III- Objectives and research methodology

CHAPTER - III

OBJECTIVES AND RESEARCH METHODOLOGY

The potential applications of Turmeric (Dried Rhizomes of the plant *Curcuma domestica* var. syn. *C. Longa*) is in regular food items, confections, medicine, religious functions and as biopesticides. (2010). The traditional method used for turmeric processing has many drawbacks which lead to reduce the quality of the final product, so it is required to improve the quality of turmeric. The quality of the turmeric can be improved only after making changes and improvements in the present method of processing. The proposed method reduces total cost of processing so that the turmeric of good quality is produced with optimum cost.

3.1 THE VARIOUS OBJECTIVES FOR STUDY AND FABRICATION OF THE PROPOSED WORK

Broadly the objectives of the proposed work is to design and fabricate the turmeric boiler unit (blancher) which can boil turmeric Rhizomes uniformly, with less consumption of fuel, less laborious work like handling, loading-unloading, less time consumption and to get Rhizomes of good quality after processing. The detailed objectives are as discussed below:

1. To reduce the fuel consumption in traditional method.

   In traditional method fuel is required to heat water and to boil Rhizomes in open pan, which consumes large amount of fuel in the time span of around 80 to 90 minutes per 100 kg Rhizomes. The fuel consumption in this method is reduced by steam boiling and designing the new blancher for turmeric processing.
2. To reduce the time consumption in processing the turmeric per metric ton.

   In traditional method 80 to 90 minutes of time is required to process 100 kg of Rhizomes. In this method half of the time is wasted to boil water, which consumes time and fuel. Both time and fuel consumption can be reduced by adopting steam boiling.

3. To reduce laborious work in traditional method of processing.

   In traditional method, the Rhizomes from the store are loaded in an open mild steel pan, after boiling to 80 to 90 minutes, the Rhizomes are unloaded. After boiling, the Rhizomes are very hot with temperature 80 to 100°C, which are very difficult to handle and unload, it requires number of labors to transfer from the place of boiling to the place of drying platform. During handling of the hot Rhizomes there is loss of quality of the Rhizomes due to piercing, scorching and mud mixing, which is to be reduced by designing new blancher.

4. To avoid uneven heating of Rhizomes.

   In traditional and existing method the Rhizomes are not boiled uniformly. The Rhizomes at the bottom layer of the pan gets more heat compared with the Rhizomes at top level. Also due to traditional boiling and piercing, there is loss of volatile matter of turmeric Rhizome, which affects the quality of Rhizomes. This uneven heating of Rhizomes is avoided by designing proper steam pipes in the new design of the turmeric plant called blancher. With uniform distribution of steam pipes in the blancher, there is uniform flow of steam which heats the Rhizomes uniformly throughout the blancher. The uniform heating and boiling of Rhizomes leads to better quality of turmeric Rhizomes without breaking or scorching.
III- Objectives and research methodology

5. To replace a mild steel pan in traditional method with high quality (SS 304L) stainless steel pan to improve quality of Rhizomes.

In traditional method of turmeric processing due to oxidation corrosion takes place in mild steel pan by reacting mild steel with oxygen, which lead to the loss of quality of turmeric Rhizomes by mixing these contents. It is avoided by replacing mild steel pan with stainless steel pan in the Rhizomes during boiling.

6. To improve quality of Rhizomes by proper handling and proper boiling method.

In traditional method the Rhizomes are boiled in open pan covered with gunny bags and cowdung on it. At some places the Rhizomes are boiled for about 40 to 60 minutes under slightly alkaline conditions (100 g of sodium bicarbonate or sodium carbonate in 100 liters of water). During this process there is a chance of mixing and adding the hazardous constituents in the turmeric Rhizomes. Also due to open pan there is a chance of mixing dust, cowdung, mud etc. This is to be avoided to get good quality Rhizomes.

