

Design, Fabrication And Analysis of Mini Manual Briquetting Machine

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Abstract- Fossil fuels are a major source of energy production. Fossil fuels take millions of years to form. So, the volume of production is less than the demand. These fuels cause more air pollution and environmental problems such as global warming. Therefore, now it is need to switch to alternative energy sources. Agricultural residue briquettes are a good substitute for coal, lignite and firewood. This recycled fuel is good for the environment as it conserves natural resources. In most cases, these briquettes are made with manual briquetting machines and the pressure at which agricultural waste is compressed cannot be determined. Thus, this final project is related to the development and production of a manual mini briquetting machine using lever. We focus on these social innovations and strive to provide affordable solutions to the everyday problems of those who need them, while protecting the environment.

Keywords- Briquettes, Biomass, Briquetting machine, fuels, hydraulic, calorific value

I. INTRODUCTION

Biomass is effectively used as a source of bioenergy as fuel for boilers and furnaces, due to its high calorific value. The aim of this project is to develop a machine for the production of biomass briquettes. This technology facilitates the handling, transport and storage of materials. Briquettes are blocks of compressed biomass used as fuel and ignition is used to ignite. The briquetting machine is also called a briquetting press machine. Machines for processing biomass raw materials into high density wood briquettes in the form of blocks or bars. The briquettes work in a chamber where the material is fed and in a chamber where the briquettes are under very high pressure. This results to plasticity and tightly connected to each other as blocks. Our goal in creating these machines is to promote waste management and efficient use. This machine is designed with high efficiency and low cost.

II. LITERATURE REVIEW

1. **Prof. Swapnil Solanki, Dhruvil Kotadia, Priyam Shah, Sarthak Soni, Smit** This research focuses on the design and manufacture of automatic biomass briquetting machines. The main purpose of the production of these machines is to help in waste management and efficient use. This machine is designed with high efficiency and low cost.
2. **Sunday Yusuf Kpalo, Mohamad Faiz Zainuddin, Latifah Abd Manaf, Ahmad Muhaimin Roslan** This paper surveys biomass briquetting regarding biomass assets, feedstock pre-handling, briquetting measure boundaries, briquetting innovation, and briquettes quality assessment boundaries. The review too incorporates the financial part of briquetting identifying with expenses and achievability.
3. **Kumar Joshi, I.F.S, Vinay Sharma** This paper represents building up a bio briquetting machine in level direction and a near report between two models of physically determined bio briquetting machine for a destructive woodland bio buildup of Western Himalayas named as dry and fallen pine needles.
4. **Hafiz M. Safdar, Abdul Nasir, Haroon Rashid, Shanawar Hamid, Mohsin Noor, M. Azhar Ali** The current investigation shows the turn of events, enhancement and execution assessment of transitional pressure briquettes shaping machine, chipping away at mechanical cylinder press innovation with creation limit $\approx 300 \text{ kg/m}^3$ and produces 85 mm distance across briquettes.
5. **Oke Peter Kayode, Olaiya Niyi** This article focuses on the design and manufacture of hydraulic variable pressure briquetting machines. The pressure variable at which the briquette is compressed is used to determine the effect of pressure on the calorific value of the briquette.
6. **Ikubanni Peter Pelumi, Omololu Tobiloba, Ofoegbu Wallace, Omoworare Oluwatoba, Adeleke Adekunle Akanni, Agboola Olayinka Oluwole, Olabamiji Taye Sola** Briquetting is a powerful method of using farming buildups as a productive, successful and clean energy for

