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Future Prospects of Drying Operations in Fluidized Bed Dryer

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Abstract—*The purpose of this study was to scrutinize the property of the fluidized bed drying technique on the final excellence of varieties of rice in medium and long grain. The consequences were correlated to that of paddy drying by means of a traditional process. Dried samples were dehusked and also polished. Finally, the information was investigated for Results to demonstrate that paddy drying in a fluidized bed dryer would diminish the value factors except for rice whiteness for which conventional drying is more acceptable. For that reason modification of fluidized bed drying method is suggested and designed in Ergun visual CFB. The fluidized bed dryer is a extremely efficient tool for training the essentials of grain drying. The heating of dry air and drying technique is evaluated with the help of results. The effect of drying air temperature on drying rate with milling quality can be demonstrated. The fuel consumption efficiency to dry the moisture stack can also be considered. Although it is easy to educate unskilled workers how to activate a dryer, effective and efficient use of dryers to produce highquality grain can only be done by skilled technicians who recognize the process.*

Keywords*: Fluidized bed drying, Rough rice, Sun drying, Rice quality.*

1. INTRODUCTION

Rice is one of the main economic crops of the earth and the rice bazaar involves together consuming and producing nations. In order to hold back rice deterioration subsequent harvest paddy must be dried down to a level to facilitate will enable safe storage all the way through reduction in respiration and prevention of mycotoxin invention. This correspond to a moisture content of about 13- 14%. Which is measured adequate for safe storage and the milling procedure [Bonazzi et al.(1997)]. In profitable drying of agriculture products heated air is utilized.

Mechanical methods, especially those using hot air for rapid drying of grains high in moisture content are suitable increasingly accepted [Soponronnarit et al.(1996)]. Two original efficient drying methods are the fluidized bed drying and solar drying methods. Research illustrate that rough rice drying can influence the excellence properties of rice which affects approval of the commodity by the traders at dissimilar stages of the marketing chain [Wiset et al (2001)]. Thus, with growing demand for better and higher quality products and for resourceful operations, the processing system and its control for reducing product degradation is an existing challenge for rice drying. The results exhibited no loss of eminence due to thermal gradients if paddy is bare to temperature levels of 30ºC, 55ºC, 70ºC and 90ºC. This revision represented the temperature alone cannot explain the practical quality degradation of rice throughout drying. Several of the third world countries produce huge quantities of fruits and vegetables for limited utilization and export. According to the Food as well as Agricultural association (FAO, 1991), the estimate for 1990 be roughly 341.9 million metric tonnes. India produces 27.8 million metric tonnes or 8.1%, while China has a making capacity of 21.5 million metric tonnes or 6.3% of the total world production. Several of these fruits and vegetables hold a large capacity of preliminary moisture content and are therefore highly vulnerable to rapid quality humiliation, still to the extent of spoilage, if it is not reserved in thermally prohibited storage amenities. As a consequence, it is vital that, as well as employing reliable storage systems, post harvest technique such as drying can be implemented to adapt these consumable products into more stabilized products that can be able to be kept under a nominal controlled environment for an extended period of time. In this paper, the authors reviewed literature on different types of drying strategies for agricultural food stuffs and planned several low cost dryers for application in farming areas wherever raw materials and labour are eagerly available.

2. INTENTION OF DRYING

At harvest time rice grain will have 20-25% moisture. At high grain moisture substance there is natural respiration in the grain that causes deterioration of the paddy. High moisture advances the improvement of insects and molds that are destructive to the grain. High moisture in grain additionally brings down the germination rate of rice. Along these lines, drying of rice is basic to prevent from infestation and quality deterioration of rice grain and seed. The reason for drying is to decrease the moisture substance of rice to a level safe for storage. As even short term storage of high moisture paddy rice can bring about quality deterioration, it is essential to dry rice grain at the earliest opportunity in the wake of harvesting preferably within 24 hours [Gummert et al(1993)]. Drying of grain includes surrounding air with low relative humidity or to warmed air. This will dissipate the moisture from the grain and afterward the drying air will expel the moisture from the grain. Since drying practices can largely affect grain or seed quality, it is critical to see a few basics of grain drying.

