DESIGN AND FABRICATION OF PEDIGREE MAKING MACHINE

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ABSTRACT

Drinking juice never made us realize that how much fruit pulp is getting wasted. If we can utilize that pulp for some other purpose by decreasing its moisture content which is responsible for decaying of things it would be of great benefit. Pulp to pedigree deals with heating of pulp to reduce its moisture content and then grinding it to make pedigree which can be fed to the animals. This machine not only reduces the moisture but also helps in storing of pulp. Further, the dried pulp is finely grinded. This pulp then can be readily utilized in the form of pedigree to cattle animals and help saving useful pulp from getting wasted.

I. INTRODUCTION

Livestock play an integral role in the livelihood of poor farmers by providing economic, social and food security. Taking 2010 as the base year, percent more milk in 2050, while these values for developing countries will be 116 percent, respectively (FAO, 2011). To meet this demand, huge quantity of feed resources will be required; challenging sustainability of the feed production systems. Already there is a considerable shortage of feed availability in most developing countries The ongoing shift in the cropping pattern from cereals to more remunerative fruit and vegetable crops in many Asian countries will lead to decreased supply of cereals and crop residues for animal feeding. Fruit and vegetable processing, packing, distribution and CZ consumption in the organized sector in India, the Philippines, China and the USA generate approximately 1.81, 6.53, 32.0 and 15.0 million tons of fruit and vegetable wastes. Therefore if we can utilize the pulp for some other purpose by decreasing its moisture content which is responsible for decaying of nutrients and proteins. Pulp to pedigree deals with heating of pulp in a heating furnace to reduce its moisture content to permissible level so that its nutrient content does not get affected and then grinding it to make pedigree which can be fed to the animals. This machine not only reduces the moisture but also helps in storing of pulp by reducing the water w of pulp. Further, the dried pulp is finely grinded in a grinder with the help of suitable motor.. This pulp then can be readily utilized in the form of pedigree to cattle animals and help saving useful pulp from getting wasted.

1.1 Problem Statement

Here we define the problem statement-

Nowadays availability of food for the cattle animals is biggest issue for farmers. The problem is increasing day by day due to environmental conditions like draught. As we know human life is somehow depended upon cattle animals so, it is essential to fulfill the demand of animals. Following are the majorly occurring problem on which our project implies better solution-

1. Increasing cost of pedigree day by day.
2. Poor knowledge of farmers to provide nutritive pedigree
3. Huge Production of Fruit and Vegetable waste.
4. Drawbacks of conventional pedigree processing methods
5. Less availability of fodder in summer season.
6. Increasing environmental pollution by barracking.

1.2 Objective

The main purpose of this machine is heating of pulp to reduce its moisture content and then grinding it to make pedigree which can be fed to the animals.

- To use the wasted pulp for animal feed
- Long term storage and use the product

1.3 Methodology

What Pedigree making machine does?

This machine works on heating and drying process by using heating element and hot air flow. If the temperature of furnace and air velocity kept to the required condition for the fruit pulp and waste then we can minimize the moisture content. And also there is no harm to the other nutrients while heating. The drying process of this fruit waste increase the life and after some process we can directly feed this to animal as food. This increases the nutrition to animals and reduces the fruit waste.

Need of machine -

Food processing is done to increase the life of food and also the nutrients in it. Long years ago there are some conventional food preserving techniques which are time consuming, complicated and risky. But now days drying methods are used to preserve some food content. In this sun heating is most common method to remove moisture content of food.

Food processing Industries are the one of rising industries but the waste generation is also more. Generally the waste is barrack into ground. To avoid this wastage we can convert it into pedigree for animals.

Conceptual survey -

We referred four different research papers regarding food processing and conservation of food stock by different methods. We found out the different nutrition sources in various fruits and vegetables which are useful in making of animal feed.

