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Moisture Content in Byproducts of Sugar Industry: A Critical Review

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Abstract

Sugar industry is seasonal in nature consumes large quantity of water as a result it discharges large volume of effluents and wastes from manufacture process. It has been realized that along with the production of sugar from sugarcane, it is better to produce many value added products by diversification and utilizing the byproducts of the sugar industry. The main byproducts of the sugar industry are bagasse, molasses and filter cake. Much attention has not been paid to the quantity of the water available in these byproducts so as to achieve the better efficiency of water consumed in the sugar industry. This paper gives the main focus on literature available for new byproduct as water available in the existing byproduct.

Key Words: Moisture Content, Byproduct, Bagasse, Molasses, Filter Cake.

1. INTRODUCTION:

World prices for sugar and petroleum products have shown spectacular variations since 1973. The long term outlook is very likely to be a gradual increase in the price of all fossil fuels and stagnation, for the price of sugar. It has been realized that though the production of sugar from sugarcane is undoubtedly the most paying proposition, it is better to produce many value added products by diversification and utilizing the byproducts of the sugar industry. The main byproducts of the sugar industry are bagasse, molasses and filter cake or press mud. Besides these byproducts, there are other byproducts also which are of less commercial value, viz., sugarcane trash, sugarcane tops, wax boiler or fly ash and factory and distillery effluents. The bagasse is used mainly as fuel to generate steam and power in the sugarcane factories as well as to produce pulp and board, furfural, particle board, medium density fiber boards (MDF) and cattle feed, etc. The molasses is used for animal feed or can be used after transformation as rum, potable alcohol or industrial alcohol, source of ethanol and alco-chemicals, acetic acid, butanol / acetone, citric acid, yeast and monosodium glutamate, and potable spirits. The filter cake or press mud or filter mud are precipitated impurities contained in the cane juice, after removal by filtration, form a cake of varying moisture content.

2. LITERATURE REVIEW:

Excell T. L. and Koenig M. F. S. (1963) has studied the more economic technique of microwave drying for shredded cane bagasse samples and investigated the moisture in the bagasse on three different samples. They had concluded that the mean moisture content in the bagasse is 56.33%.

Olbrich Hubert (1963) has studied the sugar industries in the Western Europe and found out that the average percentage of moisture content in the molasses is about 20% in case of sugar cane molasses and 16.5% in case of beet molasses.

Ravno A. B. and Lionnet G. R. E. (1975) has carried out the study on filter cake in Huletts Sugar Limited in South Africa and found that the quantity of filter cake produced is 5% of total cane crushed with average moisture content in three different samples is about 78.91%.

Paturau J. M. (1986) has carried out extensive study on alternative uses of sugarcane and its byproducts in agro industries and concluded that molasses produced is approximately 3% of total cane crushed with average moisture content of 20% and quantity of filter cake produced is 3.4% of total cane crushed with approximate 80 % moisture content.

Bernhardt H. W. and Notcutt P. (1993) has carried out study during the sugar season for the year 1990 - 1991 in South Africa and concluded that around 600000 Tons filter cake produced per season and found that the quantity of filter cake produced is just more than 3% of the total cane crushed with average moisture content of 73.3%.

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Mangal Singh (1994) has carried out study sugar industries in India and concluded that the quantity of bagasse produced is about 31.82 % of total cane crushed with 50% moisture content, the quantity of molasses produced is about 4.25 % of total cane crushed with 18% moisture content and the quantity of filter cake produced is about 4 % of total cane crushed with 75% moisture content.

Eugenia J. Olguin, et al. (1995) has carried out study of five sugar industries as representative samples with different capacities from 23 sugar industries in the State of Veracruz in Mexico, one of the most important region for sugar production. They had investigated that the average quantity of bagasse produced is 31.8% of total cane crushed with moisture content of 50%, also the average quantity of molasses produced is 3.4% of total cane crushed with approximate moisture content of 18% and the average quantity of filter cake produced is 4.8% of total cane crushed.

K. C. Koster (1995) has examined the diffusion industries (cane handled by diffusers) of South African sugar industries for the period of five years and concluded that moisture content of bagasse in diffusers is 51.41% as compares to moisture content of bagasse in mills is 51.93%.