- provincial and rural communities. Therefore, a cylinder type briquetting machine was planned and manufactured in this examination.
7. **Aneta Szymajda , Grazyna Laska** Collect biomass of cow dung. After drying and grinding, the analytical moisture content was determined, then ash content, total carbon, total sulfur, calorific value and heating value were measured. Studies have shown that the moisture content of the biomass burned has a significant impact on both ash content and calorific value.
 8. **Philippe Bernard Himbane , Lat Grand Ndiaye , Alfredo Napoli , Diouma Kobor** In this examination, carbonized nut shells, cashew shells and millet stalks were utilized as crude materials to produce coal briquettes. clay and gum were applied as covers during briquetting by utilization of manual press. Physicochemical and mechanical trial of the acquired briquettes were directed.
 9. **Dr. Y.M. Sonkhaskar, Harjot Singh Saluja, Rishabh Srivastava, Ritvick Parikh, Utkarsh Singhai** This article tries to make a manual powered machine with help simple mechanism. The mechanism used to make this machine is the scotch yoke mechanism. Become one in an agricultural country like India, these machines offer a method for converting field waste into useful products.
 10. **Arkadiusz Kowalski , Przemyslaw Frankowski , Agnieszka Tychoniuk** This article looks at the briquette press design process - from idea to designing and developing technology, calculating the strength and applying the simulation model check production assumptions. The project design phase includes detailed descriptions of dimensions. Selection of main hydraulic cylinder elements.
 11. **Manjunath K S , Omprakash M , Niranjan Pangeni , Biradar Hanumant** This paper focus around the plan and creation of briquetting machine which convert the farming and forest waste into source of fuel. It additionally centers around the creation of biomass briquettes utilizing crude materials predominantly sawdust and dry leaves with restricting specialists like coffee husk and wheat flour. Likewise study is completed to explore the calorific estimations of the briquettes utilizing bomb calorimeter.
 12. **Imeh E. Onukak , Ibrahim A. Mohammed-Dabo , Alewo O. Ameh , Stanley I.R. Okoduwa , Opeoluwa O. Fasanya** This study shows that TSWs can be used to create fuel briquettes, which are a source of sustainable energy production. It is green, cheaper and cheaper than fossil fuels.
 13. **Maria Angeles Garrido , Juan A. Conesa , Maria Dolores Garcia** This study describes the physical properties of biomass and briquettes made from various plastic waste without the use of external binders.
 14. **Supriya Darekar, Mahesh Kulkarni, Sachin Jarag, Santosh Ghutukade** This research describes the design and manufacture of biomass briquette machine applications ranging from home cooking to industrial boilers. The efficient use of large quantities of agricultural waste and residues, which are a very large untapped fuel source and also provide briquettes made from a variety of biomaterials.
 15. **S Suryaningsih, O Nurhilal, Y Yuliah, C Mulyana** This study aims to obtain data on the properties of large amounts of biomass briquettes from agricultural industrial waste. Each type of briquette was characterized and analyzed for its physicochemical properties, including heating value, moisture content, solid carbon content, and the results were compared with charcoal and coal.
 16. **Gbabo Agidi, Tope Onatola , Ibrahim Mohammed Gana** This research focuses on the fact that the equipment has been designed, produced, tested and proven to be useful for converting agricultural waste such as rice husks, sawdust and sugarcane into briquettes that can generate useful heat for household and household purposes. Industrial applications. The test results show that the ratio of binder concentration and the degree of machine compression is the highest for different materials, specific gravity and compressive strength.
 17. **Ajit Kaur , Arvind Kumar, Puneetpal Singh, Krishnendu Kundu** The current study was on Production, investigation furthermore, advancement of Briquettes from Biomass deposits. It was directed to develop briquettes with various blends of biomass and fasteners to improve their proficiency and lessen contamination contrasted with chose business briquettes.
 18. **Aries Roda D. Romallosa** The study includes a compact briquette machine designed to compress and manufacture cylindrical briquettes with a hole in the center using biomass and municipal waste using a hydraulic cart and semi- automatically return to the starting position with a towing device. The quality of the three types of briquettes made with used paper, sawdust and carbonated rice husks is slightly different. The parameters analyzed were bulk density, calorific value, and humidity .
 19. **Reuben shuma, Daniel M. Madyira** The aim of this review study is that yellow straw briquettes can only be considered for future production based on the availability of supplies. The degree of moisture loss is determined by the percentage of moisture in the binder. It also shows the optimal briquette parameter pressure and the ratio of free biomass to binder.
 20. **Mambo Wilson , Kamugasha Dick , Adimo Ochieng, Okwalinga David Bruno , Namagembe Flavia** This