II. LITERATURE REVIEW

2.1. Utilization of fruit and vegetable wastes as livestock feed and as substrates for generation of other value-added products. (RAP Publication 2013/04)

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Livestock play an integral role in the livelihood of poor farmers by providing economic, social and food security. Taking 2010 as the base year, 58 percent more milk in 2050, while these values for developing countries will be 116 percent, respectively (FAO, 2011). To meet this demand, huge quantity of feed resources will be required; challenging sustainability of the feed production systems. Already there is a considerable shortage of feed availability in most developing countries. Taking some examples from INDIA, a shortage of 25, 159 and 117 million tons of concentrates, green forages and crop residues, constituting respectively a shortage of 32, 20 and 25 percent of the requirement has been estimated (Ravi Kiran *et al*., 2012). The area under fodder production cannot be increased due to increasing human population and urbanization and the industrial intensive model of livestock production has severe limitations due to increasing cost of fossil fuels, competition for food-feed-fuel and other biophysical limiting factors. The global price of feed ingredients such as maize, wheat, fish meal and soybean meal has increased by 160, 118, 186 and 108 percent, respectively in the last decade, while the price rise in livestock products such as poultry meat, pork and lamb was only 59, 32 and -37 percent respectively, while that of beef was 142 percent (Index Mundi, *2013*).

Under these conditions, to meet the nutrient requirements of livestock and to sustain their productivity and profitability seem only possible if non-conventional, alternate feed resources are explored.

The ongoing shift in the cropping pattern from cereals to more remunerative fruit and vegetable crops in many Asian countries will lead to decreased supply of cereals and crop residues for animal feeding. A strong shift in this direction has already been observed in north India, for example. This change has resulted in generation of huge quantities of fruit and vegetable byproducts and wastes. For example, fruit and vegetable processing, packing, distribution and consumption in the organized sector in India, the Philippines, China and the USA generate approximately 1.81, 6.53, 32.0 and 15.0 million tonnes of fruit and vegetable wastes. These are either composted or dumped in landfills or rivers, causing environmental hazards. Alternatives to such disposal methods could be recycling through livestock as feed resources and/ or further processing to extract or develop value-added products. Such an approach will convert “wastes to opportunities for development” in addition to contributing to sustainable intensification of livestock industry.

We referred –

- Fruit and vegetable wastes like baby corn husk, cauliflower and cabbage leaves, pea Pods, sarson saag waste, culled snow peas and tomato pomace; citrus, carrot and bottle gourd pulp; banana and mango peels etc. are a rich source of nutrients and these can be fed either as such, after drying or ensiling with cereal straws, without effecting the palatability, nutrient utilization, health or performance of livestock.
- These can also be used for the production of value-added products like essential oils, polyphenols, anti-carcinogenic compounds, edible oil, pigments, enzymes, bio-ethanol, bio-methane, bio-degradable plastic, single cell proteins etc. The effective and efficient utilization of fruit and vegetable wastes will reduce the cost of animal feeding thereby increasing farmers’ profits, generate an array of value-added products and help in waste management and reduction of environmental pollution.

2.2 “ Experimental investigation of solar drying for orange peels by forced convection”

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Int. Symp. on Convective Heat and Mass Transfer in Sustainable Energy April 26 – May 1, 2009, Tunisia

Solar drier does not degrade any more the dried products with the manner of the products dried at the natural sun. The drying unit is composed mainly of a solar air collector and an enclosure of drying. The transformation of the solar radiation into heat is done thanks to the solar collector whose effectiveness is increased by the addition of suitable baffles in the mobile air vein. The efficiency of the collector reaches then 80. The hot air on the outlet side of the collector arrives in the enclosure of drying where the heat transfer with the product to be dried is done by convection. The kinetics drying study shows that in addition to the dependence of the temperature and air velocity of drying, the speed of drying also depends on fragmentation on the product to dry, and mainly, of the product surface in contact with the drying air. Thus, the hygrometry is reduced from 76 to 13 % in one day.. The total efficiency of the drier reached 28 %. Two types of driers, one direct and the other indirect drier which is presented here were conceived, carried out and tested at the National School of Engineers of Gabès, Tunisia, in order to dry agro-alimentary products such as of orange peels. The orange peels are interesting for their wealth of vitamin C. The studies showed that they lower the cholesterol level in the blood.

