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# Design and Development of Chicken Feed Dough Mixing Machine 120 Kg/Hour Capacity

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**Abstract:** This study aims to increase the population and productivity of native chickens through the production of ready-made feed as a source of animal protein for native chickens. The target to be achieved is to increase the knowledge and skills of farmers in producing ready-made feed (pellets) for native chickens and ensure the availability of feed for native chickens both in terms of quality and quantity. The activities to be carried out are the manufacture of a chicken feed mixer machine with a capacity of 120 kg/hour and an intensive introduction program for raising native chickens; introduction of feed ingredients for native chicken rations; introduction of native chicken ration formulations; and training in making ready-made feed (pellets). The method used in empowering the target partner group (native chicken farmer community is a learning technique in the form of providing theory, simulations to the community who are target partners and then direct practice with students and target partners.

**Keywords:** mixer, dough and native chicken

## I. Introduction

Pellet is a feed material that is mixed, compacted and molded by a mechanical process. Pellet feed processing can be an option because of several advantages, including: Increasing feed consumption and reducing dispersion of feed loss, Preventing demixing, which is a process carried out to reduce the non-uniformity of a system such as concentration, viscosity, temperature and others. Good pellets are pellets with a good resistance index, so that the pellets are not physically damaged during handling and transportation, are durable and not easily broken, indicating that the minimum specification standard is 80%. The hardness and durability of pellets are closely related to their quality, so they have several advantages such as reducing feed waste, increasing feed consumption and efficiency, and extending shelf life.

Based on a preliminary survey, the community service team with local farmers in Sukorejo village had problems in the field of animal husbandry, one of which was that the population and productivity of local chickens were still low, so that it became an obstacle/constraint in developing local chickens as a superior livestock commodity in the village. The main problem in developing local chickens is that the provision of quality feed and in quantities according to livestock needs has not been able to be provided by farmers. The high price of feed is a burden for people who raise native chickens. The quality of feed given to livestock is largely determined by the content of nutrients, especially protein. The protein content in feed makes the feed better quality. Quality feed directly affects the growth and production of chickens.

Providing quality feed (finished feed) has not been able to be done by farmers because the price (expensive) is a burden on farmers, therefore most farmers only provide makeshift feed without thinking about whether the feed given is of good quality or not, meets the nutritional needs of the livestock or not. Chickens are left to roam around looking for food on their own. The weakness of this maintenance method is characterized by low livestock growth (small/thin), low egg production (few), livestock are easily sick and the mortality rate is quite high. This condition causes the livestock population and productivity to decrease drastically which causes farmers to experience losses.

## II. Methodology

Observation is the initial stage in the research process, this research stage is carried out by conducting observations and interviews with farmers. The observation and interview process is carried out for data and problems experienced by farmers regarding the feed processing process using a livestock feed mixer machine. Obstacles in the use of livestock feed mixer machines are in the mixing capacity, which inhibits feed production. Analysis of livestock feed mixer machines is based on data obtained from observation and interview results.

  

Field study is a process of collecting data in the field that is used to support the research being carried out. The data collected is data on how the livestock feed mixer machine works, the mixing capacity and the production capacity of the livestock feed machine. Observations are made during the operation of the machine, entering raw materials to the printing process from raw materials into pellet-shaped livestock feed. Field studies are also carried out to find out what obstacles are found in the livestock feed mixer machine. Other data collected is data on how to obtain raw materials for feed and the composition of the mixture of raw materials for livestock feed.

Literature study is a process of searching for related references that is carried out to support research. Reference search was conducted related to previous studies that have been conducted and from journals related to animal husbandry, animal feed and animal feed dough mixer machines. Reference search was also conducted to obtain data on the analysis of animal feed dough mixer machines, as well as knowledge about materials and materials, and also knowledge about transmission and pulleys.

