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Study the effect and properties of animal feed pellets

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Abstract
With increasing emphasis on self-employment as a means of improving the standard of living. The pelletizing machine is mainly used for supplying required nutrients to animals and poultry feed. There are high-cost machineries available in the market. Our aim is to support the small-scale producer with economized machine to increase the rate of production and rate of supply. It is driven by electric motor makes it more energy saving and environmentally friendly. The experimental work was carried out by testing the machine and operation capacity was found to be 250kg/hr. Raw materials are mixed together in the oily form and feed into pellet machine. This paper represents the design, fabrication, development and testing of a cheap electrically operated pellet machine with locally available materials and promote their business well in the field. The effect of moisture addition during steam conditioning of feed on pellet quality and electrical energy consumption in pelleting process was investigated. Complete mixture for cattle (from 15 to 25 kg) was conditioned up to moisture content of 15.97%, 19.40%, and 21.88%. Pellets, produced from conditioned material with higher content of moisture, were more stable and less hard. Higher moisture content of conditioned material resulted in decreasing of energy consumption during pelleting process. Electrical energy consumption in pelleting process, along with achieving targeted pellet quality, could be significantly lower by choosing proper conditioning process parameters.

Keywords: Maize corn, cotton seed cake, wheat bran, mineral mixture, wheat flour, jaggery

Introduction
Cattle feed industry, a major ingredient of animal feed industry is currently evolving from a fragmented industry into an organized sector. The feed manufactures are using increasingly modern and sophisticated methods in an effort to incorporate best global practices. Cattle feed industry has got high potential for growth, given that India is the world's leading producer of milk, and production is expected to grow at compounded annual growth rate of 4 per cent. The demand outlook will require dairy companies to step up production and get higher animal yields on the back of superior feed and nutrition (John, M. P., 2013) [3].
Researchers at Ralston Purina (Kertz, 1981) [4] evaluated different forms of feed for dairy cows, comparing pellets, coarse mix, crumbles, and meal. They found that cows consumed the pelleted feed more rapidly than the other forms of feed. When eating time is limited, such as in milking parlor feeding, eating rate may be the most limiting effect on milk production. Although they did not test pellets with fines, the fact that pellets had an advantage over crumbles suggests fines would be detrimental (Kertz, A.F., 1981) [4].
Chemical and physiochemical qualities of the feed ingredient are the main factors determining the ability to form pellets with high physical quality. Fat is known to reduce the pellet quality. Carbohydrates, on the other hand, improve the quality of pelletized feed. Starch becomes sticky and has a strong adhesive effect upon gelatinization in the presence of water, whereas water-soluble fibers may improve the structural integrity of pellets by embedding coarser particles into a network (Hemmingsen, A. K. T, 2008) [5].

Materials and Methods
The research work is undertaken on Performance and evaluation of animal feed pelletizing machine this chapter deals with the materials used and methods followed in pelletizing machine and development for animal feeding purpose. The main emphasis was to study the quality of pellets and empowering the self-employment of small-scale producers or formers. With economized machine to increase the rate of production and rate of supply by measuring moisture content, ash content, density, crude fat, crude fiber.

General descript

A pellet machine or pellet press is the machine used to create pellets from powdered material. To obtain good finishing and accuracy, various tools and machine were employed during the

The machine components are

a. Frame
b. Barrel
c. Hopper
d. Die plate
e. Power transmission

Frame

The frame acted as a support to other components. Frame is made of cast iron material. It was a rigid structure and it was designed to withstand dynamic stress. Welded to base was the baring support.

Barrel

The barrel was also welded to the vertical part of the frame. It was made of cast iron material. The barrel is a cylinder with internal diameter105mm and thickness of 5mm.a flange was welded to the end of the barrel to support the die plate.

Hopper

The Hopper is a funnel shaped frustum cut out of a square pyramid. It is made up of galvanized sheet tin. The height of hopper is 260mm. It acts as feeding chute.

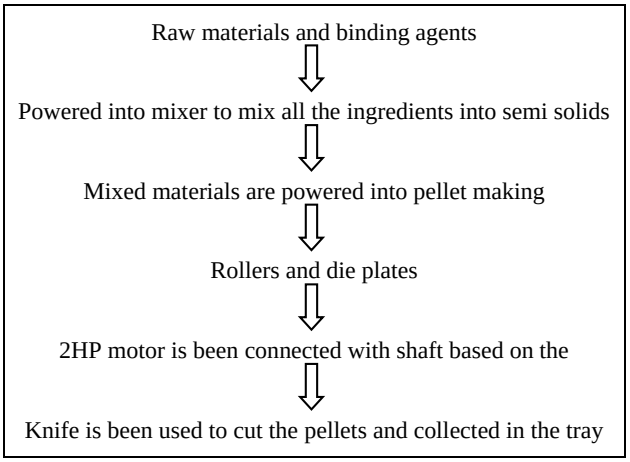
Die plate

The pelleting die is required to restrict the flow of feed material and provide the cylindrical shape of the pellet. The die had a thickness of 5mm. the effective diameter of die plate was 100mm.die plate is made of alloy steel.

Power Transmission

The power is obtained from drive and driven pulley mechanism. Speed variation is maintained by bevel type gear.