In our area, the south of Tunisia, it is common to dry dates, spices, peppers, fish, etc. Previously, a study of the drying kinetics has been carried out. Tests were carried out in full sun at the same time for the indirect and direct drier.

We referred –

- it is well known that air solar collector can be of interest for drying, especially when they are used in such a way that the products have no direct contact with sun radiation,
- presenting a real product of some economical interest, the orange peels, the drying kinetics curves have been established in quasi-steady states regimes and can be used for similar applications, and are presented in the first part of the paper,
- the second part of the paper, deals with a real air dryer system with two major key points:
  - interest of baffles to increase the efficiency of air solar collectors even with low air flow,
  - Interest of a combination between natural convection and forced convection, through the use of a fan,

to control as precisely as possible the quality of the drying process.

2.3 "Thermodynamic model of microwave drying of citrus peel with different treatments"

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The microwave drying operation includes mechanisms associated with the hot air drying and microwave heating. The coupling of both techniques produces cross-flow of heat and mass unquantifiable and difficult to explain using traditional methodologies. The application of thermodynamics in the microstructure of the product permits to describe and quantify the real phenomena in heating and dehydration which occur in the tissue. One of the critical steps for off-flavors extraction and fiber conformation of orange by-product is the drying operation. The effect of different microwave power densities (0 W/g, 2 W/g, 4 W/g and 6 W/g) combined with 55ºC air drying on drying kinetics, dielectric properties and microstructure of orange peel has been studied. Mass variation, water activity and dielectric properties were measured at time points 0 min, 5 min, 15 min, 40

min, 60 min and 120 min for each drying experiment. The effect of power density on absolute humidity, drying curves, desorption isotherms and dielectric loss factor at 15 GHz was analyzed. Results showed that higher microwave power levels resulted in higher amounts of water evaporated in the same time and faster drying rates. However, desorption isotherms did not show differences among power density while microstructure microscopy showed the opposite. Dielectric loss factor allowed the determination of the critical water activity at which liquid phase disappeared suggesting that microwave energy could be an advantage until the critical water activity is reached.

A correct quantification of micro structural transformations, produced during the microwave drying process may allow the design of suitable structures for extraction processes off-flavors. The citrus juice industry produces a great amount of waste that needs an innovation and development to become products. There is a continuous demand to develop innovative approaches for the valorization of citrus by-products; transforming them into healthy food ingredients by applying environmentally and economically sustainable processes. Citrus wastes are a potential source of different bioactive compounds such as dietary fiber and natural antioxidants among others, and also potential sources of flavors and food colorants.

Furthermore, in previous work it was observed that microwave drying of citrus peels could potentially reduce evaporation costs, resulting in a stabilized product for further conversion into dietary fiber with optimal microbial, sensory and technological properties.

We Referred-

Higher microwave power levels increased the amount of water diffused through the orange peel tissue for the same drying time. Drying rate was faster when combining hot air and microwave energy than only with hot air, showing that microwave energy helps heating the liquid phase and accelerates evaporation. However, the amount of water adsorbed it is not influenced by the drying treatment although changes on tissue microstructure are observed.

2.4 Thermal properties of foods.

Chapter 9, book- 'American Society of Heating, Refrigeration and air-Conditioning Engineers Handbook.' ASHRAE Handbook Refrigeration, 2006.

Thermal properties of foods and beverages must be known to perform the various heat transfer calculations involved in designing storage and refrigeration equipment and estimating process times for refrigerating, freezing, heating, or drying of foods and beverages. Because the thermal properties of foods and beverages strongly depend on chemical composition and temperature, and because many types of food are available. This chapter summarizes prediction methods for estimating these thermo physical properties and includes examples on the use of these prediction methods. Tables of measured thermo physical property data for various foods and beverages are also provided.

In general, thermo physical properties of a food or beverage are well behaved when its temperature is above its initial freezing point. However, below the initial freezing point, the thermo physical properties vary greatly because of the complex processes involved during freezing.

