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RESEARCH ARTICLE

“ECONOMIC ANALYSIS OF PRODUCTION OF ALCOHOL, POWER AND BIOCOMPOST IN SUGAR INDUSTRY OF KARNATAKA”

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Abstract

Karnataka state stands 3rd position in terms of sugar production and 4th position in cultivation of sugarcane in the India. In fact, there are presently around 64 working sugar factories with annual crushing capacity of 3.29 lakh MT/day, cogeneration capacity of 1500 MW/day, alcohol production capacity of 2100 KLPD and ethanol production capacity of 1130 KLPD. In the year 2017-18, Karnataka sugar industry had crushed a total of 347.5 lakh MT of cane and produced around 36.87 Lakh MT of sugar. The sugar industry in Karnataka is able to manufacture sugar in such huge quantities due to the fact that sugarcane is abundantly available in the state. But, Karnataka encounters up and down situations of sugar production and price fluctuations after few years. However, it is realized that the importance of integrated sugar-energy complexes to counterbalance the problem of wide sugar price fluctuation in domestic market. In the present work we undertook the cost-profit analysis of production of alcohol, power and bio-compost in sugar industry of Karnataka. We found that the economic returns on capital invested on sugar mills in Karnataka would be stable, if co-products i.e. bagasse, molasses and press mud are efficiently used for production of bio-ethanol, power and bio-compost.

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Introduction:-

Sugarcane has emerged as a multi-product crop for the production of sugar and certain by-products. The economically important by products are molasses, bagasse and pressmud. Molasses is used for production of alcohol, ethanol and industrially important chemicals. Bagasse is utilized as a fuel in the boilers and also used as a production of electricity, paper and particle board. Press mud also mixed with another residual output of the distillery viz. spent wash and used as biocompost. A sugar mill can thus have multiple streams of revenue from ethanol, electricity, biocompost, paper and boards, besides a host of ancillary products.

Indian sugar industry is an important agro based industry and has its big share in Indian economy. It has very strong impact on the socio-economic development of farmers and rural India. In our country nearly 50 million farmers and equivalent labors are engaged in sugarcane cultivation. The Indian sugar industry currently has about 532 operational sugar mills, sugar output 251 lakh tons. Besides, about 2.7 billion liters of alcohol and 2,300 MW power and many chemicals are also produced. The industry is able to export around 1,300 MW of power to the grid. Indian sugar industry is fully capable of meeting demand of potable alcohol as well as 10% blending in gasoline. Industry

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is gradually transforming into sugar complexes by producing sugar, bio-electricity, bio-ethanol, fertiliser and chemicals; these contribute about 1% to the National GDP.

Karnataka sugar industries are one of the most notable sugar manufacturing state in the India. Karnataka sugar industry has been contributing nearly 15% of India's, total sugar production. The pace of growth of sugar manufacturing has been massive over the past few years. The latest sugar statistics of sugar production in Karnataka indicates that state is doing better than the other states in the country. The sugar industries had been a spectacular growth owing to the different conducive in the state. Sugarcane is one of the chief crops manufactured in Karnataka so that most of sugar industries been setup over the years in the state.

Karnataka sugar sector encounters up and down situations of sugar production and price fluctuations after few years (Fig2). During favourable market conditions the sugar mills earn profit in some years and faces huge losses at the time of low ex-factory sugar prices. Hence, it realized that the importance of integrated sugar-energy complexes to counterbalance the problem of wide sugar price fluctuation in domestic market. It is observed that the economic returns on capital invested on sugar mills would be stable, when the co-products i.e. bagasse, molasses and press mud are efficiently used for production of bio-ethanol, power and bio-fertiliser.

Literature Review:-

Mahadik (1991)¹ analyzed the economics of molasses based by-products of certain districts in Maharashtra State. The study found that the utilization of the main by-products bagasse and molasses will reduce the production cost of the sugar to marginal level. The study concluded with a suggestion that every sugar factory must utilize their by-products effectively to reduce the total cost of the sugar.

