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REVIEW PAPER ON PERFORMANCE EVALUATION OF DISTILLERY PLANT THROUGH ENERGY CONSERVATION METHODS

Mr. Chougule G.A*, Mr. Jadhav V. V, Prof. Shaikh S.M
ME Heat Power Engineering Student. J. J. M. C. O. E. Jaysingpur Maharashtra, India.
ME Heat Power Engineering Student. J. J. M. C. O. E. Jaysingpur Maharashtra, India.
Professor, J. J. M. C. O. E. Jaysingpur Maharashtra, India.

ABSTRACT

India is amongst two largest sugar producing countries in the world and fourth largest producer of ethanol in the world and second largest in Asia. India produces about 2.75 billion liters alcohol annually. Many pervious researchers investigated energy conservation in sugar & distillery industrial sector. These studies are mostly focused on the fermentation process by molasses in distillery plant, the production of the ethanol distillated from sugar molasses by utilization of yeast. The energy conservation in such plants is never being given more attention by previous researchers. So there is wide scope of the energy conservation & efficiency improvement. For improve efficiency the suggestions are enumerated to achieve the effective conservation of energy, heat & fuel through modernization of equipments & technology. Such suggestions are helpful to increase the profitability of distillery sector.

KEYWORDS— Distillery, Ethanol, Alcohol, Fermentation, energy conservation.

INTRODUCTION

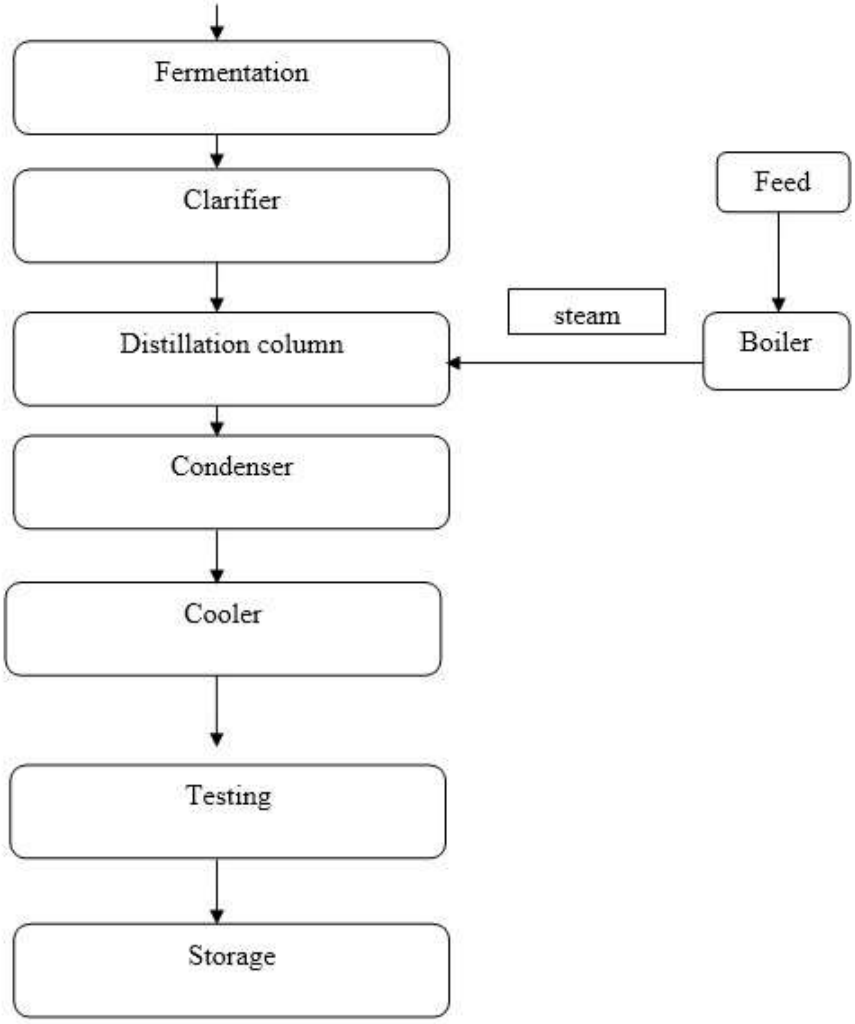
India is amongst two largest sugar producing countries in the world and fourth largest producer of ethanol in the world and second largest in Asia. India produces about 2.75 billion liters alcohol annually. The demand for potable alcohol has been ever increasing Today 95 percent of ethanol is produced by fermentation and only 5percent is produced from petroleum feed stock by ethylene route Ethanol has become one of the important products as alternative feedstock for large number of organic chemicals and fuel. Alcohol is now being used for potable liquor, as chemical feed stock, as solvent and as oxygenates. Various routes for manufacture of ethanol are:

