

Fabrication of Integrated Malting Unit for Production of Malts

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ABSTRACT

Malting is a three step process i.e. steeping (grain soaked in water), germination (development of sprout and enhance enzymatic activity) and kilning (drying the grain and stop the enzymatic activity). All these three steps are completed in separate plants. The present study is based on the development of integrated malting unit which serves all three processes in a single unit. Integrated malting unit is used for small scale production of malt. Integrated malting unit proved useful for development of new malting technique for grains.

Keywords: Malt, Integrated malting unit, nutritional quality

I. INTRODUCTION

Malt is germinated dried cereal grain. Malt is prepared in three main steps soaking, germination and drying. The main objective of malting is to develop the hydrolytic enzymes, which are absent in the non-germinated grain **lyumugabeet et al.; 2012**. The malted grain is high in vitamins (A, B, C, and E) and protein contents **Briggs, D.E. et al.; 1999**. During soaking water availability is increase due to softening of grain. Germination induces the synthesis of hydrolytic enzymes like starch degrading enzymes, and proteases **FAO, (1995)** and **Traoré et al.; 2004**. Traditional Malting process is used to improve the nutritional quality of protein **Wang, Y.D. and Fields, M.L.; 1978**.

Malt is mostly prepared from barley grains but other cereals and starch containing substances are also used now days. These include corn, rice, wheat, sorghum, sweet sorghum, cassava, etc.

Barley is the primary cereal used in the production of malt in the world **Broderick; 1977**. Barley is rich in protein, carbohydrates, dietary fibers, minerals, and vitamins **Mahesh Gupta et al; 2010**.

Finger millet has gained importance because of its nutritional quality in terms of dietary fiber, functional fiber, starch pattern as well as high calcium and iron contents **Balkrishna Rao et al; 1973; Deosthale et al; 1970**. Malting characteristics of finger millet are superior to other millets and ranks next to

barley malt **Mallesh and Desikachar; 1986** and **Pawar and Dhanvijay; 2007**. Malting of finger millet improves its digestibility, sensory and nutritional quality as well as has pronounced effect in lowering the antinutrients.

Finger millet and sorghum Malting of is a common in India and Africa among malted sorghum and malted maize the malted finger millet is considered superior **Taylor, J. et al; 2006**. Malting results in mobilization of hydrolytic enzymes such as amylases and proteases which are essential for the solubilization of starch and proteins in the grains **Mikola, L. et al; 1980**. Malted grain is used to make beer, whisky, malted shakes, malt vinegar, flavored drinks, and some baked goods, such as malt loaf, bagels, and rich tea biscuits etc. **Mahgoub, S.E.O et al., 1998; Mallesh, N.G. et al., 1986**.

There are many crops including cereals and legumes which are locally cultivated in Uttarakhand in large quantity. Underutilized crops are the lesser known species in terms of trade and research, and often adapted to marginal and stress conditions (**Joshi et al.; 2002**). With ample of nutritional benefits, these are very much accepted as part of staple diet and also have the potential to be converted or included in processed foods. In spite of the advantages associated with their production and nutritive value, these lesser known crops have received very little attention in terms of research.

Most of the underutilized crops which include, millets, pseudo cereals, legumes, are consumed as food. Traditional products prepared from these crops include weaning mix, dalia, porridge, fermented beverages, snacks, composite flour mix etc. These all products are made at household levels using household practice of processing i.e. popping, roasting, germinating or sprouting, malting, cooking and fermentation. Utilization of these crops would certainly lead to sustained market demand and in turn would ensure increased income and better livelihoods for the small scale farmers of Uttarakhand state. Studies related to value addition of underutilized crops using malting technology needs a radical approach as very little work has been done in India.

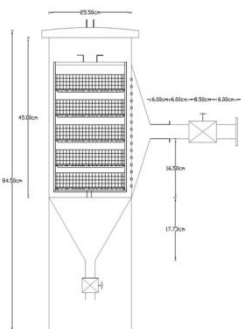
Therefore, the present study has been planned keeping in view all the above factors in mind an integrated malting unit for the production of malt at household level was fabricated in the department of Post-harvest Process and Food Engineering, G. B. Pant University of Agriculture and Technology, Pantnagar. Malting unit is simple and less expensive in fabrication. Many small scale malting equipment's have been built Meredith, W. O. S., et al. but there is no such equipment in which all three processes (steeping, germination and kilning) is completed in single unit.

Description of Integrated malting unit

Integrated malting unit shown in figure 1 (a) and the line diagram of integrated malting unit shown in figure 1(b).



Fig 1(a) Integrated Malting Unit
Fig 1 (b) Line diagram of Integrated Malting Unit



The unit contains a cylindrical outer cover with conical base of stainless steel/ G.I metal. Inside the unit there are arrangements of sieves as shown in figure 2, on which grains spread for malting.



Figure 2 Sieves arrangement

The capacity of each stainless steel sieve to retain grain on it is 1kg so the total capacity is 5 kg. Figure 3 shows the whole setup of integrated unit with drying arrangement having blower, heater and temperature controller for providing the hot air for drying the grain which are spread on stainless steel sieves.



Figure 3 Whole setup of Integrated Malting Unit

Method of use of integrated malting unit

The grain spreads on the sieves at uniform thickness and water is added from the top of the unit so that the top sieve should dip in water and water is replaced 3-4 times during entire period of steeping for proper aeration of grain by the fresh water by opening the bottom valve, at the time of steeping and germination the side valve is closed to prevent the leakage of water into heating system. After completion of steeping process all water is drained out by opening the bottom valve and left the grain for germination on sieves. After completion of

germination process the side valve is open for the last step of malting i.e. drying, hot air of desired temperature comes from the side and cross the sieves so that the hot air spread equally over all sieves and the grain is dried. After removal of sieves from the unit we get malt.

Fabrication of the Integrated Malting unit

Integrated malting unit was developed in the department of Post-harvest Process and Food Engineering, G. B. Pant University of Agriculture and Technology, Pantnagar in December 2012. The height and outer diameter of integrated malting unit is 84.50 cm and 25.50 cm respectively, the height and diameter of sieve arrangement is 22.50cm and 36.56 cm respectively. The height of chamber where all three processes completed is 45.00 cm. The sieves are refabricated by providing hole in it so that hot air can flow over germinated grain. The size of bottom valve is ½” and side valve is 4”. Figure 4 shows the side arm of integrated malting unit in which holes are provided for distribution of hot air into the integrated malting unit chamber over the sieves arrangement. The drying unit of integrated malting unit contains heater and a blower with temperature and air velocity controlling regulator. The heating unit is attached to the side arm of integrated malting unit as shown in figure 3. The total cost of fabrication is approximately rupees 10, 000-11,000.

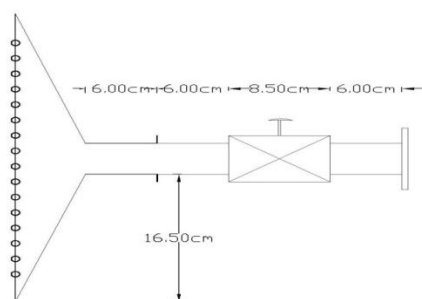


Figure 4 Side arm of integrated malting unit

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II. CONCLUSION

Integrated malting unit proved useful for development of new malting technique for grains. The integrated malting unit can reduce the cost of process of malt production. The integrated malting unit can also provide employment for small scale malt producer. There are some future works required for the betterment of integrated malting unit.

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