7. To reduce handling and labour cost.

In traditional method more labours are required to handle the turmeric Rhizomes. The Rhizomes are to be transferred from store to boiling unit, hot Rhizomes from boiling unit are unloaded and transferred to the drying platform etc. The process is laborious and due to improper handling of hot Rhizomes, the quality of the Rhizomes get affected due to scorching, mudmixing etc. The handling and laborious work is reduced by designing a suitable trolley to transfer the hot Rhizomes directly from boiling unit to the drying platform.
III- Objectives and research methodology

8. To design and fabricate a turmeric blancher which can sustain high load, high temperature and pressure and it is rigid to handle by unskilled labors with minimum processing cost of the turmeric.

9. To design, fabricate and testing of a new blancher for turmeric processing, which optimizes the processing cost of turmeric by reducing labour cost, reduces handling cost, reduction in time and fuel consumption and improving the quality of Rhizomes by uniform heating affected by steam boiling in a stainless steel (SS 304L) blancher.

10. To design and fabricate a turmeric blancher which is mobile in operation.

The traditional and existing method of turmeric processing are difficult to install and they are not mobile to operate. These require high initial cost for installation and they are not suitable to process less quantity of turmeric available with the single small scale farmer. A new proposed turmeric blancher is mobile to operate, it can be easily installed at any suitable place with minimum installation cost. The proposed turmeric blancher can be installed to handle minimum as well as maximum turmeric Rhizomes for processing with small scale farmers in India.

3.2 RESEARCH METHODOLOGY:

The main problems in processing of turmeric were studied and taken into consideration through literature Review. The field problems in the processing method were discussed with the experts and leading farmers in this region in the exhibition held at Marathwada Agricultural and Engineering University, Parbhani.

From the literature review it is concluded that there is only traditional and existing method used to process turmeric with little changes made in the processing of turmeric Rhizomes in India. The main difficulties occurred in the processing of turmeric Rhizomes is listed below after discussion with experts and leading farmers. The traditional method of turmeric processing requires more labor cost, more fuel
cost, more handling cost and it is time consuming. In this method the quality of the Rhizomes are not maintained due to uneven heating of Rhizomes, improper handling of Rhizomes during loading, unloading, boiling, drying, scorching, trampling and polishing. The quality of Rhizomes is also affected due to entering dust, mud mixing, cowdung mixing in open pan [K.J.Kamble, S.B.Soni. (2009)]. In traditional method at some places Rhizomes are boiled for about 40 to 60 minutes under slightly alkaline condition (100 gm of Sodium bicarbonate or sodium carbonate in 100 liters of water) [B.Sashikumar (2001)] which affects the quality of Rhizomes.

Considering the field problems and conclusion of literature review the research work is carried out to design and fabricate the mobile blancher. The design work is carried out manually with standard design considerations. [V.B.Bhandari. (2007)] and [S.K.Bansal. (2009)]. The various components of mobile blancher with its assembly is designed. The housing of the blancher is designed in a cylindrical fashion and in a hexagonal shape as per the requirement and aesthetic look. After manual design the blancher unit is modeled using Uni-Graphics Software. After modeling the blancher on Uni-Graphics software, a mathematical model is developed to calculate steam flow rate and time required to process the turmeric Rhizomes. Meshing of the model had been carried out using Hypermesh. The meshed model is analyzed and tested in ANSYS™ software. The finite element model is generated with the quadrilateral, 2D shell and 3D brick elements to generate the Hypermesh. The self weight is considered 1 G [9.81 m/s² and 760 Torr], number of lines are 10082, number of surface areas are 2851, number of 2D elements are 72391, number of 3D elements are 18289 and total number of elements are 90680. The thermal analysis is carried out within temperature limits 120°C to 210°C and pressure limits 2 bar to 9 bar. Uniform temperature of the blancher is studied at 120°C, 150°C, 180°C, 210°C. It was found that the temperature and heat distribution is uniform throughout the assembly. The results of deflection and stress analysis for the pressure range 3 bar to 9 bar are within the limits.