1. Alcohol from Fermentation of molasses
2. Alcohol from Lignocelluloses biomass
3. Alcohol from starchy feed stocks
4. Catalytic hydration of ethylene and Ethylene esterification and hydrolysis.

Molasses, a by-product of sugar industry is used as raw material by most of the distilleries for production of alcohol by fermentation and distillation processes. The molasses contains about 40-50% sugar, which is diluted to bring sugar contents to 10-15% or 20- 25% Brix for further fermentation process. The pH is adjusted by addition of sulphuric acid, if necessary.

Yeast culture is done separately and propagated in a series of fermenters, each About 10 times larger than the previous one. The diluted molasses is inoculated with about 10% by volume of yeast inoculums. In the fermenters the reducible sugars are broken down to ethyl alcohol and carbon dioxide (CO_2). The reaction is exothermic and cooling water is used to pass from plate type heat exchanger to maintain the temperature at 29 - 32°C. Sludge is produced and discharged from the bottom, while the clear fermented beer from the top is sent to the degasifying section of the analyzer column after the heat exchange with the spent wash to preheat it to about 90°C. In the analyzer which is a

bubble-Cap fractionating column, the beer is heated by live steam and fractionated to give a 40% alcohol stream from the top. This stream is further fractionated in the rectifier column to obtain rectified spirit. Part of the rectified spirit is sent back to the column, and the condensed water from this stage, known as 'spent lees' is usually pumped back to the analyzer column. The bottom discharge from the analyzer column is known as the spent wash.
The overall process of the distillery plant is,



LITERATURE REVIEW

A number of research papers have been published on energy conservation of distillery of sugar plant. A brief review of some selected references on this topic is presented:

G. Thamilvanan and R. Senthamil Selvi, (2013) [1] in their paper established the study on Bio-fuel (Ethanol) was distillated from sugar molasses by utilization of yeast. In this study, sugar molasses was induced to fermentation process followed by analysis of Brix value, POL percentage, purity, reducing sugar value and simple distillation methods used to determine the significant amount of ethanol produced from sugar molasses. . Intense research has been carried out for obtaining efficient fermentative organisms, low cost fermentation, substrates, and optimal environmental condition for fermentation to occur.

P.K. Tewari, V.S. Batra, M. Balakrishnan, (2007) [2] have discussed the Molasses based alcohol distilleries. Those are one of the most polluting industries; in addition, they are high consumers of raw water. Growing scarcity of high quality freshwater as well as stringent regulatory standards is compelling these units to explore appropriate water management options. This paper provides an overview of the water use and effluent treatment status in Indian distilleries and the challenges faced by this sector. Practices adopted by progressive Indian distilleries to minimize freshwater use are illustrated through case studies. Further, the R&D focus pertaining to wastewater treatment and disposal is also summarized in this paper.