2.1. Moisture eliminating process

In paddy grain, moisture is available at two areas at the surface of the grain, surface moisture and in the bit, inner moisture. Surface moisture will promptly vanish when grain is presented to hot air. Inward moisture evaporates much slower in light of the fact that it first needs to move from the piece to the outside surface. Accordingly, surface moisture and inner moisture dissipate at an alternate rate[Phan Hieu Hien et al (1998)]. This distinction results in an alternate drying rate at which grain moisture content decays amid the drying procedure. The drying rate is ordinarily communicated in (%/hr). Average drying rates of grain dryers are in the 0.5%/hr to 1%/hr range.

2.2. Equilibrium Relative Humidity

In the event that the grain is put away in an encased storage environment the air encompassing the grain on the off chance that it is all around fixed is not in free contact with outside air. For this situation, the relative humidity of the encased air will achieve equilibrium with the moisture content in the grain. The last relative humidity of the encased air is regularly communicated by the 'equilibrium relative humidity'. The higher the grain moisture substance of the put away grain, the higher the equilibrium relative humidity, and the higher the odds of mold improvement or loss of germination [Yasuo et al (2003)]. All in all, an equilibrium relative humidity inside the storage of 65% or less is viewed as a sheltered counteractive action against the improvement of molds.

2.3. Uniform Drying

During the drying process there is always volatility in Moisture Content of individual grains. Particularly in fixed bed dryers the grains at the air inlet dry earlier than at the air outlet resulting in a moisture gradient in the grain volume at the end of the drying process. For production of good featured grain or seed, this unpredictability should be kept as low as possible. Regular stirring in sun drying, grain turning in fixed bed dryers or re-circulating fluidized bed dryers will get better uniformity of drying, reduce the re-wetting of dried grains and thus preserve grain quality.

3. FINANCIAL PARTS OF DRYING

The utilization of mechanical drying systems offers such a variety of points of interest over sun drying like support of paddy quality, safe drying amid downpour and around evening time, expanded limit, simple control of drying parameters and the potential for saving money on labour cost that it is astounding that so couple of mechanical dryers are being utilized. Different studies have hence centered on the elements that prompted the disappointment of presentation of various drying systems. The imperatives can be assembled under headers identified with innovation, know how, after generation framework, administration and financial aspects. Innovation can be produced, know-how and administration related issues can be tended to through limit building measures, and post harvest framework related issues can be dealt with by picking the right innovation alternatives. In any case, regarding financial aspects drying faces an issue, which is one of a kind for after creation operations, to be specific the accessibility of sun drying as a straightforward and exceptionally economical option. Much of the time immaculate financial aspects in this manner turn into the restricting component for the presentation of mechanical drying systems.

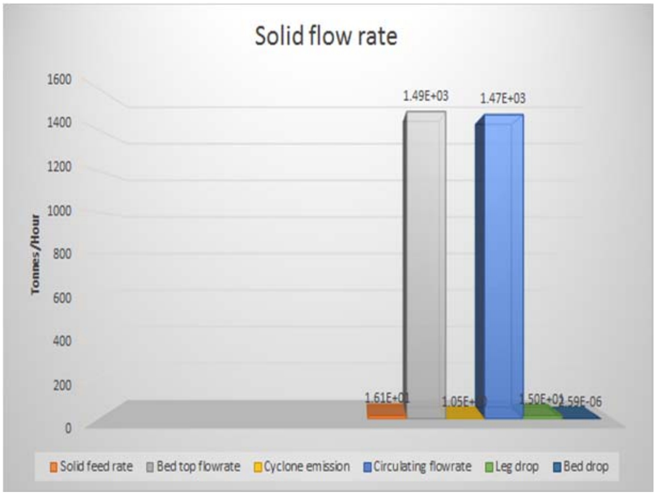
3.1. Expenditure for drying

Every one of the dryers that were effectively popularized in Vietnam has drying taken a toll with under 5% of the paddy esteem. Contextual investigations in other Asian nations demonstrate that mechanical dryers with cost higher than 5% of the paddy esteem can't be presented effectively. There is no reason for posting cost numbers for various drying systems here since drying cost depend in numerous site particular variables and a "strategy for success" including money saving advantage count must be directed for every individual drying framework considering the states of the territory. Drying expense are made out of settled cost comprising of deterioration, expense of interest, repair expense, and opportunity cost, and of variable expenses comprising mostly of fuel, labour andpowercosts.