- study aims to develop a hand-operated hydraulic briquette press machine, evaluate its efficiency and evaluate the physical properties of the resulting briquettes.
21. **Debasish Padhee,a, Jageshwar Komra, Roopnarayan Patel ,Divyanand Verma** This study shows how a suitable commercial biomass briquette machine is made and suitable for use in rural communities. The efficiency of the developed machine was assessed using sawdust and cow dung as raw materials. The study concluded that briquettes made from a mixture of sawdust and beef powder in various proportions can be used as an alternative energy source.
 22. **David Solano, Patrick Vinyes ,Pol Arranz** This paper offers introduction to the energy utilization of wood and rural waste and biomass briquetting measure.
 23. **Ojaomo, E. K., Maliki, O. B. , Olusanya, A. J** A physically worked basic briquetting machine was planned also, created. The machine is produced using locally accessible materials. The collecting was done through welding and machining measures. The straightforwardness and execution assessment of this machine legitimize its proficiency, simplicity of activity just as appropriateness for limited scope creation of briquettes.
 24. **Erzam Sahaluddin Hasan, Muhammad Jahiding, Mashuni, WOS Ilmawati1,Wa Wati1, I Nyoman Sudiana** Study of the quality of brown coal briquettes from North Kolaka was carried out to determine the effect of various adhesives on similar properties and calorific values.
 25. **Manoj Kumar Sharma, Gohil Priyank, Nikita Sharma** The paper has built up a bunch of method to create biomass briquettes through distinctive creation in country towns that can be utilized for warming and cooking.
 26. **Amanor, Ishmael Nartey** This study focuses on Design, Construction and Testing of a Briquetting Machine.
 27. **Monika Aniszewska , Arkadiusz Gendek** This article discusses the burning rate and heating value of large-scale crop residues that can be used to make processed wood fuel.
 28. **Mohammad Khairulnizam Bin Ibrahim** Briquette innovation is the one technology which utilizes the biomass item morally justified way. To build up a limited scale of cylinder type briquetting apparatuses, an investigation was completed to pick the best plan to create briquette machine. Four examples of various plans at that point was sketch in 3D drawing by utilizing Solidworks Premium Programming.
 29. **Tamilvanan A** This research focuses on developing a method of making briquettes with constant quality at low pressure using wet techniques and provides a way to control it in a controlled manner. These techniques are used to carry out cylindrical briquette research, observing the variables resulting from the briquette combustion rate process with different percentages of waste paper volume.
 30. **A.Ramirez- Gomeza,E.Gallegoa,J.M.Fuentes,a,C. Gonzalez-Montellanob,F.Ayugaa** This study describes the values for particle properties of a large area of biomass briquettes. The report shows typical values for the variables examined.
 31. **Obi, O. F., Akubuo, C. O., Okonkwo, W. I** In this study, a suitable commercial biomass briquette machine was designed and constructed for use in rural communities and an efficiency assessment was carried out with sawdust. The physical properties and fuel of briquettes were determined by the variable of the biomass binder ratio.
 32. **Akintunde, M. A. , Seriki, M. E** The percentage by weight of paper paste increases, and the percentage of solid carbon and ash content decreases. The volatile matter and caloric value also increase with the increase in the proportion of paper paste.
 33. **F.Zannikos, S.Kalligeros, G.Anastopoulos, E.Loïs** This article discusses the manufacture of household biomass briquettes combined with plastics from various sources. The general burning properties of briquettes in the open are examined.
 34. **Krizan, P., Matus, M., Soos, L** This contribute to the description of the briquette machine single design process. The designs described are coming from basic input requirements and analysis of mathematical models related to the biomass compression process and based on the compression conditions in the briquette chamber during biomass compression.
 35. **Maninder, Rupinderjit Singh Kathuria, Sonia Grover** In this study, raw materials in the form of sawdust, walnuts, cotton stalks, etc., were compacted into briquettes at high temperature and high pressure using various technologies. We discuss the various benefits, factors that affect biomass briquettes, and the comparison between coal and biomass briquettes.
 36. **Osarenwindu, J O, Ihenyen O.I** This study shows that manual briquette machines for agricultural waste are designed and produced using local materials. With this machine different agrowastes can be used for briquette production. The pressure and compaction force in briquette production are also determined.
 37. **Dr. P. Sugumaran , Dr. S. Seshadri** This innovation can end up being one among the answers for enhancing the fuel prerequisites and financial advancement of the country zones by giving work to country individuals.
 38. **M. Madhava , B.V.S Prasad , Y. Koushik , K. R Ramesh Babu ,R.Srihari** The density of biomass after briquette production increased 1.5 times for rice husks,