Sarayu Mohana, Bhavik K. Acharya & Datta Madamwar, (2009) [3] in their research paper discussed the distillery spent wash is the unwanted residual liquid waste generated during alcohol production and pollution caused by it is one of the most critical environmental issue. This review presented an overview of the pollution problems caused by distillery spent wash, the technologies employed globally for its treatment and its alternative use in various biotechnological sectors. This review also indicated that a wide range of biological as well as physicochemical treatments have been investigated over the years for the treatment of distillery spent wash. This research has produced many patented systems that provide a variety of advantages in terms of system efficiency, size, capital cost, treatment flexibility, process stability and operating costs.

S. P. Nangare and R. S. Kulkarni (2012) [4] have examined the, performance of a boiler regarding in its overall efficiency. They analyzed the combustion process chain for the heat conversation from bagasse. In this paper the comparison proves that extra air abstracts more heat from combustion and exhausts it to atmosphere. It is analyzed that around 40 to 50% extra feed air removes 10 to 13% of energy from boilers and influences on boiler efficiency. This paper concluded with analysis of generation side is compared and forwarded for each boiler plant and it will provide scope for the conservation. This concludes that 10 % of Total electricity generation can be enriched by correction in extra air as a ultimate measure in the efficiency improvement of power plant.

Vishal N Patel & Prof. M M Madhikar,(2015)[5] in their article demonstrated the efficiency improvement scope in sugar industry through the detailed energy audit. In these detailed analysis they found that the overall power factor of the plant varies from month to month. So that for improve power factor of sugar plant they suggested that the installation of super heavy duty capacitor. Also they suggested to install automatic temperature controller for cooling tower which would be switch off the fan when the temperature goes down below the set temperature & ON when temperature goes above the set temperature.

Charles Mbohwa(2013) [6] in his paper discussed the energy management in the sugar industry. The South African sugar industry produces sugar and electricity and raw materials for ethanol production among other by-products. He was discussed about bio-energy role and potential in the South African sugar industry with a view to inform decision making and advise government policies. He found a lot of opportunities for energy saving exist in the sugar industry and the need to exploit these for better energy performance. This paper identifies energy management best practices necessary to increase the efficiency of the cogeneration processes. Adoption of energy conservation and efficiency measures is imperative for the sugar industry to generate electricity for own use and for export to the national grid.

A N Pathak(1999) [7] in their work, they was discussed about the recent development in the sugarcane processing in the small scale sector. In this study they were focused on the heat losses occurred in the sugar industries. The suggestions were given to achieve the target of effective conservations of energy, fuel &heat through modernization of equipments & technology. The hot condensate will be recycled for use to boiler or to the process which will eliminate the use of cold water. They also discussed about the use of non conventional energy in sugar industry. Also the automation oat various sectors should improved productivity, reducing losses & energy cost. The use of alternative sources of energy like solar energy, bio energy, etc. for power generation & utilization of byproduct of sugar industry by value addition, to increase the profitability of this sector is also discussed in this paper.

Dr. A. G. Matani & Dr. S. K. Doifode(2013) [8] was discussed about the negative environmental impacts such as diminishing soil, water and air quality; climate change; loss of biodiversity, production of radioactive waste and acid rain through the consumption of fossile fuel for electric power generation. They found the advanced energy conservation

techniques & environment protection technologies for energy conservation. This paper highlights advancements in energy conservation and sustainable development activities implemented by various industries and educational institutes in different parts of the world. They also studied the strategies of Government of India regarding the power generation, transmission, distribution, regulation & conservation.

M.Bala Raghav, G.Srinivasa Rao, & K.Naga Bhavya(2013) [9] they have analyzed the different methods of energy auditing by analyzing the energy consumption of EEE department in K.L.University and provided the paths of less energy consumption. They have showed where the power consumption is more in the given system. It also included the reduction losses and improvement of power quality. They suggested the new models in place of old existing models and found the cost benefits for new installed application over the old application.

