



# DESIGN, FABRICATION AND PERFORMANCE EVALUATION OF MORINGA (*OLIFERA*) DRIED LEAVES PULVERIZER

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## ABSTRACT

This project is to develop the moringa *oleifera* leaves pulverizer from the locally sourced materials. The proposed machine works with the shearing mechanism. The main features of the machine are shaft, hopper, sprout, frame, belt, pulley, bearings and electric motor. The machine was designed, fabricated and tested fulfilling the all scientific standards. During study, a solar dryer was used for drying moringa *oleifera* leaves at average temperature of 40–50 C for 3 days. The principle of operation was that after drying moringa *oleifera* leaves (using solar dryer) it was feed through the hopper and by gravity, the leaves fall freely into the pulverizing chamber. Then the pulverizing chamber crushes and powders of the moringa leaves, which comes out through the sprout. The machine can be used to produce moringa tea and moringa powder safely without using the local burr mill. The findings of this work regarding pulverizing mechanisms can also be applied to other herbs and leaves.

Keywords: Moringa *oleifera*, shearing mechanism, Pulverizing Chamber

## INTRODUCTION

Moringa *oleifera* is the most widely cultivated species of Moringaceae family, that is the native to the sub-Himalayan tracts South Asia. Popular English names are Horseradish tree, Drumstick tree, Never Die tree, West Indian Ben tree, and Radish tree. Moringaceae family comprise of 13 species, distributed in the Indian subcontinent, Kenya, northeastern and southwestern Africa, Arabia, and Madagascar. Moringa *oleifera* is a subtropical deciduous perennial dicotyledonous tree. The stem is with a whitish-gray bark, with drooping branches, pale green leaves with opposite, ovale leaf. All parts of the Moringa tree are edible and have long been consumed

by humans. According to the Food and Agriculture Organization's (FAO) report, about 70–80% of the world's population, especially in developing countries, relies on herbal medicine to prevent and cure diseases and about 25% of the synthesized drugs are manufactured from medicinal plants. The health benefits of moringa leave are they are rich in Vitamins and Minerals Rich in Amino Acids, Fight Inflammation, Rich in Antioxidants, Lower Blood Sugar Levels, Lowers Cholesterol, Protects the Live, Protects Against Arsenic Toxicity. Moringa powder can be used for protect tissue (liver, kidneys, heart, and lungs), and to reduce pain for the body. Antioxidants help protect cells against free radicals. It is produced by digesting food, smoking, and exposure to radiation. Antioxidants from plant-based sources such as moringa powder are considered best in medical purpose to cure diseases.

A pulverizer is a mechanical device for the reduction in grain size of many different types of materials. The various usages of the pulverized moringa oleifera leaves is that it can be used as spice for food, flavourful, nutty, and delicious, moringa tea delivers nutrients as well as a tasty liquid treat. Moringa has been said to prevent 300 diseases, Moringa leaf powder is one of the richest sources of natural Iron and calcium, Moringa powder is also considered a natural multivitamin. The Moringa leaf powder is traditionally used. Moringa dry leaves pulverize into fine powder has a fine grain size and Moringa powder can be added to milk, soup, tea, sauce and other food. Different methods used to dry moringa leaves are microwave method, infrared, lyophilisation method, oven drying or convection drying, solar drying and shadow drying. Indian foods are prepared tastily using variety of spice powders. However, Spice grinding is not that much easy and suitable for all households and chefs in restaurants due to lack of knowledge in proper proportion of ingredients and no machine for grinding small quantity.

Many machines came but, the fineness of spice powder cannot be achieved even with the latest machines like mixer grinder. Hence, many households and chefs of restaurant using spice powder available in markets, but these powders had some preservatives and chemicals that cause severe health issues to human. The flour mills provide superfine spice powder and excellent taste but it is more economic and requires high voltage for operation and produces more noise.

The general term, size reduction, includes the mechanical processes of cutting, shearing, crushing, grinding, and milling moringa dried. These processes expose more surface area for digestion without causing any noticeable change in the chemical properties of the material. At the same time, size reduction facilitates uniform mixing. And although uniformity in size and shape of the reduced particles is usually desired, it is seldom attained. Fineness modulus of coarse aggregates represents the average size of the particles in the coarse aggregate by an index number. It is calculated by performing sieve analysis with standard sieves. The cumulative percentage retained on each sieve is added and subtracted by 100 gives the value of fine aggregate. Higher the aggregate size higher the Fineness modulus hence fineness modulus of coarse aggregate is higher than fine aggregate told that fineness modulus indicates the uniformity of grinding in resultant product. It is determined by adding the weight fractions retained above each sieve and dividing the sum by 100.

The study was conducted on grinding experiment of commercial grade coriander in batches, semi-

continuous and continuous grinding in hammer mill. The various operations used to pulverize materials, which results in the reduction in the grain size of the particles these occur where the elements are crushed, split and grinded. Various methods used locally in pulverizing moringa dried leaves are rubbing stone and grinding stone pounding using traditionally, size reduction is done using mortar and pestle, the end product gotten is sifted with sieve and the process repeated over again till the chaff residue is minimal.