**Design and Development**

After conducting data search and concept creation obtained from literature study literature and from survey results, then the machine elements (dynamic parts) of the design and manufacture of feed dough mixer machine can be planned. Planning and Designing are the initial steps in making a machine, the planning of making this machine must be done correctly so that the machine that is made later can work optimally, the planning carried out includes:

1. Power design;
2. Capacity design;
3. Mixer blade design;
4. Pulley and v-belt design;
5. Shaft and pin design;
6. Bearing design.

**Manufacturing Process**

The manufacturing process is carried out after all planning and design processes are complete.

1. Shaft making
2. Mixer blade making

The mixer blade is made from a plate with a length of 160mm. The knife holder is also made from a tube-shaped plate with a diameter of 250 mm and a length of 500 mm.

**Assembly Process**

The assembly process is carried out after the manufacturing process (machining) is complete, so that it will form a "Dough Mixer Machine". The assembly process of the dough mixer machine parts includes:

1. Installing bearings on the frame;
2. Installing the mixer blade on the shaft;
3. Installing the mixer cover body;
4. Installing the shaft on the bearing;
5. Installing the pulley on the shaft;
6. Installing the motor and motor pulley;
7. Adjusting the distance between the motor pulley and the shaft pulley;
8. Installing the V-belt.

**Machine Testing**

Tool testing is carried out to determine whether the dough mixer machine can work properly. The things done in tool testing are as follows:

1. See if the machine elements are working properly;
2. See if the bolts holding the machine elements are not loose, not loose, and not broken;
3. Measuring the time for mixing;
4. Seeing the results of mixing.

**Machine Improvement**

This machine improvement is carried out if there are problems or deficiencies in the tool testing stage, so that it cannot function properly according to the procedures, objectives and planning carried out.

  

## III.Results and Discussion

A dough mixer machine that can crush feed dough is planned to have a capacity of 120 kg/hour. This dough mixer machine has the following advantages: using simple technology, can be operated by only 2 people, economical and easy to maintain. The chicken feed dough mixer machine design is shown in Figure 1.

Figure 1. Chicken feed dough mixer machine design.

This dough crusher machine has the following specifications:

1. Length x width x height = 1.5 x 1.25 x 1.25 meters.
2. Feed dough mixing capacity = 120 kg/hour.
3. Using a 6.5 Hp engine drive to drive the rotary system mixer blade.
4. The mixing system uses 9 blades and an angle between the blades of $120^{o}$.

**Power Planning Results**

The magnitude of the dough mixing force (F) is 0.4 kg. With a radius of the mixing tube of 277.5 mm. Then the torque that occurs (T) is 320 kg.mm. The power required to mix the dough (P) is 1390 W, the correction factor value (fc) is 0.8, so the planned power (Pd) is 1390 W.

**Capacity Planning**

After knowing the cross-sectional area of the knife (A) is 0.0016 $mm^2$, n = 900 rpm then calculate the volume of dough from the experimental results (V) is 0.01413 $m^3$. From this volume, the density of the dough mixer ($\rho$) can be found to be 120 $kg/m^3$, the speed of the cutting knife (V) is 282.6 m/min. So the capacity of the dough mixer machine (Q) is 120 kg/min.

**Pulley and V-Belt Design Results**

The engine used is 6.5 HP and the motor rotation speed is 900 rpm. The diameter of the drive pulley = 95 mm and the diameter of the driven pulley = 180 mm, the length of the belt used L = 1044 mm. Axle distance (C) = 1226 mm. The reduction ratio required (i) = 1.83. From these data, the belt used is type B with the following specifications $\alpha$ = 36°; W= 16.07; $L_0$= 12.5; K= 5.5; $K_0$ = 9.5; e = 19.0; f = 12.5.