Dr. Sonali Dasgupta(2012) [10] has examined the electrical energy system improvement through the energy audit. Thus, she discussed about the systematic approach is required for reducing the power consumption and increasing the energy efficiency without adversely affecting its productivity which is provided by Energy Audit. In this paper she has given various suggestions to improve electrical system efficiency. She suggested to installing automatic power factor controller improve the power factor.

CONCLUSION

From the outcome of the study, the following conclusions will be drawn:

- The present study is honestly tried elaborate effort to examine the performance of a distillery industry regarding its overall efficiency, cogeneration.
- Combustion is the main process chain for the heat conversation from bagasse. We will improve the efficiency by improving heat generation in furnace or increasing boiler efficiency.
- These studies are mostly focused on the fermentation process by molasses in distillery plant, the production of the ethanol distillated from sugar molasses by utilization of yeast. The energy conservation in such plants is never being given more attention by previous researchers. So there is wide scope of the energy conservation & efficiency improvement.
- For improve efficiency the suggestions are enumerated to achieve the effective conservation of energy, heat & fuel through modernization of equipments & technology. Such suggestions are helpful to increase the profitability of distillery sector.

REFERENCES

[1] G. Thamilvanan and R. Senthamil Selvi, 2013, “Distillation of ethanol from Sugar Molasses”, International Journal of Medicine and Biosciences, Periyar Maniammai University, Thanjavur.
[2] P.K. Tewari, V.S. Batra, M. Balakrishnan, 2007 , “Water management initiatives in sugarcane molasses based distilleries in India”, New Delhi, India;
[3] Sarayu Mohana, Bhavik K. Acharya & Datta Madamwar, 2009, “Distillery spent wash: Treatment technologies and potential applications”, Journal of Hazardous Materials 163 (2009) 12–25
[4] S. P. Nangare and R. S. Kulkarni, 2012, “Theoretical Analysis Of Energy Utilization Measures Through Energy Audit In Sugar Industry Power Plant”, Department of Mechanical Engg, Sanjeevan Engineering & Technology Institute, Panhala, India.
[5] Vishal N Patel ,Prof. M M Madhikar, 2015 , “Efficiency Optimization & Detailed Energy Audit of Sugar Industry”, IJSRD - International Journal for Scientific Research & Development| Vol. 3, Issue 02,
[6] Charles Mbohwa, 2013, “Energy management in the South African Sugar industry”, Proceedings of the World Congress on Engineering 2013, Vol I, WCE 2013, July 3 - 5, , London, U.K.
[7] A N Pathak, 1999, “Energy Conservation in Sugar Industries”, Journal of Scientific & Industrial Research, Vol. 58, pp-76-82.
[8] Dr. A. G. Matani & Dr. S. K. Doifode, 2013, “Advanced Energy Conservation Techniques And environment Protection Technologies & Strategies”, International Journal Of Electrical Engineering & Technology, Volume 4, Issue 1, pp. 139-144.

[9] M.Bala Raghav, , G.Srinivasa Rao, & K.Naga Bhavya, 2013,"Energy Conservation And Audit-A Case Study", International Journal of Advanced Research in Electrical,Electronics and Instrumentation Engineering, Vol. 2, Issue 10.
[10] Dr. Sonali Dasgupta, 2012, "Improve Energy Efficiency Of Electrical System By energy Audit (Data Logging)", International Journal Of Electronics And Communication Engineering & Technology (IJECET), Volume 3, Issue 3, pp. 240-245
[11] Vishal N Patel & Prof. M M Madhikar, 2015, "Efficiency Optimization & Detailed Energy Audit of Sugar Industry", International Journal for Scientific Research & Development, Vol. 3, Issue 02.
[12] Sourena Sattari, Akram Avami, Bahare Farahmandpour, 2007, "Energy conservation opportunities: Sugar industry in Iran", Proceedings of the WSEAS Int. Conference on Energy Planning, Energy Saving, Environmental Education, Arcachon, France.