

Design and Development of Solar Cum Manual Pelletization Plant for Production of Fuel Pellets from Forest Waste

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Abstract: The waste leaves and grass are available in large volumes. They can be processed and produced in the shape of pellets which can be used as domestic fuel and domestic products. This will also help in conserving energy, saving forest trees from felling and keeping the environment clean. This project is about processing of raw material and production of pellets using Pellet machine. The dry leaves fallen from tree and dry grass is collected and ground in a grinder and is converted into a thick powder form. This powder is then mixed with the starchs in a mixer. These agents can be any liquid (starch) obtained during boiling of rice. After mixing the powder and starch, the mixture is converted in the form of pellets with the help of pellet machine. For this purpose a machine has been designed and used.

Key words: Dry leaves, Pellets, Pellet machine, Grinder, Starch, DC motor, battery, solarpanel.

1 Introduction

Biomass is used as source of fuel to generate power to the extent of more than 50% of the country's requirements. India is predominantly an agricultural economy, with huge quantity of forest waste available in the form of husk, straw, shells of coconuts wild bushes etc. With an estimated production of 350 million tons of agricultural waste every year, forest waste is capable of adding the fuel to the tune of about 200 million tonnes producing 17,000 MW of power and resulting in a saving of about Rs.20, 000 crores every year. Biomass available in India comprises of rice husk, rice straw, bagasse, coconut shell, jute, cotton, husk etc.



Figure 1: Dry leaves (Forest waste)

Plenty of dry leaves (Fig 1) fall from the trees and plants during autumn and summer seasons. After falling from trees, these leaves spread all over the ground surface and are wasted. In due course, these dried leaves get spoiled and produce bad smell and in turn pollute the environment. Same is the case with dry grass. The waste leaves and grass can be processed and converted into many useful products. These products include: domestic fuel (as wood) [5] and domestic products (substitute of wood). This project consists of Die and roller. The forming process takes place with the help of roller and die the products are made from leaves powder and starch.

2 Present problem

The fuel using in our day to day life is non-renewable source. Some or the other day it will get vanished [1]. To overcome such problems pellets are introduced [2]. Mainly in villages, the people cut the trees for woods to use them in domestic purposes such as burning them in stoves [3]. This will cause deforestation, to

overcome this problem pellet concept is introduced. By designing simple machine which is used for making fuel pellets from forest waste which is helpful for many people as employment. Cutting the trees is illegal and the nature gets disturbed by doing so. As the trees reduces oxygen levels gets reduced causing endanger to human [6].

3 Proposed solution

The only way to save the environment and resolve the fuel problems for especially village people is making pellets. Pellet fuel [4] is a renewable, clean-burning and cost stable home heating alternative. Using pellets for heat, in freestanding stoves, fireplace inserts furnaces and boilers. Pellet fuel for heating can also be found in such large-scale environments. In short, by producing fuel pellets millions of tons of forest waste is diverted from land fields and turn it in to fuel.

3.1 Objectives

- The primary objective of this project is to make tools for producing pellets.
- The objective of this project is to provide information about pellet.
- To produce pellets from forest wastage.
- To develop a green environment using pellet as an alternative fuel.
- To make a pellet with the help of agriculture waste.

4 Methodology

Pelletizing is the process of compressing or molding a material into the shape of a pellet. This project is about processing of raw material and production of pellets and logs using roller. The forest waste is collected and ground in a grinder and is converted into a thick powder form. (Fig 2)



Figure 2: Crushed forest waste powder

This crushed powder is then mixed in a mixer with the starch. These agents can be fevicol and liquid (starch) obtained during boiling of rice. After mixing the powder and starch, the mixture is formed in the shape of pellets and logs with the help of pelletisation machine. For experimental purpose a machine has been designed and used. This consists of die and roller. The forming process takes place with the help of roller and die the products are made from leaves powder and starch.

It consists of the following tools:

1. Grinder: In this work, simple tools are designed which are used to make pellets. These tools are manual, anyone can use these tools easily i.e., it does not require higher knowledge to operate the tools. Grinder is used to crush the collected forest wastage. The body of grinder is made of aluminium. The operator has to rotate the handle, the blades rotates accordingly. This is nothing but conversion of axis of rotation using bevel gear beneath the blades. Bevel gear is attached to the handle and blades with two individual normal gears so that when the operator rotates the handle, the blade rotates. Figure 3 of grinder is below:



Figure 3: Grinder blades



Figure 6: Bevel gear in grinder

2. Die & rollers: After mixing the powder with the starch, it is to be poured in a machine. This palletization machine consists of a roller and dies. A handle is used to rotate the roller. When the handle is rotated the rollers are rotated and press the mixture in to the die holes. Then the mixture takes the shape of fuel pellets which come out of the die and collected. These collected wet pellets are dried in sunlight and then used as fuel for cooking purpose. The following figure 4-7 shows rollers and dies tool



Figure 4: Roller and die setup



Figure 5: Blades in grinder



Figure 7: Grinder with handle

3. Gears set up one spur gear is normally driven. The gear box consists of 2 bevel gears and 2 spur gears one spur gear is manually driven and one bevel gear is connected with electric motor



Figure 8: Gears setup 4 Battery



Figure 10: DC motor

DC motor specs 12v-3amp 6000 rpm Gearbox specs Gear Ratio: 100:1 Speed: 45-60 RPM Torque: 100kgcm and solar panel



Figure 9: Battery 12v-7amp hour battery i.e., 84 watts output.



Figure 11: Solar panel output: 10watts Machine set up



Figure 12: Pelletization machine (Forest waste)



Figure 13: Pelletization machine Side view

5 Advantages

- Eco-friend
- Low pollution
- High-calorific value
- This project will create employment to the village people.
- The product that is obtained by using neem tree will be used for mosquito coils.
- By this product we can make the cow dung cakes.
- Increase the efficiency of biogas plants.
- These pellets can be used in cold countries to make room hotter.
- This is no cost fuels.
- By mixing the fevicol or polymer, resin with this powder we can make the ply wood or hard board.



Figure 14: Fuel pellets

6 Conclusion

- Making pellets will help in conserving energy, saving forest trees from felling and keeping the environment clean
- As the forest waste is available everywhere, it is less cost or no cost.
- Pellet stoves look like traditional wood stoves but operate more like a modern furnace.

7 Scope for further work

The work can be extended using other starches and rolling process to produce other useful industrial/domestic products. The powder can be used for making pulp in paper industry and used for making cow dung cakes, and used for firing in boilers.

References

- [1]. "Biomass Energy, Alternate Energy", 16 February 2015.
- [2]. "Sources of biomass Energy Centre", 16 February 2015.
- [3]. "Organic Energy Ltd", 25 November 2015.
- [4]. "Use EFB Pellet as Renewable Energy Biofuel Resource", 16 February 2015.
- [5]. "Wood Pellets from PKS & Coconut Shell, Wood Pellets from PKS and Coconut Shell", 13 January 2013.
- [6]. Vattenfall Alakangas, Eija, "Pretty weird and awfully clever", "European pellet standards", 16 February 2015.