Lokhande (2005)² revealed in his article, that utilisation of bagasse and molasses should be initiated in every sugar mill of India. Ethanol, alcohol, and paper projects have tremendous scope for development in India. In future, 10-15% ethanol may be allowed to be blended with petrol. Bagasse based power generation projects installed adjacent to each sugar factory would fulfil need of power.

A. P. Pandey (2007)³ revealed that in the sugar industry several by-products especially bagasse and molasses are found. At one time bagasse was used as fuel, which sugar factories did not know what to do with the accumulating molasses, a health hazards. Small cottage industries may be established for disposing these by-products in a positive way for preparing paper, cardboards, alcohol, fertilizers, cattle field etc. Apart from its manufacturing process of sugar also needs certain modification so that yield may be improved.

R K Research Report (2008)⁴ concludes that the sugar industry is a major supplier of by-products like molasses for alcohol, ethanol and chemical industries, bagasse for paper industry. Indian sugar industry is dominated by the cooperative sector, which accounts for more than 55 percent in terms of the number of factories, installed. Maharashtra and Uttar Pradesh alone accounting for 60 percent of Indian's total sugar production.

Rangrajan committee (2012)⁵ revealed that sugar sectors issues about cane reservation area and bonding minimum distance criterion, price of sugarcane levy sugar obligation regulated release of free sale sugar Trade policy for sugar, Regulation relating to by-products and other issues such as jute packaging materials and recommended that rationalization of sugarcane pricing and liberalization of sugar trade need to be introduced over a two to three year period, in a calibrated two recommendation of the committee namely, removal of levy sugar obligation from the sugar season 2012-13 and deregulation of release mechanism for non-levy sugar.

Objectives:-

The main objectives of our work are below

1. To understand the trend of production and productivity of sugarcane in India and Karnataka
2. To estimate the quantity of molasses, bagasse and pressmud generated in sugar industry of Karnataka
3. Cost-profit analysis of production of ethanol from molasses in Karnataka
4. Cost-profit analysis of production of Electricity from Bagasse in Karnataka
5. Cost-profit analysis of production of Biocompost from Pressmud in Karnataka

Methodology:-

The study covers a period of 10 years from the year 2009-2010 to 2018-2019. The study is mainly based on secondary data through various issues of Agricultural Statistics at a Glance, published by the Ministry of Agriculture & Farmers' Welfare, Government of India, Indian Sugar Mills Association, Commission on Development of Biofuels and All India Distillers Association. The other sources used for the study study are Handbook of Sugar Statistics, Journals, magazines etc.

Descriptive statistics are useful to describe patterns and general trends in a data set. In order to achieve the objectives the following methodologies and tools have been used. It includes numerical and graphic procedure to summarize a set of data in a clear and understandable way. To examine the nature of each series these have been subjected to different descriptive measures. Statistical measures used to describe the above series are Standard Deviation, Average, Compound Annual Growth Rate (CAGR), and Coefficient of Variance (CV). In order to find out the economic significance of production of alcohol, power and biocompost the cost-profit analysis per MT of cane crushed was carried out.

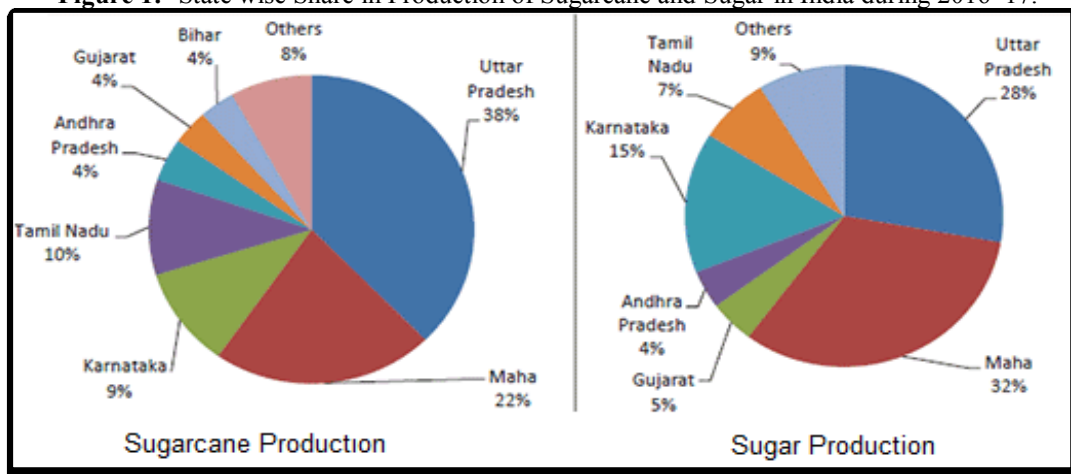
There is no empirical data yet available on the cost of production of alcohol, power and biocompost in India. The value used in this model is based off of an estimate from the Indian National Sugar Institute ⁶ of the difference in conversion cost of alcohol, power and biocompost from molasses, bagasse and pressmud compared to crushing of sugarcane to sugar. Cost data for the distillation of molasses to produce ethanol was obtained from the All India Distiller's Association.

