

Rapid Prototyping Of Non-Polluting Pine Needles Briquettes/Pallets Using Either Liquid-Based or Powder- Based Rp Process; (A Review)

Ravinder Kumar^a, Rishi Sharma^{b*}, 2. S Vaibhav^c

^a Associate Professor in School of Mechanical Engineering, Lovely professional University, Phagwara, India

^{b,c} Mechanical Engineering Department, Career Point University Hamirpur (HP) India, 176041

Abstract

Today the major problem of environment is pollution. The World is suffering with the increase of pollution day by day. Pollution affects the air, water, land & soil etc. We burn fossil and other fuels like Wood, Paper, coal, Heavy waxes, etc to produce useful Energy and Heat for Industrial and Domestic uses, which is a major cause in the rapid- increase of pollution. In this article; review of forming non-polluting, high thermal and burning efficiency briquettes with pine needles by rapid prototyping process either liquid based or powder based were studied along with the use of various binder materials. The main objective of this study is to make or form a non- polluting, high thermal value, high density, high burning efficiency, less smoke, less ash content briquettes and also make a comparison with coal and different binder material briquettes by proximate and ultimate analysis. It has been found that pine needles briquettes formed with paper starch binder material have high burning efficiency, high calorific value, less smoke, less ash content as compared to pine needle briquettes formed with binder materials clay and cow dung . In the formation of the non-polluting pine needle briquettes, the proper selection of binder material along with proper quantity along with pine char is essential for better results. With the use of pine needle briquettes formed with binder materials like paper starch, clay, cow dung, etc. may become better alternative of coal and other fuels required for domestic and industrial purposes and also to overcome the pollution problem of the world.

KEY WORDS: Rapid Prototyping, Briquettes, Pine Needles, Binder materials, proximate and ultimate analysis, PNB (pine needle briquette).

1. Introduction

Nearly half the world population is dependent on wood as their primary energy source. It has been founded that by burning wood as Conserve Energy source which increase the pollution in the environment. The mercury in the air at high levels is a serious problem to human health. Pollution in the air is coming from power plants. The major cause of human health problems is mercury present in the air, which also damages the brain and nervous system of human being. Bio-mass briquettes is an alternative of coal and wood which produces less smoke during burning and also full –filled the requirement of power plants. We can produce non-polluting biomass briquettes which have high colorific value, heating value and less smoke and less ash contents compared to other fossil fuels.

1.1 Introduction to biomass

Biomass is a renewable energy resource which will work throughout and made up of waste biomass. The demand for the bio energy systems is increasing at the rapidly. India is heavily dependent on the traditional energy sources. The pine tree forests are very abundant in the Himalayan region. It is estimated that about 1, 20,000 hectares land of only Himachal Pradesh covered with the pine forest. The pines leaves have about 70 to 80 percent of mean volatile matter content. Dry pine needles are useful for making biomass and also in various solutions to overcome the water level. So we can make a pine char through carbonization process to make these pine needles pollution free and by adding some binder materials with this pine char we can make pine needle briquettes. Which has less smoke, less ash content and high calorific and heating value?

1.2 Introduction to briquettes

Briquettes good alternative of wood and coal used in power plant for producing energy. The formation of briquettes from biomass residues into high density briquettes is a new trend of technology. It will help in generation employment in rural areas of developing countries. Therefore, formation of briquettes with biomass after carbonization would be an alternative of coal and wood. Briquetting making is a new type of renewable energy formation technologies and the research work is continuously going on. Densification process is the technique used in formation of briquettes. PNB (pine needle briquettes) formation is simple and can be easily collected from biomass. The briquettes shown in figures are made up of PNB and used in house hold for daily purpose.



Fig 1. Pallets



Fig 2. Briquettes

2. Literature Review

The manufacturing and the design of the briquettes was not considered during the study. Which may play a vital role for future reference? The yield strength measured during the study of briquettes and which is most important factor [1]. The physical and combustion characteristics studied and found that with ash content, volatile matter, moisture ration etc. after that compression force and shear force detected. The briquettes were tested to check density, compressive strength and shear strength [2]. C. Antwi-Boasiako, B.B. Acheampong, discussed about the strength properties and found some values regarding calorific values of pine needles briquettes. The effect on Wood density of the briquette is

compared with some factors calorific values. In this the briquette recorded less elongation value (8.85%) than the standard stipulated specifying its quality to repel weakening in the texture. The production cost was found to be lower due to the lower binder requirement for the new machine. Biomass briquettes become an alternative source of energy formation and have similar effects like coal. Most of livelihood of millions of peoples throughout the world is affected by Energy deficiency. In the study examines the small hydro, biomass, and biogas, solar and small wind turbines are studied depending on the availability of the resources in the present locality. They form the briquettes having high combustion of 230cal/Kg, similar to fire wood. The various types of alternative technologies selected which are depending upon site conditions. [6] Rue Shan et al. The main objective of this study is to make an alternative source of energy produced by biomass. In this article, the author studied about methods of production different biomass briquettes for gasification and energy formation. The biofuels used in gas turbines depending upon combustion characteristics and emissions. [7] This work examines the production of house hold briquettes from pine needles and biomass with some plastic materials to influenced the geometry of briquettes on smoke emissions and also for accurate burning. The briquettes design not discussed which may be an important factor to determine the exact burning. The holes addition also increases the efficient burning of biomass briquettes. [9] The shear strength durability, impact resistance and calorific value with optimum densities for good quality of briquettes were determined, the design of briquettes was not determined for efficient burning. It has been found that the impact resistance does not influenced by increasing the pressure of die and the shear strength and calorific value increased due to die pressure.[2],[4] concluded that the washed straw char reactivity decreased by 50% as compared to dry straw char. These briquettes have the high density and most of test done like water boiling test, proximate and ultimate analysis to check the durability of PNB. [11] Briquettes with small amount PET (polyethylene terephthalate) shows some behavior in burning of briquettes because of increase of oxygen supply. Burning of plastic in biomass mixture increase the CO emissions compared with carbon monoxide emissions. [4], [5] in this article the Detailed design of the new briquetting machine was studied. The moisture content of PNB is lower noted in maximum studies and calculated about 30% lower with other briquettes. The lower moisture content advantages PNB briquettes in drying. The drying timing of these briquettes is less which defiantly helps to bind up briquettes very smoothly. [14]Discussed about the effects of applied pressure levels were investigated. Effects of the binder materials are mainly on calorific value, heating value, density also effect on smoke producing. The texture of briquettes also depends upon the binder materials. Mostly found that the PNB made with paper starch binder materials is very become much efficient compared to cow dung and clay. The heating value of bamboo briquette is high compared to PNB and it increased or noted 21.26 MJ/Kg, which is much high. The burning rate is also high and it noticed 2.01g/min. [13], [14] it has been noticed that the density of other fuel briquettes like rice husk briquettes, groundnut briquettes is high compared to PNB. But the briquettes of rice husk etc. have other problems like efficient burning, high smoke and ash contents which reduced in PNB.