- dry leaves, peanut husks and sawdust. Peanut shell briquettes showed high resistance to damage, followed by hack saw briquettes. Briquettes made from dry leaves have a high resistance to water ingress. The use of briquettes in a locally grated household oven proved to be satisfactory.
39. **Sujata Tayde, Jyoti Pohare , D.M. Mahalle** This research was conducted to test the briquettes. For this study, availability the biomass in the Akola area and the biomass most suitable for making briquettes were studied Peanut residue, sawdust, soybean residue, single ratio or mass.
 40. **Alexandru Muntean , Bohumil Havrland , Victor Pobedinsky , Tatiana Ivanova , Grigore Marian** This article discusses the problem of using an efficient press with a working body with a piston for the production of organic briquettes. The structural analysis of the "BrikStar" and pressing briquette piston was carried out the area is described in detail.
 41. **J.T. Oladeji** The study also concluded that the two briquettes would not be destroyed during transport and storage, because the values obtained for their resting densities were inferred from the maximum briquette densities of the two residues.
 42. **S. H. Sengar , A. G. Mohod , Y. P. Khandetod , S. S.Patil , A. D. Chendake** This article shows that cashew, grass and rice husks are used as the main biomass in the form of raw biomass, hydrolyzed biomass and carbonized biomass. Carbonated biomass is considered suitable for briquette fuel compared to raw and hydrolyzed biomass.
 43. **Olorunnisola** In this study an attempt was made to obtain binder-free briquettes from a mixture of used paper and coconut shell particles at low pressure from these briquettes.
 44. **Olawale J. Okegbile, Abdulkadir B. Hassan, Abubakar Mohammed, Barakat J. Irekeola** has tested the effect of starch and resin as a binder on the fuel properties of briquettes made from sawdust in various proportions. The calorific value, volatile matter and flame temperature are determined. The results showed that the briquettes formed when starch was used as a binder performed better in all aspects of the gum.
 45. **Riya Roy** An experimental study was carried out to produce and analyze the quality of various briquettes, using dry leaves, straw and wheat powder as starting materials and paper pulp, cow dung as binder. This briquette is analyzed by direct analysis. The results are then compared with commercial cow dung briquettes.
 46. **Ogwu, I.Y., Tembe, E.T. and Shomkegh, S.A** The heating power ratio was determined by the combination of binary and tertiary biomass briquettes (sawdust) from *Azelia africana*, *Daniella oliveri* and rice husks with bond strengths of 20% 30% and 40%. When analyzing samples directly, it was found that there was a significant difference between the density, the percentage of ash, the percentage of volatiles and the percentage of fixed carbon of the sample.
 47. **Wei Sheng Zeng, Shou Zheng Tang, Qian Hui Xiao** The calorific value of plants is an important indicator for evaluation and reflection of the material cycle and energy conversion in forest ecosystems. This article systematically analyzes the caloric value and ash content of various plant organs using hypothesis testing and regression analysis.
 48. **Emerhi, E. A.** found that the calorific value of briquettes made from sawdust a mixture of three tropical hardwoods associated with different binders was the best briquette obtained when sawdust was mixed with starch.
 49. **Harshita Jain , Y. Vijayalakshmi , T. Neeraja** has created a pilot study project which has been accepted for the current investigation. Six biomass materials were identified for this research, namely coal dust, rice husk sawdust, dry leaves, sawdust, peanut husks, and two binders, namely cow dung and starch. The results showed that cow dung which is used as a binder for coal dust and other biomass materials provides a higher heating value. The use of starch as a binder with coal dust and other biomass materials makes the briquette structure smooth, dense, dry, even, without even cracking and shiny.
 50. **P.D. Grover , S.K. Mishra** This paper shows the biomass briquetting technologies and practices. At present two main high pressure technologies: ram or piston press and screw extrusion machines, are also discussed.