4. RESULTS

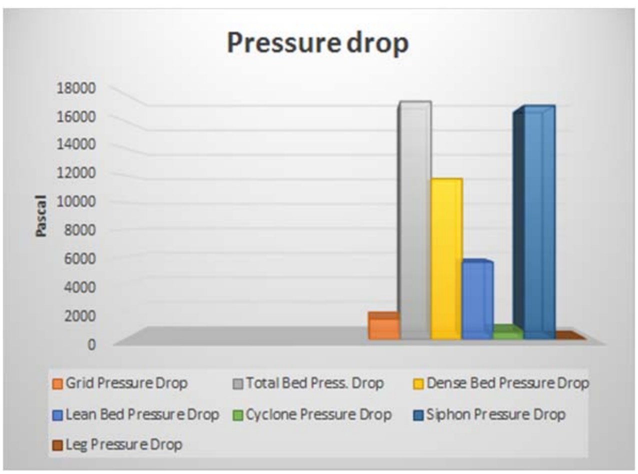
Grid Performances were estimated in the software for the circulating fluidized bed Grid Pressure Drop (Pa)= 1.500E+03 and Jet penetration length (m) = 2.957E-01. The Expert suggestion the software is Grid Pressure Drop has Economic design with Low pressure drop. Hence, Low pressure drops cost less. Grids with pressure drops between 1400 and 3000 Pa are acceptable. The gas distribution would be more regular with higher pressure drops. The flow pattern was considered for the dilute bed model is applied for simulation the results obtained were Lower bed voidage is 0.80070, Upper bed voidage is 0.98894, Gas velocity at bottom is 5.0 m/s, Solid Circulating Rate is 91.6 m/s and Net solid flow rate is 1.487E+03 t/h. Contingent upon the motivation behind the drying cost estimation drying expense can either be expressed as yearly cost or as cost per unit of weight. On the off chance that the evaluation is done to contrast the dryer and other drying systems, e.g. with sun drying, the expense per unit of weight is more suitable, if the drying framework is assessed as a feature of the entire post harvest framework yearly cost figures may be more doable. In the accompanying the expense is eluded to one metric ton of dried paddy [M.M. Bandong et al(1994)].

4.1. Solid flow rate graph



The above Bar graph represents the solid flow rate in the components of circulating fluidized bed dryer. The rate of flow is referred in tonnes/hour.

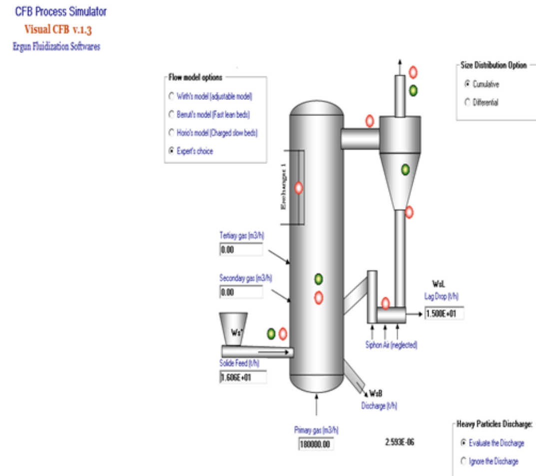
4.2. Pressure drop graph



The above Bar graph represents the pressure drop in all the components and aspects of fluidized bed dryer.

4.3. Circulating fluidized bed simulator

This module is the spirit of the software. The simulation of the whole CFB system is constantly the objective of the design study and modeling task. The global simulation of a CFB requirements some basic information of the system. These facts can be acquired during a "step-by-step" study of diverse items composing the system (i.e., grid, flow pattern, cyclone, etc).