After the introduction of the burr mill, the manually pulverized dried leaves is milled into fine powder with the help of the burr mill. The disc attrition which is sometimes called the Burr mill consists of a set of two hard surfaced circular plates pressed together and rotating with relative motion. Stones are replaced by steel disks mounting interchange metal or abrasive grinding plates rotating at higher speeds, thus permitting a much broader range of application. They are used in the grinding of tough organic materials, such as wood pulp and corn grits. Grinding takes place between the plates, which may operate in the vertical or horizontal plane. The material is fed between the plates and is reduced by crushing and shear. Though the power requirement is low, operating empty may cause excessive burr wear and a lot of heat is generated during shearing action and metal chips would be in the powder. Efforts to change the process would be further boosted through this research by establishing a suitable mechanism for pulverizing moringa dried leaves.

Presently, the manual pulverisation with the mortar and pestle is no more practiced, with the invention of hammer mill, which is used in pulverizing dried moringa leaves mechanically before the process is completed with the use of burr mill. These mechanical means of pulverizing dried moringa leaves saves times and energy and better end product is gotten than the old traditional means. The specific objective of this project is to design and fabrication of moringa (*oleifera*) leaves pulveriser; and evaluate the performance of the moringa (*oleifera*) leaves pulveriser.

Impact pulverizer is one among the wide range of industrial crushers is used for design medium fine grinding of semi or soft hard material. The study of machine is to form a locally sourced paraphernalia. Shearing medium are the proposal machine works. The feature of the machine are belt, pulley, electric motor, frame stand, pulley belt and bearing Hooper.

## METHODS

The pulverizing unit is made up of iron and the processes of developing the model were iron roller, galvanised sheet was marked out and punched on one side to have an effect on the other side without getting through to the other side, the punched galvanised steel was wrapped around the roller, development of the hopper and pulverizing chamber, construction of frame for the pulverizing chamber, assemblage of the various components.

The punched galvanised sheet was also wrapped around the wall of the pulverizing chamber in such a way to give a clearance of 2 mm, and at any contact with the dried leaves it shears the leaves and this is called pulverizing; increasing the surface area of the leaves. The principle of operation is that the punched sheet was

stationary to the wall of the pulverizing chamber and the other punched galvanised was rolled around the roller and this rotates.

The moringa oleifera leaves pulverizer is powered by an electric motor. The design principle was gotten from the ancient tradition methods of grinding and pounding materials into reduced form. The two traditional methods used involves mortar and pestle and grinding stone which works on the impact force created on the material to a stationary material which is not smooth.

The moringa oleifera leaves pulverizer works with these principles and it makes the production of moringa pulverized leaves much easier and faster. The auger as a roller and it was wound round with punched galvanised steel which is not through to the other side of the galvanised steel the elevation on the galvanised steel are randomly placed and the space between them is considerably small, a shaft was attached to the auger supported by two flat bearing.

The principle of operation was that after drying moringa oleifera leaves (using solar dryer) it was feed through the hopper and by gravity the leaves fall freely into the pulverizing chamber the hopper was designed to prevent accumulation of leaves at corners, at any contact the auger makes with the leaves it shreds and it was reduced in size thereby pulverizing the leaves to increase the surface area. The moringa oleifera leaves pulverizer is powered by an electric motor. The design principle was gotten from the ancient tradition methods of grinding and pounding materials into reduced form. The two traditional methods used involves mortar and pestle and grinding stone which works on the impact force created on the material to a stationary material which is not smooth.

## RESULTS AND DISCUSSION

The Moringa (*oleifera*) leaves pulveriser machine that has been developed to pulverized dried moringa leaves is presented in. The efficiency of the machine was evaluated at different motor speed 9000 rpm and 6500 rpm with machine efficiency of 82% and 85% respectively. The machine was developed using locally available materials and it's cost effective with estimated cost of 5500 INR. The experimental procedure carried out gave the result of the fine modulus and uniformity index of the pulverized dried leaves, it was discovered that the speed also affected the average size of the leaves. This machine is more efficient to produce dried powder of different grain sizes with low cost budget and less skill compared to conventional hammer mills, milling cum grinders and blenders used for producing dried powder are costly and required less skilled labour. The whole set up of the Pulverizer machine is been displayed below.



The machine can be used to produce moringa tea and moringa powder safely without using the local burr mill. The findings of this work regarding pulverizing mechanisms can also be applied to other herbs and leaves. The experimental procedure carried out gave the result of the fine modulus and uniformity index of the pulverized dried leaves, it was discovered that the speed also affected the average size of the leaves. The difference in percentage of fineness of moringa leaves particles could be due to differences in hardness of grains. The results however disagreed that the high moisture rolled corn had a greater proportion of coarse particles than the fine. These differences in performance of the mills could be attributed to variation in plates clearance and grains moisture content. This shows that the system is good and safe for the fabrication.

## CONCLUSION

Moringa (*oleifera*) leaves pulveriser machine has been developed to Pulverize the dried moringa leaves in order to increase the surface area of the leaves for the production of moringa powder which can be use as tea, encapsulated as drug ,to improve immune and can be use as additives in industries to improve food products like yogurt, biscuits, bread etc. The dryness of the leaves is a very important factor that determines the quality and efficiency of your machine which was achieved using solar dryer. This machine is more efficient, economical and easy to use to produce dried powder of different grain sizes compared to hammer mills, milling cum grinders and blenders. The machine is good and also applied for herbs and leaves. This machine will be good and dependable to use.

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