Result and Discussion:-

Production Trend of Sugarcane: Area of Cultivation, Production and Productivity:

The sugarcane is grown in 21 various States of India on 50 lakh hectare area. The top 4 sugarcane-cultivating states of India are UP, Maharashtra, Karnataka and Tamil Nadu—in that order, with Bihar ranking fifth. Figures 1 below provide data on sugarcane production and the area under cultivation, respectively, for 2016–17, where the top four sugarcane-producing states accounted for almost 80% of the country's production. In relation to this, it is unsurprising that almost 80% of the gross-cropped area under sugarcane in India fell within the top four States. Karnataka is by far the third largest sugarcane producer, producing 9 percent of the country's total cane output.

Figure 1:- State wise Share in Production of Sugarcane and Sugar in India during 2016–17.



Sources: DES and Directorate of Sugar, DFPD; Note: Maha Maharashtra

During last 10 years ending 2018-19, India has registered CAGR of 1.04 per cent in area of cane cultivation, 1.67 percent in sugar production with average cane productivity of 71.68 MT/ha where as that of Karnataka has registered a CAGR of 2.16 per cent in area of cane cultivation, 1.71 percent in sugar production with average cane productivity of 85.69 MT/ha. In Karnataka, the sugarcane is cultivated over an average area of 4.22 lakh ha with production 36.18 million tonnes of sugarcane and productivity of 85.69 tonnes per hectare (**Table1**). Belgaum, Bagalkot, Mandya, Vijayapur and Bidar are the leading districts in terms of area under sugarcane. This shows that the growth of

sugarcane production and productivity is higher as compared to India on whole and Karnataka being top when compared all other cane producing states including UP.

However, climatic conditions, inadequate availability of quality seed and irrigation facilities, lack of efficient technology and inadequate farm credit were primarily responsible for fluctuating yield ratio. As in the case of the rest of the country, sugar industry in Karnataka also is facing with unpredictability due to a number of reasons including uncertainties in sugarcane production on account of weather and rainfall conditions. The major benefits of Karnataka sugar industry are many as it has generated many facilities in the state such as communication, employment and transport.

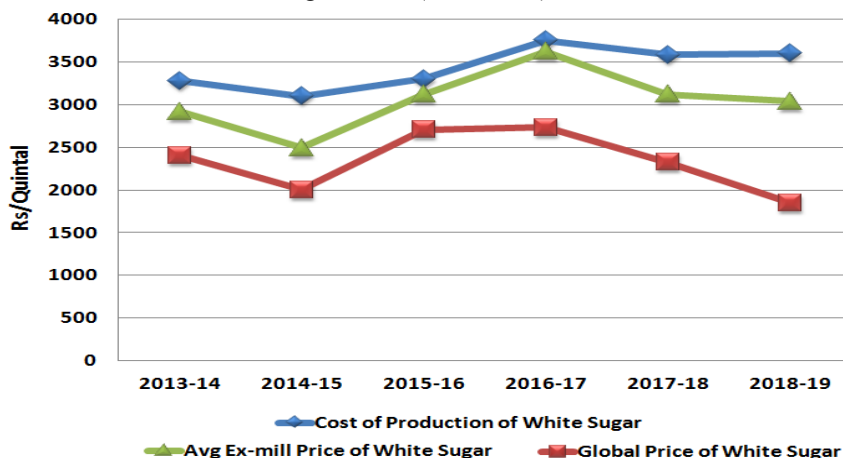
Table 1:- Area of cane cultivation, Production and Productivity of sugarcane in India and Karnataka.