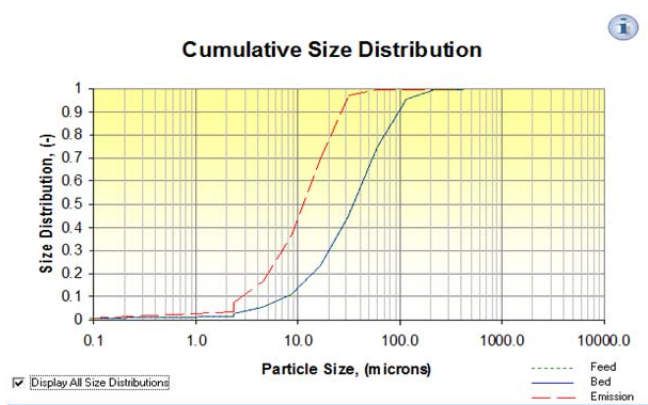


The figure above represents the main CFB design window. A number of options being accessible directly on the work sheet the choice of flow model and the discharge evaluation.

4.4. Cumulative size distribution graphs for process flow

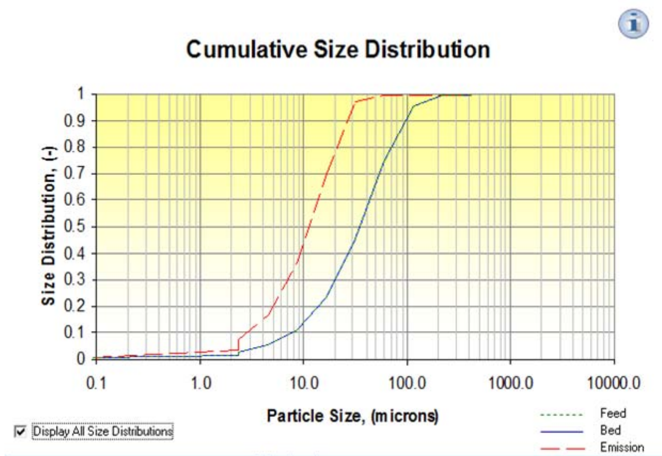
This addendum presents particle size distributions factors for various sources or processes designed for which recognized emission data were accessible. usually, the sources of data used to develop particle size distributions. Particle size distribution information reported in the literature by different individuals as well as companies. Particle size data from Ergun visual CFB were mathematically tempered into more uniform along with consistent data. Particle size distribution articulated as the cumulative weight percent of particles less than a specified aerodynamic diameter, in micrometers. A sized flow factor can be derived commencing the mathematical product of a mass flow factor and the cumulative weight percent of particles lesser than an exact point in the graph.

4.4.1. Cumulative size distribution at solid feed



The above graph presents cumulative size distribution at solid feed in the CFB here it is clearly showing the feed and bed have particle size more than the emission.

4.4.2. Cumulative size distribution at bed, grid and cyclone emission



The above graph exhibits the cumulative size distribution in the dryer. It is for size distribution at bed, grid and cyclone emission.

5. CONCLUSIONS

In this research work we designed a business level fluidized bed paddy dryer and was tested in Ergun visual CFB software. The operating conditions were as follows paddy bed height 11.5 cm, paddy feed rate 4.82 tons/h drying air flow rate 1.7 m3/s (1.9 kg/s),fraction of air recycled 0.85, drying air velocity through bed 1.4 m/s. In this case by means of average inlet air temperature of 140°C, it can be accomplished as follows fluidized bed dryer could reduce moisture content of paddy from average 28 % dry basis to 23 % dry basis. Paddy temperature at drying compartment outlet was average 64°C. Total average specific primary energy consumption was 6.15 MJ/kg water evaporation. This works on the principle of fluidization. Fluidization is a process in which solids are caused to behave like a fluid by blowing gas or liquid upwards through the solid-filled reactor, Fluidization is widely used in commercial operations

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