D. P. Kulkarni (1996) has carried out extensive field survey for each operation involved in the process of white sugar manufacture from sugar cane in various sugarcane producing countries of the World and concluded that the sugarcane contains water is around 67.5%, the quantity of bagasse production is in the range of 24-30% of total cane crushed with approximate 45-50% moisture content, also the quantity of molasses production is in the range of 3.5-4.5% of total cane crushed with approximate 15-20% moisture content and the quantity of filter cake produced is in the range of 3.5-4% of total cane crushed with approximate 75-80% moisture content.

Somwanshi K. Y. and Ghorpade M. D. (2003) has carried out study at Natural Sugar and Allied Industries Ltd. Sainagar, Ranjani, India and investigated the quantity of average bagasse produced is 28.20% of total cane crushed with approximate moisture content of 50%, also average quantity of molasses produced is 4.26 % of total cane crushed with approximate moisture content of 12% and the average quantity of filter cake produced is 3.58% of total cane crushed with approximate moisture content of 70%.

Sapkal D. B., et.al. (2004) has carried out study on achieving zero waste water discharge in typical Indian sugar industry and investigated on 100 tons sugarcane crushing and concluded that quantity of bagasse produced is 34 tons i.e. 34% of crushed cane having moisture content of 50%, also quantity of molasses produced is 3.5 tons i.e. 3.5% of crushed cane having moisture content of 14.28% and the quantity of filter cake produced is 4 tons i.e. 4% of crushed cane with moisture content of 70%.

Rame Gowda B., et al. (2005) has carried out the study at Ponni Sugars (Erode) Ltd. at Tamil Nadu, India having crushing capacity of 2500 tons per day and concluded that the quantity of bagasse produced is about 27 % of total cane crushed with 50% moisture content, the quantity of molasses produced is about 4.5 % of total cane crushed with 10% moisture content and the quantity of filter cake produced is about 4.75 % of total cane crushed with 75% moisture content.

Yadav R. L. and Solomon S. (2006) has studied the potential of developing sugarcane byproducts based on Indian industries and concluded that typical sugar industry processing of 100 tons of sugarcane produces the quantity of bagasse of 30 tons (i.e. 30%) with moisture content in the range of 43-50%, the quantity of molasses of 4 tons (i.e. 4%) and the quantity of filter cake of 3 tons (i.e. 3%) with moisture content in range of 50-75%.

Kartikeyan M. and Prem Kumar J. (2006) has carried out study on utilization of water from sugarcane at Rajshree Sugars and Chemicals Ltd. Unit-II, Mundiampakkam, India concluded that the average quantity of bagasse produced is 27% of total cane crushed with 52% moisture content, the quantity of molasses produced is about 4.5 % of total cane crushed with 15% moisture content and the quantity of filter cake produced is about 4.5 % of total cane crushed with 75% moisture content.

G. Covey, et al. (2006) has carried study on new opportunity to pulp bagasse in Australia. They have concludes that potential availability of bagasse having excess of 100×10^6 tons and the approximate quantity of moisture content in bagasse is 50% from region like Northern, Herbert, Burdekin, Mackay ,Bundaberg and NSW Mills .

Mbohwa C. (2009) has studied advantages of bagasse power development as environmental friendly option in South African conditions and concluded that the approximate quantity of bagasse produced is in the range of 23 to 37 % of total cane crushed depends on fibre percentage of cane which is in the range of 12 to 19% with moisture content in bagasse is 45 to 55%.

Anwar S. I. (2010) has carried study on moisture content in bagasse of sugar industry and jaggery industry in India and concluded that quantity of sugar industry bagasse

having moisture contains in the range of 46-52% as compare to 48 % moisture content in jaggery bagasse with base value of cane fibre is 14%.

J. Lois-Correa, et al. (2010) has conducted the study on experimental evaluation of sugar cane bagasse storage in Bales system that in a zone of Pablo Noriega sugar mill in the province of Havana, Cuba and concluded that the wet raw bagasse having approximate moisture content of 50%.

