International Journal of Innovative Studies in Sciences and Engineering Technology (IJISSET)

ISSN 2455-4863 (Online) **www.ijisset.org** *Volume: 3 Issue: 12 | December 2017*

Study and Review of BAGAS Dryer

[1]Vishal Shinde, [1]Shivanand Wani, [1]Vivek Patil, [1]Rahul Shahapure, [1]AvadhutYamgar, [2]Prof. R.B.Patil

[1]UG Student Mechanical Engg. Dept., AITRC, Vita

[2]Asst.Prof.Mechanical Engg. Dept., AITRC, Vita

Abstract: *Sugar cane bagasse is the only fuel used in the sugar-alcohol industry in Brazil, the world's leading sugar cane producer. The sugar alcohol industry produces cogenerated electrical energy for its own consumption and the surplus is sold to the market. Improving the use of bagasse in furnaces is currently an important industrial strategy. The topic has aroused great interest due to an increase in the cogeneration level in recent years. This work reviews the state of the art of sugar cane bagasse drying.*

1. INTRODUCTION

The export of surplus electricity from sugar industry cogeneration is becoming the norm in many parts of the world. Cogeneration systems are composed of a steam generation system, steam turbines and, of course, the process plant that acts as the condenser for the LP exhaust steam. The need to keep generating beyond the end of crop means that many systems also have water cooled condensers, typically inte-grated with a turbine which is then a pass-out condensing machine. The steam generation system is the principle source of losses from modern cogeneration stations. It has a boiler, an air pre-heater, an economiser and sometimes a bagasse dryer. The bagasse dryer, like the pre-heater and economiser,increases the steam generation efficiency but it only becomes a significant influence when flue gas is used as the heat source for drying, the steam generation efficiency. being directly related to the final gas temperature. It must be remembered that, even though bagasse drying is a means of making more energy available from the cogeneration station, the net increase in electricity generation depends on the charac- teristics of the entire plant, which is also a function of mainly the turbine inlet steam condition, the temperature and pressure of the exhaust and the turbine efficiency. Arrascaeta and Friedman1,2 have presented the state of art of sugar cane bagasse drying until 1987. However, despite the importance of bagasse drying in recent years, it has not been sufficiently discussed. The aim of this work is to present a review of the most important drying systems (whether reported in the literature or not) and a discussion of their main characteristics. Advantages of drying sugar cane bagasse When the boiler efficiency is determined based on the Higher Heating Value - HHV, it is possible to perceive that a critical aspect is the bagasse moisture content.3This value represents about 14.79% of total heat losses, since the typical boiler efficiency is about 65.83%. Don et al.4according Upadhiaya5reported that the HHV of brix free, ash free and moisture-free bagasse is 19605 kJ by kg of dry bagasse, but if its moisture content is 50%, in the same conditions of brix and ash, the LHV becomes 7929 kJ by kg of wet bagasse. The reduction of cane bagasse moisture increases the LHV, and at the same time, the volume of the boiler exit gases is reduced

2. LITERATURE REVIEW

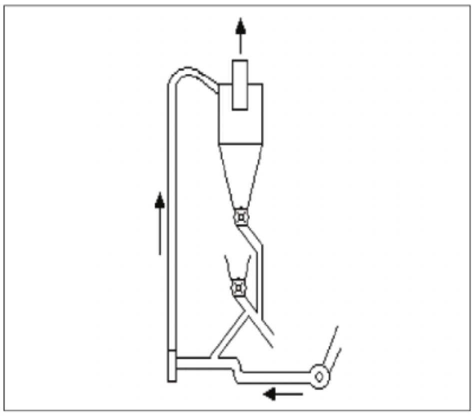
Remembering that the specific heat of water vapour is almost twice that of other gases, the heat losses by exit flue gas are also reduced. Water vapour reduction also decreases the load of induced draft fans. Boulet stated that drying the sugar cane bagasse could reduce air pollution and air demand in the furnace. Nebra7 concluded that pneu- matic drying is a good choice even when combustion gases coming from an air pre-heater are used (GIT 180°C). Bailliet8stated that the main advantage of sugar cane bagasse drying over the air pre-heater is the substantial increase in bagasse "burnability". Hence, bagasse drying is definitely a good course of action for mills producing large amounts of it with moisture above 50%. [2]

Table 1. Industrial bagasse drying systems

Type and size	Capacity [t/h]	Year	Plant, location	Reference	Remarks
Counter current flow	1.4	1910	Palo Alto Sugar Factory Donaldsonville, Louisiana	6	Pilot scale
Rotary dryer	(three) 30	1976	Atlantic Sugar Association, Florida	10	GIT = 218 °C
Rotary dryer 3.6mx12 m	50	1976	St. Mary Sugar Co., Louisiana	2	GIT = 315°C
Rotary dryer	35	1979	Waialua Sugar Co., Hawaii	16	GIT = 244°C
Pneumatic dryer	(five) 5	1980	Açucareira Santo Antonio, Brazil	12	GIT = 300°C
Pneumatic dryer	12		Açucareira Santo Antonio, Brazil	12	GIT= 330°C
Pneumatic dryer	30		Açucareira Santo Antonio, Brazil	12	GIT= 300°C
Pneumatic dryer	25	1981	Barra Grande sugar factory, Lençois Paulistas, SP, Brazil	7	GIT = 300°C
Pneumatic dryer	(six) 4.7		Cruz Alta Plant, Olímpia, SP, Brazil	12	GIT = 259°C
Pneumatic dryer	(six) 5		Cruz Alta Plant, Olímpia, SP, Brazil	12	GIT = 239°C
Pneumatic dryer	(six) 6.1		Cruz Alta Plant, Olímpia, SP, Brazil	12	GIT = 257°C
Rotary dryer 3.6mx9m	65				
	10.7	1980	Davies Hamakua Sugar Co., Paauilo - Hawaii	16	Pellets
Rotary dryer 4.2mx9 m	72	1980	Hilo Coast Processing Co., Pepeekeo, Hawaii	16	
Pneumatic dryer			Paia Factory of HC&S Co., Maui, Hawaii	16	
Pneumatic dryer	24	1982	Central Azucarero Don Pedro, Batangas, Philippines	2	
Rotary dryer 3.6mx12 m.	45		Central Aidsisa, Bacolod, Philippines	2	GIT=258°C
Rotary dryer 2.4mx15.7 m	13		Central Victoria, Bacolod, Philippines	2	
Pneumatic dryer	2	1980	Sugar Research Inst., Mackay, Queensland, Australia	11	Pilot scale
Pneumatic dryer		1983	Chun Cheng Sugar Factory, China	2	Pilot scale
GIT = 140°C					