**Shaft and Key Design.**

The shaft material to be used is S30C With tensile strength specifications ($\sigma_B$) = 48 $kg/mm^2$ the weight of the blade is 16.4 kg, the weight of the pulley is 1 kg, the pulley tensile force is 7.17 kg. The force on RA = 0.97 kg and RB = 17.37 kg. The largest moment that occurs is 2336 kg with a torque (T2) = 319.7 kg.mm. safety factors (Sf1) and (Sf2) used are 6 (because it uses S-C material) and 2.0 (because the shaft is given a keyway) while the bending factor (Km) is taken as 1.5 because the impact load is large, the torsion factor (Kt) is taken as 2.0 because there is a large shock/impact, the allowable bending stress ($\tau_a$) = 4 $kg/mm^2$. To design a key, you must know the tangential force (F), the magnitude of the tangential force is F = 16.82 kg. The shaft diameter is 38 mm with S30C key material with a tensile strength ($\sigma_B$) = 48 $kg/mm^2$ with a safety factor (Sf1) = 6 and (Sf2) = 2.0. Key length (lk) = 65 mm, key width (b) = 10 mm, and key height (h) = 5 mm.

**Bearing Design Results**

The bearings to be used are angular ball rolling bearings in an installed state with an open bearing

  

number UC208-24, which have the following specifications: d = 38; D = 80; B = 20; r = 1. The radial load on the bearing (Fr) = 17.37 kg and the axial load of the bearing (Fa) = 0 So that the X factor = 0.56, V = 1 and the Y factor = 0, because the bearing used is a radial bearing, the equivalent load of the bearing is 9.72 kg. The bearing speed factor is (fn) = 0.01, and the bearing life factor is (fh) = 6.59. The nominal bearing life (Lh) = 143095.59 hours with the bearing life reliability factor (Ln) = 143095.59 hours.

**Dough Mixer Machine Testing**

This machine testing was carried out in the Manufacturing Process laboratory, Department of Mechanical Engineering, Faculty of Engineering - University of Jember. The objectives of the machine experiment are:

a. To find out the performance of the dough mixer machine.
b. To find out the mixing results.
c. To find out the capacity of the dough mixer machine.
d. To find out the success rate of the mixing.

Table 1. Results of the Dough Mixer Machine Test:

| Testing | $W_1$ (kg) | $W_2$ (kg) | t (min) |
|---|---|---|---|
| 1 | 1,024 | 0,620 | 1 |
| 2 | 0,391 | 0,338 | 1,05 |
| 3 | 0.618 | 0,549 | 1 |
| 4 | 0,522 | 0,495 | 1,6 |
| Total | 2,56 | 2,002 | 4,65 |

Description:
W1 = Weight of dough before being put into the hopper (kg)
W2 = Weight of dough that comes out (kg)
t = Time for mixing ingredients (minutes)

Dough that is chopped & comes out = $\frac{W_2}{W_1} \times 100\,\%$

$$= \frac{2{,}002kg}{2{,}56kg} \times 100\,\%$$

= 92.8% from initial weight.

So in each process, the dough that does not come out is 7.2% or 0.558 kg of the experiment. Machine capacity (Q) = 9.56 kg in 4.65 minutes, so the capacity obtained is 120 kg/hour. After testing, the size of the machine capacity is as expected, the results of mixing the dough as shown in Figure 2 below:

Figure 2. Results of mixing chicken feed raw material dough

## IV. Conclusion

Based on the design and testing results of the feed dough crusher machine, it can be concluded that:

1. The power required to mix the feed dough is 1390 W.
2. The diameter of the drive pulley is 95 mm and the diameter of the driven pulley is 180 mm.

  

3. The shaft material used is S30C with a tensile strength (σB) = 48 kg/mm$^2$. The diameter of the shaft used is 38 mm and the length of the shaft is 780 mm;
4. Based on the test results, the percentage of dough that comes out is 92.8%, the remaining 7.2% does not come out, this happens in every process.
5. The capacity of the dough mixer machine is 120 kg/hour at 900 rpm and the dough can be mixed evenly.

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