Conclusions

This study has overviewed Biomass Briquettes formation due to forest waste, this can be an alternative of other fuels and briquettes of PNB (pine needle briquette) compressed with vertical machine. The PNB have less smoke and ash content as found in proximate analysis compared to other briquettes like rice husk and waste biomass. The boiling test also done to found the heating value of PNB, which found good and same as coal heating value. According to study the initial burning of PNB is a biggest disadvantage and future research can be done on this factor. The PNB briquette requires multiple holes for efficient burning. It has surly potential to replace the other wood fuels and become a renewable energy resource for future and also protect our forests from the fires.

References

- [1] Characterization of the burning behavior and gaseous emissions of pine needles in a cone calorimeter – FTIR apparatus, Tall Fatah, Frank Richard, Benjamin Barito, ThomasRogaume, JocelynLuche , Justin Zaida, Fire Safety Journal 182(2016)91–100
- [2] Analysis of Physical and Combustion Characteristics of Briquetting Mechanisms, A.Saranraj and A.D.Latha, IJSRD - International Journal for Scientific Research & Development| Vol. 3, Issue 12, 2016 | ISSN (online): 2321-0613.
- [3] Strength properties and calorific values of sawdust-briquettes as wood-residue energy generation source from tropical hardwoods of different densities, C. Antwi-Boasiako, B.B. Acheampong, Biomass and Bioenergy 85 (2016), 144-152
- [4] Automatic Screw Press Briquette Making Machine, Ravina Sanap, Madhuri Nalawade, Jyoti Shende, Pinku Patil, International Journal of Novel Research in Electrical and Mechanical Engineering Vol. 3, Issue 1, pp: (19-23), Month: January-April 2016
- [5] Renewable energy based off-grid rural electrification in Uttarakhand state of India: Technology options, modeling method, barriers and recommendations Anurag Chauhan n, R.P.Saini
- [6] Biodiesel production from palm oil using active and stable K doped hydroxyapatite catalysts Guanyi Chen Shan a, Jiafu Shi a, Changye Liu d, Beibei Yan a,e)
- [7] Enhancement of coal briquette quality through corn stalk blending and binder optimization, Guangjun Lu, Fangqin Cheng, and Jianfeng Li, Environmental Progress & Sustainable Energy, 2014
- [8] Climate change affects of forestry and substitution of carbon-intensive materials and fossil fuels Leif Gustavsson a, SylviaHaus a, MattiasLundblad b, AndersLundström c, CarinaA.Ortiz b, RogerSathre a, n, NguyenLeTruong a, Per-ErikWikberg c)
- [9] Effect of a mild torrefaction for production of eucalypt wood briquettes under different compression pressures, Solange Araújo, Mariana Almeida Vilas Boas, Duarte Miranda Neiva, Ang_élica de Cassia Carneiro, Benedito Vital, Marcelino Breguez, Helena Pereira, Biomass and Bio energy 90 (2016), 181-186
- [10] Analysis of Physical and Combustion Characteristics of Briquetting Mechanisms, A.Saranraj and A.D.Latha, IJSRD - International Journal for Scientific Research & Development| Vol. 3, Issue 12, 2016 | ISSN (online): 2321-0613
- [11] Analysis of Physical Properties of Biomass Briquettes Prepared by Wet Briquetting Method, *Madhurjya Saikia and Deben Baruah*, International Journal of Engineering Research and Development, Volume 6, Issue 5 (March 2013), PP. 12-14
- [12] Automatic Screw Press Briquette Making Machine, Ravina Sanap, Madhuri Nalawade, Jyoti Shende, Pinku Patil, International Journal of Novel Research in Electrical and Mechanical Engineering Vol. 3, Issue 1, pp: (19-23), Month: January-April 2016
- [13] Effect of Applied Pressure and Binder Proportion on the Fuel Properties of Holey Bio-Briquettes, Mallika Thabuota, Thanchanok Pagketananga, Kasidet Panyacharoena, Pisit Mongkuta, Prasong Wongwichaa, International Conference on Alternative Energy in Developing Countries and Emerging Economies, 2015
- [14] Effects of Process Parameters on the Density and Durability of Biomass Briquettes Made from Wet Method, Tito EsauMwinuka, International Journal of Engineering Research and Development Volume 11, (January 2015), and PP.32-38