| Year | India | | | Karnataka | | |
|----------------|----------------|-----------------------------------|----------------------|----------------|-----------------------------------|----------------------|
| | Area ('000 ha) | Sugarcane Production (Million MT) | Productivity (MT/ha) | Area ('000 ha) | Sugarcane Production (Million MT) | Productivity (MT/ha) |
| 2009-10 | 4202.00 | 292302.00 | 69.56 | 337.00 | 30443.00 | 90.30 |
| 2010-11 | 4886.00 | 342382.00 | 70.07 | 423.00 | 39657.00 | 93.80 |
| 2011-12 | 5038.00 | 361037.00 | 71.66 | 430.00 | 38808.00 | 90.30 |
| 2012-13 | 5063.00 | 341198.00 | 67.39 | 425.00 | 35732.00 | 84.10 |
| 2013-14 | 4993.00 | 352141.00 | 70.53 | 420.00 | 37905.00 | 90.30 |
| 2014-15 | 5144.00 | 359330.00 | 69.85 | 480.00 | 43776.00 | 91.20 |
| 2015-16 | 4927.00 | 348448.00 | 70.72 | 450.00 | 37834.00 | 84.10 |
| 2016-17 | 4436.00 | 306804.00 | 69.16 | 397.00 | 27378.00 | 69.00 |
| 2017-18 | 4732.00 | 376667.00 | 79.60 | 350.00 | 28263.00 | 80.75 |
| 2018-19 | 5114.00 | 400157.00 | 78.30 | 506.00 | 42006.00 | 83.00 |
| Mean | 4853.50 | 348046.60 | 71.68 | 421.80 | 36180.20 | 85.69 |
| CAGR | 1.04% | 1.67% | 0.62% | 2.16% | 1.71% | -0.44% |
| Std Dev | 310.84 | 31153.77 | 4.00 | 51.98 | 5672.71 | 7.27 |
| CV | 6.40 | 8.95 | 5.58 | 12.32 | 15.68 | 8.48 |

Production Trend of Sugar and By-products in Sugar industry of Karnataka:

India's higher sugarcane prices remain a challenge; and cost of sugar production remains high. In the white sugar Indian prices remain uncompetitive (Fig2). This competitive disadvantage vis-à-vis subdued global price makes Indian exports uncompetitive. To combat this, government has taken many measures, namely increasing import duty and removal of export duty, stock holding limit on sugar mills to reduce inventory (minimum indicative export quotas or MIES) etc. India currently has over 70 lakh tons of surplus sugar. Impactful diversion of surplus sugar into ethanol will need time to fructify.

Fig 2:- Comparison of Cost of Production of White Sugar in India with Indian Ex-mill Price and Global Price of White Sugar Prices (Rs/Quintal).



Karnataka Sugar Industry ranks 3rd in terms of its contribution of sugar in the total sugar production in the country (Fig1) The Sugar Industry in Karnataka is able to manufacture sugar in such huge quantities due to the fact that sugarcane is abundantly available in the state. The major benefits of Karnataka Sugar Industry are that it has generated many facilities in the state such as communication, employment, and transport. It has also benefited the state by helping in the development of the rural areas of the state by mobilizing the various resources of the villages. The Sugar Industry in Karnataka contributes around 36 crore per year to the state exchequer in central excise duty. It also contributes more than 900 crore in the form of turnover tax and sales tax to the state exchequer. The state government in an attempt to boost Karnataka Sugar Industry has set up the Karnataka Sugar Institute (KSI) which has emerged as a center for education and training for sugar technology. The Karnataka Sugar Institute also provides important support to the Sugar Industry in Karnataka by doing R&D in the various aspects of sugarcane processing and production.