III. PROBLEM STATEMENT

- Main Aim of this project is the biomass materials are compressed into briquettes so that they can be used by energy producing companies interchange to charcoal.
- These burn are just like charcoal but they do not produce any harmful or dangerous effects to the environment.
- They can be used to boiler and power turbines to generate electricity.
- These briquettes are replacement for fossil fuel such as oil and also provide more calorific value per kg these products are available at low cost .
- Burning of briquettes are more efficient than burning the charcoal and firewood.

IV. CONCLUSION

The main purpose of paper is to protect our environment by solving pollution problems. It also helps

farmers make proper use of their waste in agriculture. Therefore, for an agricultural country like India, which produces large amounts of agricultural waste every year, using this waste as briquettes can be an economically viable, sustainable and environmentally friendly solution. The equipment has been designed, manufactured and tested and has proven to be useful in converting agricultural waste into briquettes that can generate heat which is useful for domestic and industrial applications. The nature of the resulting briquette, due to its calorific value, which can also aid combustion, indicates optimism about its potential to be used as fuel for heating operations, indicating that the fuel produced with conventional lever briquette engines emits less NO_x and less SO_x, which are the pollutants in the atmosphere.

REFERENCES

- [1] Prof. Swapnil Solanki, Dhruvil Kotadia, Priyam Shah, Sarthak Soni, Smit Shah,” Design and Fabrication of Automated Biomass Briquetting Machine “, International Research Journal of Engineering and Technology , Volume: 07 Issue: 04 , Apr 2020 .
- [2] Sunday Yusuf Kpaló, Mohamad Faiz Zainuddin , Latifah Abd Manaf , Ahmad Muhaimin Roslan ,” A Review of Technical and Economic Aspects of Biomass Briquetting”, 3 March 2020.
- [3] Kumar Joshi, I.F.S , Vinay Sharma ,” Remodeling a Manually Operated Bio Briquetting Machine for Bio Briquetting of Dry Chir Pine Needles in Western Himalayan Region”, International Journal of Forestry and Wood Science, Vol. 7(1), pp. 067-075, February, 2020.
- [4] Hafiz M. Safdar , Abdul Nasir , Haroon Rashid , Shanawar Hamid , Mohsin Noor , M. Azhar Ali,” Development, Optimization and Performance Evaluation of Indigenous Piston Press Briquetting Machine for Crop Residue”, Journal of Mechanical Engineering Research and Developments ISSN: 1024-1752 CODEN: JERDFO Vol. 43, No. 3, pp. 246-261, 2020.
- [5] Oke Peter Kayode , Olaiya Niyi Gideon Department,” Development of an improved Pressure varying Hydraulically operated Agricultural Waste Briquetting Machine”, Assumption University-eJournal of Interdisciplinary Research (AU-eJIR): Vol. 4. Issue.2, 2019.
