of Minimum Quantity Lubrication on Surface Finish of EN 47 Steel Material", Elsevier material today proceedings, Vol-38/Part-05, pp-32-53-3257.
89. Yalagandala akshay kumar, Shaik shafee, Barmavatu Praveen "Experimental investigation of residual stresses in a die casted alluminium fly wheel" Elsevier material today proceedings /vol19/issue-Part-02/pp: A10-A18/October2019.
90. Barmavatu Praveen & s chakradhar goud "fabrication of compact heat exchanger with composite alloys" International journal of innovative technology and exploring engineering, vol-8/issue-6s4/pp:717-721/april 2019.
91. Barmavatu Praveen, Yalagandala Akshay Kumar, Banoth Sravanthi, H. Ameresh "Methodological Investigation on recycling of Plastic Polymers-A Review" International journal of scientific & technological research 2277-8616/vol-9/issue-03/pp:1537-1542/march 2020.
92. Barmavatu Praveen & s chakradhar goud "CFD approach for different fluids varients in compact heat exchanger at different parametric conditions" International journal of scientific & technological research, vol-8/issue-12/pp:2288-2296/december2019.
93. Tripathi, M. A., Madhavi, K., Kandi, V. S. P., Nassa, V. K., Mallik, B., & Chakravarthi, M. K. (2023). Machine learning models for evaluating the benefits of business intelligence systems. The Journal of High Technology Management Research, 34(2), 100470.
94. Raman, R., Gupta, Z., Singh, R., Joshi, U., & Chakravarthi, M. K. (2023). Potential of Vehicular Ad-Hoc Network for use in Developing a Drone-Based Delivery System. IEEE.
95. Patil, P. P., Perez-Mendoza, A., Joshi, K., Shah, H., Pillai, B. G., & Chakravarthi, M. K. (2023).

Moving toward an intelligent edge: Machine Learning and Wireless Communication. IEEE.
96. Bind, N. K., Chinka, S. S., Akram, S., Sengodan, N., Ridoy, M. S., & Chakravarthi, M. K. (2023). Fault Analysis of An Induction Motors Using AI and ML: An Efficient Way. IEEE.
97. Raman, R., Alanya-Beltran, J., Singh, R., Trivedi, S., Pillai, B. G., & Chakravarthi, M. K. (2023). Analysis of future trend and opportunity in the emerging 5G IoT scenario. IEEE.
98. Sirisha, N., Gopikrishna, M., Ramadevi, P., Bokka, R., Ganesh, K. V. B., & Chakravarthi, M. K. (2023). IoT-based data quality and data preprocessing of multinational corporations. The Journal of High Technology Management Research, 34(2), 100477.
99. Ramadevi, P., Sadu, V., Fuskele, V., Bolleddu, S. N., Kumar, T. C. A., & Chakravarthi, M. K. (2023). Development of Autonomous Robots for Industrial and Domestic Applications. IEEE.
100. Albert, H. M., Mendam, K., Bansod, P. G., Rao, M. S. S., Asatkar, A., Chakravarthi, M. K., & Mallesh, M. P. (2023). Biosynthesis, Spectroscopic, and Antibacterial Investigations of Silver Nanoparticles. Journal of Fluorescence, 1–9.
101. Albert, H. M., Khamkar, K. A., Asatkar, A., Adsul, V. B., Raja, V., Chakravarthi, M. K., … Gonsago, C. A. (2023). Crystal formation, structural, optical, and dielectric measurements of l-histidine hydrochloride hydrate (LHHCLH) crystals for optoelectronic applications. Journal of Materials Science: Materials in Electronics, 34(30), 2040.
102. Khamkar, K. A., Nethagani, S., Priya, R., Bolleddu, S. N., Verma, A., & Chakravarthi, M. K. (2023). Development of a Highly Efficient Energy Storage System for Renewable Energy Applications. IEEE.
103. Reddy, M. K., Kumar, N. M., Karuppannan, A., Bolleddu, S. N., Verma, A., & Chakravarthi, M. K. (2023). Design and Development of Wearable Medical Devices for Health Monitoring. IEEE.
104. Jerusha Angelene Christabel G, Shynu T, S. Suman Rajest, R. Regin, & Steffi. R. (2022). The use of Internet of Things (Iot) Technology in the Context of “Smart Gardens” is Becoming Increasingly Popular. International Journal of Biological Engineering and Agriculture, 1(2), 1–13.
105. T, S., Rajest, S. S., Regin, R., & R, S. (2023). Effect Of Working Environmental Employee Satisfaction On Organizational Performance. Central Asian Journal Of Mathematical Theory And Computer Sciences, 4(1), 29-48.
106. S. Suman Rajest, Shynu T, R. Regin, & Steffi. R. (2023). A Visual Approach for Detecting Tyre Flaws That Makes Use of The Curvelet Characteristic. International Journal on Orange Technologies, 5(4), 17-40.
107. V. K. Nomula, R. Steffi, and T. Shynu, “Examining the Far-Reaching Consequences of Advancing Trends in Electrical, Electronics, and Communications Technologies in Diverse Sectors,” FMDB Transactions on Sustainable Energy Sequence, vol. 1, no. 1, pp. 27–37, 2023.