Karnataka Sugar Industry has contributed a great deal to India's total level of sugar production and thus has helped the country to meet its demand for sugar. The Karnataka state government must make more efforts in order to boost the sugar industry in Karnataka.

Table 2:- Production of Sugar and By-products in Sugar industry of Karnataka.

| Year | Quantity of Sugarcane Crushed (Lakh MT) | Sugar Production (Lakh MT) | Yield of Sugar (%) | Molasses Production (Lakh MT) | Bagasse Production (Lakh MT) ^a | Pressmud Production (Lakh MT) ^b |
|-----------------|---|----------------------------|--------------------|-------------------------------|---|--|
| 2009-10 | 235.33 | 25.58 | 10.87 | 10.74 | 21.18 | 08.24 |
| 2010-11 | 331.12 | 36.83 | 11.12 | 15.20 | 29.80 | 11.59 |
| 2011-12 | 347.53 | 38.72 | 11.14 | 15.67 | 31.28 | 12.16 |
| 2012-13 | 328.95 | 34.67 | 10.54 | 15.01 | 29.61 | 11.51 |
| 2013-14 | 383.14 | 41.77 | 10.9 | 16.86 | 34.48 | 13.41 |
| 2014-15 | 450.92 | 49.35 | 10.94 | 20.56 | 40.58 | 15.78 |
| 2015-16 | 376.65 | 40.45 | 10.74 | 17.79 | 33.90 | 13.18 |
| 2016-17 | 210.24 | 21.65 | 10.3 | 10.01 | 18.92 | 07.36 |
| 2017-18 | 352.17 | 37.54 | 10.66 | 15.96 | 31.70 | 12.33 |
| 2018-19 | 399.11 | 44.30 | 11.1 | 18.01 | 35.92 | 13.97 |
| Mean | 341.52 | 37.09 | 10.83 | 15.58 | 30.74 | 11.95 |
| CAGR (%) | 2.82 | 2.93 | 0.11 | 2.76 | 2.82 | 2.82 |
| Std Dev | 72.40 | 8.27 | 0.27 | 3.20 | 6.52 | 2.53 |
| CV | 21.20 | 22.29 | 2.53 | 20.55 | 21.20 | 21.19 |

a. Estimated bagasse yield at 9 % of cane crushed

b. Estimated pressmud yield at 3.5% of cane crushed

Karnataka State has fairly balanced spread of sugar factories in southern and northern parts where large tracts of land are put under sugarcane cultivation, especially in the irrigation command areas with assured irrigation facilities. There are 64 sugar factories across the State which can again be classified into (i) State owned (3 units) (ii) Co-operative sector (16 units), & (iii) Private companies (49 units). There is predominance of Private Sugar Companies in the State which take a major share of sugarcane production. In Karnataka there are presently around 64 working sugar factories with annual crushing capacity of 3.29 lakh MT/day, cogeneration capacity of 1500 MW/day, alcohol production capacity of 2100 KLPD and ethanol production capacity of 1130 KLPD. In the year 2017-18 Karnataka Sugar industry had crushed a total of 347.5 lakh MT of cane and produced around 36.87 Lakh MT of sugar.

Table 3:- District wise Production Capacity of Power, Alcohol and Ethanol in Sugar industry of Karnataka.

| District | Factories in operation | Total Crushing capacity per day (TCD) | Capacity of Co-generation (MW) | Capacity of Alcohol Production (KLPD) | Capacity of Ethanol Production (KLPD) |
|----------|------------------------|---------------------------------------|--------------------------------|---------------------------------------|---------------------------------------|
| | | | | | |