Marquezi and Nebra9 have shown that bagasse drying can save more energy than the air pre-heater. Drying sugar cane bagasse in an integrated system makes possible to obtain exit gases from the steam generation system at a lower temperature1,11. The use of bagasse dryer could reduce the temperature of the boiler exit gases from 300 to 140°C, increasing the steam [3] generation system efficiency from 54% to 69%10.Currently there are bagasse dryers with even better performances, capable of reducing the GOT to about 75°C12, 13, 14. Energetic and exergetic analysis of a steam generation system has shown that bagasse drying improves the energetic efficiency from 71.44% to 84.98%, simultaneously increasing the exergetic efficiency by 3.14% Meirelles [4] studied the use of a fluidized bed dryer for a sugar canebagasse of unusual characteristics: very high inlet moisture (71 to 91%) and small particle sizes (0.51 to 1.02 mm). Meirelles found that amixer was required to achieve fluidization. During the drying process, bagasse agglomeration was reduced and the dried particles were elutriated. Researchers at the Faculties of Mechanical Engineering and Chemical Engineering at State University of Campinas (UNICAMP) have been working on drying of agricultural residues in cyclones33. Nebra et al.34 presented a review of the drying process in cyclones, including part of the work by the UNICAMP researchers. [5]

Figure 1a. Pneumatic dryer (Santo Antonio Factory)[12]



Corrêa et al. 7,8,9 presented theoretical and experimental data on bagasse dry- ing in a cyclone that underwent geometric changes in order to work as a dryer. These authors worked with bagasse with inlet moisture content from 48 to 78% (w.b.); bagasse mass flow in the range of 0.0017 to 0.012 kg/s; GIT 210°C; and air flow rate of 7.8x10-2 kg/s.They succeeded in reducing bagasse moisture content by 74% along aparticle residence time of 5 to 23 seconds. Apilot-scale system was used in this experiment. [6]

The cyclone was 1.0 m in height. It must be pointed out that cyclonic dryers allow a longer residence time than other pneumatic types. Barbosa and Menegalli38 and Barbosa39 studied sugar cane bagasse drying kinetics in a pneumatic dryer (initial moisture content 36% to 82%). They found that the most significant moisture reduction happened in two places: the acceleration zone at the pneumatic duct, and the cyclone.[7]

This pilot-scale system measured 0.075 m in diameter and 3.0 m in height; bagasse mass flow varied from 0.0034 to 0.017 kg/s, air mass flow from 0.028 to 0.048 kg/s, GIT from 120 to 233°C, and final moisture content from 21.3% to 78.9%. Alarcón and Jústiz40 also worked with a pneumatic dryer. Coarse particles were removed in the beginning of the drying process, and the smaller particles remaining in the dryer had their moisture content reduced from 50 to 30%. GIT was in the range of 240 to 270°C. Bigger particles were used as raw material in the paper and pharmaceutical industries and smaller ones were burned to generate thermal energy[8]

3. CONCLUSIONS

The first industrial bagasse dryer was of the rotary type. Many other types have since been experimentally studied and used in industries, such as fluidized and solar dryers. At present, pneumatic dryers are most often used in factories because of their low price and small space requirements. Bagasse dryers undoubtedly promote energy savings that increase the efficiency of the steam generation system. With the current increase in export cogeneration in most Brazilian factories, the bagasse dryer could become an important element of the system, even though studies about trade-off between the air pre-heater, the economizer and the drier are necessary, taking into account costs and energy consumption, aiming to determine the best seating arrange- ment between these pieces of equipment.

REFERENCES

[1] Arrascaeta, A., Friedman, P. (1984), Bagasse drying: past, present and future International Sugar Journal,Vol. 86, no. 1021, pp. 3-6.

[2] Arrascaeta, A., Friedman, P.(1987), Bagasse drying, International Sugar Journal,89 (1060): 68-71.

[3] Acosta J.C. (1995), The boiler efficiency fuelled by bagasse, International Sugar Journal,97 (1158): 248-255 (in Spanish).

[4] Don, C.E, Mellet, P, Ravno, B.D, and Bodger,R. (1977), Calorific Values of South African Bagasse. Proceedings of The South African Sugar Technologists' Association,pp 169 -173.

[5] Upadhiaya, U.C. (1991), Bagasse as a fuel, International Sugar Journal, 93 (1111):132-138.

[6] Boulet, W.P. (1975), Waste fuel drying and the energy, The Sugar Journal, 10: 40-47.

[7] Nebra, S.A., Macedo, I.C.M. (1989), Pneumatic drying of bagasse, International Sugar Journal,91 (1081): 3-8.

[8] 8. Bailliet, V.J. (1976), Bagasse drying versus air pre-heating, The Sugar Journal,38 (10) 52-5