- [6] Ikubanni Peter Pelumi, Omololu Tobiloba, Ofoegbu Wallace, Omowore Oluwatoba, Adeleke Adekunle Akanni , Agboola Olayinka Oluwole , Olabamiji Taye Sola,” Performance Evaluation of Briquette Produced from a Designed and Fabricated Piston-Type Briquetting Machine”, International Journal of Engineering Research and Technology. ISSN 0974-3154, Volume 12, Number 8 (2019), pp. 1227-1238.
- [7] Aneta Szymajda , Grazyna Laska ,” The Effect of Moisture and Ash on the Calorific Value of Cow Dung Biomass”, Department of Agri-Food Engineering and Environmental Management June 2019.
- [8] Philippe Bernard Himbane , Lat Grand Ndiaye , Alfredo Napoli , Diouma Kobor, “Physicochemical and mechanical properties of biomass coal briquettes produced by artisanal method”, Vol. 12(12), pp. 480-486, December 2018.
- [9] Dr. Y.M. Sonkhaskar, Harjot Singh Saluja, Rishabh Srivastava, Ritvick Parikh, Utkarsh Singhai,” Low Cost Manual Briquette Making Machine Using Scotch Yoke Mechanism”, International Journal of Innovative Research in Science, Engineering and Technology , Vol. 7, Issue 7, July 2018.
- [10] Arkadiusz Kowalski , Przemyslaw Frankowski , Agnieszka Tychoniuk,” Design of Briquetting Press – from Idea to Start of Production”, Engineering for Rural Development Jelgava, 23.25.05.2018.
- [11] Manjunath K S , Omprakash M , Niranjan Pangeeni , Biradar Hanumant ,” Design and Fabrication of Briquetting Machine for Solid Waste”, International Journal of Latest Engineering Research and Applications (IJLERA) ISSN: 2455- 7137 Volume – 03, Issue – 05, May 2018, PP – 61-66.
- [12] Imeh E. Onukak , Ibrahim A. Mohammed-Dabo , Alewo O. Ameh , Stanley I.R. Okoduwa , Opeoluwa O. Fasanya , Production and Characterization of Biomass Briquettes from Tannery Solid Waste”, : 20 October 2017.
- [13] Maria Angeles Garrido , Juan A. Conesa , Maria Dolores Garcia,” Characterization and Production of Fuel Briquettes Made from Biomass and Plastic Wastes”, June 2017.
- [14] Supriya Darekar, Mahesh Kulkarni, Sachin Jarag, Santosh Ghutukade ,” Design of Briquetting Machine”, International Journal of Innovative Research in Science, Engineering and Technology , Vol. 6, Issue 4, April 2017
- [15] S Suryaningsih, O Nurhilal, Y Yuliah, C Mulyana,” Combustion quality analysis of briquettes from variety of agricultural waste as source of alternative fuels “, International Conference on Biomass: Technology, Application, and Sustainable Development, 2017.
- [16] Gbabo Agidi, Tope Onatola , Ibrahim Mohammed Gana,” Design and fabrication of hydraulically operated machine for making briquette from agricultural waste “, Direct Research Journal of Agriculture and Food Science , Vol.5 (3), pp. 121-129, March 2017 .
- [17] Aries Roda D. Romallosa ,” Quality Analyses of Biomass Briquettes Produced using a Jack-Driven Briquetting