We Referred-

Various thermal properties of food as follows

- Freezing point

- Ice fraction
- Specific heat
- Enthalpy
- Thermal conductivity
- Thermal diffusivity
- Heat transfer coefficient

III. DESIGN CALCULATION OF PARTS (4 kg fruit pulp are taken for calculation.)

So Mp= 4 kg

Amount of moisture content in peels(x)- 80 % = 0.8

Specific heat of orange peels (c_{ps})- 3.81 KJ/Kg.

Specific heat of air (c_{pg})- 1.005 KJ/Kg.

Latent heat of water (h_w)- 2257 KJ/Kg.

Initial temperature of peels (T3)- 30 ^{0}C.

Final temperature of peels (T4)- 90 ^{0}C.

Initial temperature of air = 33 ^{0}C.

Temperature of air at inlet of compartment(T1)- 130 ^{0}C

Temperature of compartment at outlet(T2)- 50 ^{0}C.

1. Mass Flow Rate Of Air Required (Ma):

By Energy balance

$$\mathbf{Ma*c_{pg}\,(T1 - T2) = Mp\,*c_{ps}\,(T3 - T4) + (xh_w)}$$

$$\mathbf{Ma * 1.005 * (130 - 50)= 4 * 3.81 * (90 - 30) + (4 * 0.8 * 2257)}$$

$$\mathbf{Ma= 101.203\ Kg/\ hr\ = 0.0281\ Kg/sec}$$

Finally mass flow rate of air 0.1 Kg/ sec selected.

Density of air at 130 degree= ρ = 0.8646 Kg/ m^3

Volume flow rate of air = Mass flow rate / density of air

= 0.1 / 0.8646 = 0.11565 m^3/sec = 244.94 CFM = 245 CFM

So exhaust fan of minimum discharge 245 cfm must be selected.

For the fan of 245 cfm discharge, 160 mm diameter fan is used.

Air velocity(v)= Air discharge/ area of duct = 5.86 m/s

2. Convective H. T. Coefficient Of Air (h):

Air properties at 130 ^{0}C

Dynamic viscosity = 2.33 * 10^{-5} Kg/ m*sec

Density = 0.8646 Kg/m^3

Prandtl number= 0.6955

Thermal conductivity= 0.03393 W/ m*k

Characteristic length= 0.0152 m

(Calculated by assuming flat plate of length 1 meter & width (π * 0.160) meter)

So, from above data

Reynolds number Re=3305.22

Correlation used is, **$Nu= 0.683*(Re)^{0.466} * (Pr)^{(1/3)}$**

We know that **Nu= (h * characteristic length)/ Dynamic viscosity**

So finally, h. t. Coefficient of air,

h= 58.95 W/ m^2K

3. Electric Heater Selection:

Heater is required to heat the suppled air upto 130 ^{0}C from the atmospheric temperature of about 33 ^{0}C.

So, **Wattage W= h * Area of heater * (130 – 33) = 58.95 * π* 0.016*1* (130 - 33)**

W= 179.61 Watt = 180

Minimum power of electric heater must be greater than 180 Watts.

4. Furnace Capacity:

4 kg of peels having volume approximately 0.01 cubic m

So volume of furnace is for compatibility is taken as 1ft * 1ft * 1ft

V= 1* 1 * 1 cu.ft = 0.028316 cubic m

IV. CONSTRUCTION AND WORKING

a. Construction

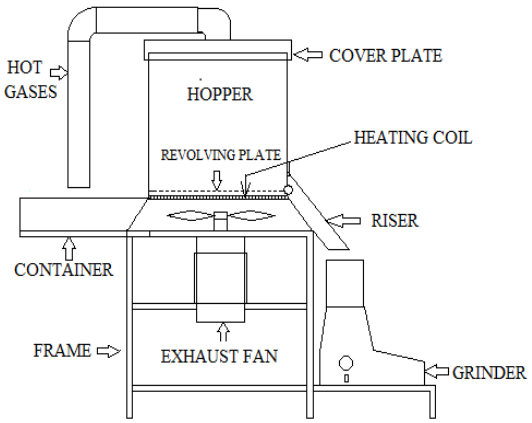
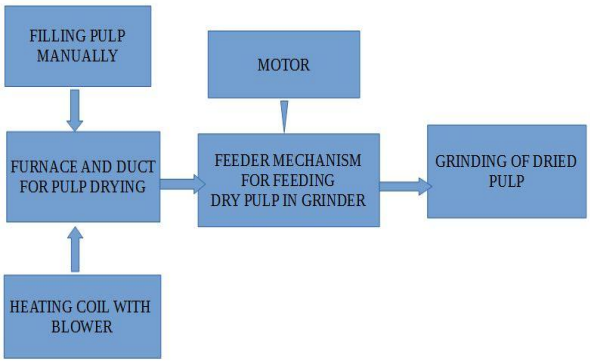