R. J. Steindl, et al. (2010) has carried study on filter cake as substitute for commercial fertilizers and soil conditioner contains nutrient making value and concluded that the filter cake from Australian sugar industries having large proportion of moisture content having in the range of 75–80%.

M. A. Rouf, et al. (2010) has concluded after carried study on filter cake from sugar industry in Bangladesh that filter cake having moisture content is in the range of 60-80% which depends on cane variety, soil condition, nutrients applied in the field, process of clarification adopted and other environmental factors.

Bhosale P. R., et al. (2012) has carried out study on filter cake from Kunbhi Kasari S.S.K, Chatrapati Shahu S.S.K, Chatrapati Rajaram S.S.K and Shri Dutta Asurle Porle these Sugar Industries in Kolhapur district in India concluded that the filter cake is a soft, spongy, amorphous and dark brown material where 1 ton sugarcane crushing results 3.6-4 tons (i.e. 3.6-4%) filter cake having approximate 80% moisture content.

NL Agency (2012) studied for preparation of report on improving the sustainability of the Brazilian sugarcane industry and concluded that represents quantity of bagasse production is 33 tons (i.e.33%) for 100 tons cane crushed with 50% moisture content.

Gunjal B. and Gunjal A. (2013) has carried out study on water conservation in sugar industries in India and concluded that 100 tons sugarcane crushed produce the quantity of bagasse of 34 tons (i.e. 34%) with 50% moisture content, produce the quantity of molasses of 3.5 tons (i.e. 3.5%) with 14.28% moisture content and produce the quantity of filter cake of 4 tons (i.e. 4%) of with 70% moisture content.

Agarwal A. and Maroo V. (2013) has carried out the study on bagasse power in India with meeting challenges of energy, environment and sustainable development. They had concluded that the bagasse produced by the sugar industry is in the range of 23% to 37% of total cane crushed which depends upon fiber percentage in cane with moisture content is in the range of 48-50%.

Santosh Kunnur et al. (2013) has carried out study on composition of Indian sugar industry bagasse states fresh bagasse normally contains 50% moisture content and concluded after experimental performance on composition of bagasse having 49% moisture content.

Sudhakar J. and Vijay P. (2013) have carried out study on moisture content in bagasse as byproduct of sugar industry in K.C.P sugar industry, India and concluded that wet bagasse having approximate 48-52% moisture content.

Alena A. and Sahu O. (2013) has carried out their research work on bagasse at Wonji Shoa Sugar Industry, Ethiopia having crushing capacity of 1700 tons per day concluded that the average bagasse produced is 31% of total cane crushed with average moisture content of 50% from different commercial cane varieties.

Yadav R. N. (2014) has carried out study on water balance at Shreenath Mhaskoba S. K. Ltd., Patethan, Dist. - Pune (Maharashtra), India. Researcher has concluded that the quantity of bagasse produced is about 30 % of total cane crushed with 50% moisture content, the quantity of molasses produced is about 4% of total cane crushed with 10% moisture content and the quantity of filter cake produced is about 4% of total cane crushed with 75% moisture content.

Nyonje E. O., et al. (2014) has studied characteristics of filter cake in three sugar industries in Kenya. After study they has concludes that moisture content in the filter cake for Sony Sugar Company is 67.7%, Transmara Sugar Company is 63.1% and Sukari Industries is 60.1%. Also concluded that the moisture content in the filter cake samples varied from 60.1% to 67.1% (average 63.1%) in Kenyan sugar Industries.

Environmental Impact Assessment Report (2014) prepared after study carried out at M/s Ugar Sugar Works Ltd.Ugar Khurd, Dist- Belgaum, Karnataka, India states that existing sugar industry having capacity of 10000 tons crushed per day produces bagasse of 3000 tons (i.e. 30%) per day having moisture content in the range of 45-55%, produces molasses of 400 tons (i.e.4%) per day and produces filter cake of 400 tons (i.e.4%) per day.

3. CONCLUSION:

From the above literature review it has been concluded that the production of bagasse is in the range 24-32% of the total cane crushed having moisture content in the range of 48-50%, production of molasses in the range 3-4.5% of total cane crushed having moisture content in the range of 10-25% and production of filter cake in the range 3-4.75% of total cane crushed having moisture content in the range of 60-80%.

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