- Machine “, International Journal of Applied Science and Technology , Vol. 7, No. 1; March 2017.
- [18] Ajit Kaur , Arvind Kumar, Puneetpal Singh, Krishnendu Kundu,” Production, Analysis and Optimization of Low Cost Briquettes from Biomass Residues”, 12(4): 1-10, 2017; Article no.37630 ISSN: 2348-0394.
- [19] Reuben shuma, Daniel M. Madyira,” Production of loose biomass briquettes” from agricultural and forest residues”, International Conference on Sustainable Materials Processing and Manufacturing, Jan 2017.
- [20] Mambo Wilson , Kamugasha Dick , Adimo Ochieng, Okwalinga David Bruno , Namagembe Flavia,” Development and Performance Evaluation of a Manually Operated Briquetting Machine “, International Journal of Scientific & Engineering Research, Volume 7, Issue 11, November-2016 .
- [21] Debasish Padhee, a, Jageshwar Komra, Roopnarayan Patel , Divyanand Verma,” Development of a Biomass Briquetting Machine Suited to Rural Communities “, International Journal of Innovative Science, Engineering & Technology, Vol. 3 Issue 11, November 2016 .
- [22] David Solano, Patrick Vinyes , Pol Arranz ,” The Biomass briquetting process “, October 2016.
- [23] Ojaomo, E. K., Maliki, O. B. , Olusanya, A. J. ,” Development of a Simple Briquetting machine for Small Scale Application”, International Journal of Engineering Research & Technology (IJERT) ISSN: 2278-0181 IJERTV4IS050826 www.ijert.org, Vol. 4 Issue 05, May-2015.
- [24] Erzam Sahaluddin Hasan, Muhammad Jahiding, Mashuni, WOS Ilmawati1, Wa Wati1, I Nyoman Suidiana ,” Proximate and The Calorific Value Analysis of Brown Coal for High-Calorie Hybrid Briquette Application”, 1. Department of Physics, Faculty of Mathematics and Natural Sciences, Halu Oleo University .2 Department of Chemistry, Faculty of Mathematics and Natural Sciences, Halu Oleo University.
- [25] Manoj Kumar Sharma, Gohil Priyank, Nikita Sharma,” Biomass Briquette Production: A Propagation of Non-Conventional Technology and Future of Pollution Free Thermal Energy Sources”, American Journal of Engineering Research (AJER) e-ISSN: 2320-0847 p-ISSN: 2320-0936 Volume- 04, Issue-02, pp-44-50, 2015.
- [26] Monika Aniszewska , Arkadiusz Gendek,” Comparison of heat of combustion and calorific value of the cones and wood of selected forest trees species”, Warsaw University of Life Sciences, Faculty of Production Engineering, Department of Agricultural and Forest Machinery, (Forest Research Papers), September 2014, Vol. 75 (3): 231–236.
- [27] Amanor, Ishmael Nartey,” Design, Construction and Testing of a Briquetting Machine”, may 2014.
- [28] Mohammad Khairulnizam Bin Ibrahim,” Development of the Small Scale Piston Type Briquetting Tool”, June 2013.
- [29] Tamilvanan A,” Preparation of Biomass Briquettes using Various Agro Residues and Waste Papers”, Journal of Biofuels , Vol. 4 Issue 2, July- December 2013 pp. 47-55.
- [30] A. Ramírez- Gomeza, E. Gallegoa, J. M. Fuentes, C. González-Montellano, F. Ayuga,” Values For particle-scale Properties of Biomass Briquettes made from Agroforestry residue”, May 2013, PP- 100-109.
- [31] Obi, O. F., Akubuo, C. O., Okonkwo, W. I. ,” Development of an Appropriate Briquetting Machine for Use in Rural Communities”, International Journal of Engineering and Advanced Technology (IJEAT) ISSN: 2249 – 8958, Volume-2, Issue-4, April 2013.
- [32] Akintunde, M. A. , Seriki, M. E. ,” Effect of Paper Paste on the Calorific Value of Sawdust Briquette”, International Journal of Advancements in Research & Technology, Volume 2, Issue 1, January-2013 .
- [33] F. Zannikos, S. Kalligeros, G. Anastopoulos, E. Lois,” Converting Biomass and Waste Plastic to Solid Fuel Briquettes”, Hindawi Publishing Corporation Journal of Renewable Energy Volume 2013, 9 pages, Oct 2012.
- [34] Krizan, P., Matus, M., Soos, L.,” Design of Pressing Chamber of Briquetting Machine with Horizontal Pressing Axis”, 11th International Scientific Conference Novi Sad, Serbia, September 20-21, 2012
- [35] Maninder, Rupinderjit Singh Kathuria, Sonia Grover,” Using Agricultural Residues as a Biomass Briquetting: An Alternative Source of Energy “, IOSR Journal of Electrical and Electronics Engineering (IOSRJEET) ISSN: 2278-1676 Volume 1, Issue 5 (July- Aug. 2012), PP 11-15 .
- [36] Osarenwindi, J O, Ihenyen O. I. ,” The Preliminary Design and Fabrication of a Manually Operated Briquetting Machine “, J. Appl. Sci. Environ. Manage. June, 2012 Vol. 16 (2) 209 - 211 .
- [37] M. Madhava , B. V. S Prasad , Y. Koushik , K. R Ramesh Babu , R. Srihari,” “Performance Evaluation of a Hand Operated Compression Type Briquetting Machine”, Journal of Agricultural Engineering Vol. 49(2): April - June, 2012.
- [38] Dr. P. Sugumaran , Dr. S. Seshadri ,” Biomass Charcoal Briquetting”, Technology for Alternative Energy Based Income Generation In Rural Areas, December 2010.
- [39] Sujata Tayde, Jyoti Pohare , D. M. Mahalle ,” Physical and thermal properties of briquettes by piston press and screw press”, International Journal of Agricultural Engineering, Vol. 3 No. 2 (October, 2010) : 223 -227.
- [40] Alexandru Muntean , Bohumil Havrland , Victor Pobedinsky , Tatiana Ivanova , Grigore Marian,” Features