Fig shows the simple setup for the pedigree making machine. It consist of the furnace made up of MS sheets. There is a lid for the manually feeding of fruit and the vegetable waste. Inside the furnace compartment A Heater coil and Temperature measuring device are installed which is not visible in the figure. Heating coil is used to heat the pulp and the temperature measuring device is used to monitor the temperature inside the furnace. A Exhaust fan is installed near the furnace compartment so as to increase the heat transfer rate by inducing hot air to the furnace. Exhaust Fan is driven by the DC motor. The furnace is followed by the grinder, the household grinder is installed near the furnace. Feeder mechanism is provided is provided to transfer the pulp from furnace to the grinder which operates on the mechanical linkage. To collect the powder form pedigree a collecting vessel is used at the bottom.

b. **Working**



This setup implies conversion of wet Fruit and Vegetable pulp into useful pedigree which can be totally utilized by farm cattle. This machine consists of Feeding the pulp manually into the furnace. The furnace consists of a heating coil with a blower.

This setup induces hot air into the system with the help of blower. In the furnace, drying process of pulp takes place. Blower increases the rate of heat transfer which in turn decreases the time of reducing the moisture content in the pulp. Monitoring of pulp and temperature inside the furnace can be performed with the help of temperature measuring device and time period for which the pulp is heated. Temperature measuring device is installed inside the furnace.

Further this dried pulp is forwarded to the grinder with the help of feeder mechanism to grinder where it will be almost converted into powder form. Grinding of pulp will be monitored using the optimum time required for converting dry pulp into almost powder state.

V. COMPONENTS USED USED IN PEDIGREE MAKING MACHINE

1. Air heating Cill

Open coil heating elements are coiled resistance wire (usually Ni-Chrome or Kanthal, but also others) fixed onto a supporting element.

Selection of correct wire gauge, wire type and coil diameter requires experience in industrial heating. Standard air heating elements are available on the market, but quit often they need to be custom built. Open coil air heaters work best below air velocities of 80 FPM. Higher air velocities could cause the coils to contact each other and short out. For higher velocities, select a tubular air heater or strip heater.

It is recommended the use of a flow switch in the airstream to avoid any potential overheating of the resistance wire. There are standard open coil heating elements available on the market. Most of these elements need a constant airflow over the resistance wire, but if watt densities are low enough they may not burn out in still air.

The big advantage of open coil heating elements is the very quick response time. Specification Used:

750 watt AC

Circular heating coil with 1m Length

2. Exhaust Fan

An exhaust fan is a type of fan, or system commonly venting into a building's attic, designed to circulate air in a home or building. It exhausts hot air from the attic to the outside through an opening in the roof or gable at a low velocity.

An Exhaust fan pulls air out of a building and forces it into the attic space. This causes a positive pressure differential in the attic forcing air out through the gable

and/or soffit vents, while at the same time producing a negative pressure differential inside the living areas which draws air in through open windows.

Typical diameter is 24 inches (61 cm), having motors of power 1⁄4 to 1⁄2 horsepower (0.19 to 0.37 kW), and using 120 to 600 watts of electric power. There are two types of fan:

Ceiling Mounted: Mounted on ceiling between the attic and living space.