S. No	Specifications	Units
1	Machine number	1542J
2	Motor power	1.5Hp
3	Voltage	415±5%
4	Speed	1415rpm
5	Frequency	50±5%
6	Current	3.2A
7	Temperature	50°C
8	Refreance	IS325
9	Efficiency	80%



Block diagram of pelletizing machine

General description

Materials

For the preparation of pellets, the raw materials used are

a. Maize corn
b. Cotton seed cake
c. Wheat bran
d. Mineral mixture
e. Salt
f. Wheat flour
g. jaggery

Maize corn

Cotton seed cake

Wheat bran

Mineral mixture

Salt

Jaggery

Method of preparation

For preparing the pellets, we are using 500 g maize corn, 100 g cotton seed cake, 200 g wheat bran, 170 g wheat flour, 10 g salt, 20 g mineral mixture and for its adhesive property, jaggery is used as binding agent. If agricultural byproducts are to be used efficiently and rationally as animal feed, they must be characterized to determine parameters such as the moisture content, ash content, density, crude fibre and crude fat. The result of these determinations indicates the positive and negative attributes towards the cattle feed.

Pellet prepatration

Analysis of pellets properties

Moisture content

The moisture content of fresh pellets was determined by hot air oven method (AOAC,2016) [1] About 10 g of the pellets was weighed into a weighed moisture box and dried in an oven at 100±5 °C for 24 hours and cooled in a desiccator. The weight of the dried sample was recorded. The moisture content of the sample was calculated by using the formula

$$\text{Moisture content (w.b.)} = \frac{W_1 - W_2}{W_1} \times 100 \quad \text{.Eqn. 1}$$

Where,

W_1 = Initial weight of the sample, g

W_2 = Final weight of the sample, g

Density of pellets

The weight of pellets was determined on the balanced in the laboratory. Then the volume of pellets was determined by a simple calculation based on the direct measurement of length, diameter of the pellets.

Formula:

$D=M/V(kg/m^3)$

Were,

D=density

M=mass

V=volume

Volume can be calculated by using cylinder formula $V=\pi r^2h$

Total ash

The ash content of fresh and dry pellets can be determined by using muffle furnace. Principle involved is that when a known weight of feed is ignited to ash, the weight of ash thus obtained is expressed in terms of percentage. Clean dry crucible is weighed and 10g of sample is placed in the crucible then, total weight is weighed carefully place the

weighted crucible over electrical burner. The crucible should be partially opened. The sample will be charred into initial expulsion of smoke. Place the crucible in the muffle furnace and heat to 600 °C. Keep it for 4 hours. This temperature all organic matter will be burnt leaving behind minerals. Remove the crucible from the furnace carefully and cool it in a desiccator to room temperature and weigh again.

Crude Fibre

The crude fibre in pellets is determined by the using Fibre-plus apparatus (AOAC, 2005) [2]. Accurately 2g of fat free dry pellets was taken in a crucible. The sample was boiled in 1.25% Sulphuric acid, subsequently boiled in 1.25% sodium hydroxide solution. The sample was dried in hot air oven at 100 °C till all the moisture was evaporated. The weight of the crucible before ashing was note down. The dried sample was ashed in muffle furnace at 550 °C for 4 h. After ashing, the crucibles were cooled in desiccators and reweighed. The residue obtained after subtraction of the ash was regarded as fibre. The crude fibre was obtained by using the following equation

$$\text{Crude fiber (\%)} = \frac{w1-w2}{w} \times 100$$

Where,

W_1= weight of the sample before ashing (g)

W_2= weight of sample after ashing (g)

Results and Discussion

The laboratory test was carried out to study the content of crude fat, crude fibre, total ash, density, and moisture content conducted to evaluate the performance and evaluation animal feed pelletizing machine presented. During the laboratory test parameters like weigh of the sample, dry weight of sample time, temperature, are recorded and explained below.

Results of Lab Test

Moisture content: The moisture content of fresh pellets was determined by hot air oven method

Serial No	W1(g)	W2(g)	Wet basis	Dry basis
1	61.236	58.8315	3.9266	4.0871
2	54.573	52.2363	4.281	4.4731
3	53.632	50.4560	5.921	6.2940

Crude Fibre

S.No	W1(g)	W2(g)	Fibre Extraction
1	39.427	39.285	0.0142
2	39.427	39.285	0.0142
3	39.430	39.285	0.0145

Chemical properties like crude fibre, total ash determined with using Fibre-plus apparatus and muffle furnace respectively. The values are tabulated in below table.

Conclusion

This machine can be commercialized for domestic use, Agriculture field, and cow forms. Our main objective is to manufacture pellet machine at low cost and make it available to all the small-scale farmers. This machine has a capacity of manufacturing 250 kg/hr. This can increase the profit rate of the farmers. The machine has a capacity which suits its purpose but can be improved and modified to reduce the specific power consumption. The machine can be fabricated affordably at small workshops or machine shops in developing countries. The main components are hopper, roller, rotating die, chamber, frame, gearing arrangements, and electric motor. The feed to be converted in pellets is introduced into the Hopper and this flows down into the pelleting chamber by Gravity flow. The die is connected to the shaft which with the help of gearing arrangements is connected to the electric motor, thus rotation of die is done with the help of electric motor. The rotation of the die initiates the rotation of the rollers which pick up the feed material and compress it into the die holes to form pellets. The emerging pellets are cut by a knife and discharged through the pelleting chamber to the discharge tray by a tangential force of the rotating die. The pellets are collected into a bowl and sun-dried. The laboratory test was carried out to study the content of crude fat, crude fibre, total ash, density, and moisture content conducted to evaluate the performance and evaluation animal feed pelletizing machine presented. During the laboratory test parameters like weigh of the sample, dry weight of sample time, temperature, are recorded then we concluded that what is the moisture content and other chemical composition of pellets. Pellets size length and diameter are noted.

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