- of Bio-Briquettes Pressing with the Piston Briquetting Press”, Engineering for Rural Development Jelgava, 27.-28.05.2010
- [41] Oladeji, J.T.2010. “Fuel Characterization of Briquettes Produced from Corn cob and Rice Husk Resides”.Pacific Journal of Science and Technology. 11(1):101-106.
- [42] S. H. Sengar , A. G. Mohod , Y. P. Khandetod , S. S.Patil , A. D. Chendake , "Performance of Briquetting Machine for Briquette Fuel", International Journal of Energy Engineering, Vol.2 No.1, pp. 28-34. doi: 10.5923/j.ijee.20120201.05.
- [43] A. Olorunnisola “Production of Fuel Briquettes from Waste Paper and Coconut Husk Admixtures”. Agricultural Engineering International: the CIGR Ejournal. Manuscript EE 06 006. Vol. IX. February, 2007.
- [44] Olawale J. Okegbile, Abdulkadir B. Hassan, Abubakar Mohammed*, Barakat J. Irekeola Department of Mechanical Engineering, Federal University of Technology, Minna, Nigeria.
- [45] Riya Roy M.Sc. (Environmental Science), Asutosh College, University of Calcutta, Kolkata, West Bengal, India.
- [46] Ogwu, I.Y1, Tembe, E.T2., and Shomkegh, S.A.3 , 1 and 2. Department of Forest Production and Products University of Agriculture Makurdi 3. Department of Social and Environmental Forestry University of Agriculture Makurdi .
- [47] Wei Sheng Zeng, Shou Zheng Tang, Qian Hui Xiao,” Calorific values and ash contents of different organs of Masson pine (*Pinus massoniana*) in southern China.
- [48] Emerhi, E. A Department of Forestry and Wildlife, Delta State University, Awai Campus, Asaba.
- [49] Harshita Jain1 , Y. Vijayalakshmi2 , T. Neeraja3 1M.Sc. Scholar, Department of Resource Management and Consumer Sciences.
- [50] P.D. Grover , S.K. Mishra,” Biomass Briquetting: Technology and Practices”, Regional Wood Energy Development Programme in Asia ,Field Document No.46.