Ducted: Remotely mounted away from the ceiling; can exhaust heat from multiple locations; operation is extremely quiet. Specifications Used:

250CFM

Quantity 1 Nos

3. DC Motor

A DC motor is an internally commutated electric motor designed to be run from a direct current power source. DC motors were the first commercially important application of electric power to driving mechanical energy, and DC distribution systems were used for more than 100 years to operate motors in commercial and industrial buildings. DC motors can be varied in speed by changing the operating voltage or the strength of the magnetic field. Depending on the connections of the field to the power supply, the speed and torque characteristics of a brushed motor can be altered to provide steady speed or speed inversely proportional to the mechanical load. Brushed motors continue to be used for electrical propulsion, cranes, paper machines and steel rolling mills. Since the brushes wear down and require replacement, brushless DC motors using power electronic devices have displaced brushed motors from many applications

When a current passes through the coil wound around a soft iron core, the side of the positive pole is acted upon by an upwards force, while the other side is acted upon by a downward force. According to Fleming's left hand rule, the forces cause a turning effect on the coil, making it rotate. To make the motor rotate in a constant direction, "direct current" commutators make the current reverse in direction every half a cycle (in a two-pole motor) thus causing the motor to continue to rotate in the same direction. Specifications Used:

12V DC motor Reversible 100RPM

4. Household Grinder

Blade grinder (also propeller grinder) is a machine that chops material while mixing it, by means of a high-speed spinning blade. Applications of blade grinders for preparing foods include numerous electric kitchen appliances such as blenders (including immersion blenders), food processors, some garbage disposals, and some coffee grinders. The terms "blade grinder" and "propeller grinder" are in popular use to distinguish the blade grinder type of coffee grinder from other types. Other consumer applications include rotary lawn mowers.

Blade grinders also resemble industrial blade (propeller) mixers, which like meat grinders rotate at much slower speeds. Unlike blade grinders, these mixers do not alter (break, cut, shred, macerate, pulverize) the material

being mixed. The high speed of rotation of blade grinders is necessary to achieve their cutting action. In a blender application, the high speed of rotation contributes to shearing, which in turn contributes to aeration and the formation of emulsions. These are desirable qualities in many food preparations. A blade grinder can run on batteries or more commonly on electricity.

VI. SPECIFICATIONS OF COMPONENTS

Sr. No.	Component	Specification
1	Heating Coil	750 Watt, AC, 1m Length
2	Exhaust Fan	Diameter 160mm, 250CFM
3	Household Grinder	Ac 230V, 40Watt.
4	DC Motor	12V, AC
5	Rack and Pinion Gear	ID 10MM
6	PVC Pipe	110mm Diameter
7	PVC Elbow	110mm Diameter
8	Switch	3/2 Switch

Other Accessories: Temperature Measuring Device, Moisture meter.

VII. ADVANTAGES

- Storage life increases
- Highly Nutritive Pedigree
- Fruit and Vegetable waste is less Costlier and easily Available
- Simple Handling
- Less time Consuming
- Use of Waste Material
- Prevents Environmental Pollution

VII. FUTURE SCOPE

- This machine can further be used to convert large amount of pulp in pedigree.
- Fast working of machine can be achieved by using a high industrial grade heater as this machine has a normal grade heater for furnace.
- Conveyor system can be implemented for automatic loading of pulp in to the furnace area.
- Automatic packaging system can be installed at the end of conveyor to package the pulp in packets.

IX. CONCLUSION

We have designed and fabricated Pedigree Making Machine, In which approximately 4kg of Fruit and vegetables pulp can be used at a time. This machine has limited use up to some extent of commercial purpose. The capacity of the same machine can be easily modified for the use of large scale commercial purpose.

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We on the behalf of this acknowledgement wants to thanks those persons and resources due to which we are able to complete the Reasearch Work. First of all we would like to thanks G. S. Moze college of Engineering, Balewadi Pune for their Idea to engage students In such activity due to which We students open up to vast engineering applications. We also would like to express our Gratitude to our respected H. O. D. of Mechanical Engineering Department Prof. A. A. Karyakarte and Faculties for their planning and guidance which proved a milestone in this this work.. We are also grateful to our parents and friends for their help and Encouragement.

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