| | | | | | |
|--------------|-----------|---------------|-------------|-------------|-------------|
| Belagavi | 22 | 111500 | 488 | 764 | 620 |
| Bagalakote | 11 | 87750 | 314 | 560 | 170 |
| Vijayapura | 09 | 33000 | 173 | 110 | 50 |
| Mandya | 04 | 18800 | 144 | 146 | 60 |
| Kalburgi | 03 | 17500 | 79 | 180 | 0 |
| Bidar | 06 | 16500 | 34 | 0 | 0 |
| Davangere | 02 | 7250 | 46 | 60 | 50 |
| Bellary | 02 | 7000 | 28 | 0 | 0 |
| U. Kannada | 01 | 6325 | 31 | 50 | 50 |
| Yadagiri | 01 | 5000 | 24 | 50 | 0 |
| Gadag | 01 | 5000 | 32 | 120 | 120 |
| C. Nagar | 01 | 3600 | 20 | 0 | 0 |
| Haveri | 01 | 2500 | 0 | 0 | 0 |
| Shimoga | 01 | 2500 | 41 | 0 | 0 |
| Hassan | 01 | 1250 | 0 | 0 | 0 |
| Total | 64 | 329225 | 1491 | 2100 | 1130 |

The major sugar factories of Karnataka Sugar Industry are: Bannari Amman Sugar Ltd. with the sugarcane crushing capacity of 5000 TCD; Davangere Sugar Company Ltd. with the sugarcane crushing capacity of 2500 TCD; Sri Chamundeswari Sugars Ltd. with the sugarcane crushing capacity of 4000 TCD; Godavari Sugar Mills Ltd. with the sugarcane crushing capacity of 7500 TCD; Mysore Sugar Company Ltd. with the sugarcane crushing capacity of 5000 TCD; Athani Farmers Sugar Factory Ltd. with the sugarcane crushing capacity of 2500 TCD

Table 4:- Revenue generated through sale of primary by-product (per tonne of cane).

| By-product | Quantity Saved (MT) | Rate (Rs./MT) | Revenue (Rs) | Remarks |
|--------------|---------------------|---------------|---------------|---|
| 1 | 2 | 3 | 4 (2x3) | |
| Bagasse | 0.070 | 1600.00 | 112.00 | Average recovery rate is 30%. About 21%-23% is consumed internally for heating purpose in boiler. |
| Molasses | 0.045 | 5000.00 | 225.00 | Recovery rate can go up to 6-7% depending on route adopted. |
| Press Mud | 0.035 | 250.00 | 8.75 | Bio-compost can be produced by mixing press mud with spent wash, yeast sludge and fly ash. |
| Total | | | 345.75 | |

Table 5:- Revenue generated through sale of value added by-products after diversification (per tonne of cane).

| Value Added product | Quantity | Rate/Unit (Rs) | Revenue (Rs) | Conversion Cost per Unit (Rs) | Total Conversion Cost | Net Revenue (Rs.) |
|--|----------|----------------|--------------|-------------------------------|-----------------------|-------------------|
| 1 | 2 | 3 | 4 (2x3) | 5 | 6 (2x5) | 7 (4-6) |
| Power* (KWhr) | 43.3 | 6.25 | 270.60 | 2.00 | 86.60 | 184.00 |
| Ethanol** (litre) | 10.5 | 42.00 | 445.20 | 10.00 | 106.00 | 339.20 |
| Biocompost*** (MT) | 0.018 | 500.00 | 08.75 | -- | -- | 008.75 |
| Total | | | | | | 531.95 |
| * Considering installation of high pressure boilers of 87 kg/sqcmg to 110 kg/sqcmg | | | | | | |
| ** Considering an average yield of 235 liters of ethanol per ton of molasses. | | | | | | |
| *** Biocompost yield reduces to 50% of pressmud after drying | | | | | | |

Table 6:- Net Profit/Loss per Ton of Sugarcane after Value Added By-products after diversification.

| By-product processing units | Net Revenue from Direct Sale of Primary By-products (Rs) | Net Revenue from sale after Value Addition (Rs) | Net Loss/Profit after Value addition (Rs) | Percentage Net Loss/Profit after Value Addition (%) |
|-----------------------------|--|---|---|---|
| | 1 | 2 | 3 = (2-1) | 4 = (3x100/1) |
| Co-generation Unit | 112.00 (Bagasse) | 184.00 (Power) | 072 | 64.28 |
| Distillery Unit | 225.00 (Molasses) | 339.20 (Alcohol) | 114 | 50.66 |
| Biocompost Unit | 008.75 (Pressmud) | 008.75 (Biocompost) | 000 | 0.00 |
| Total | 345.75 | 531.95 | 186 | 53.79 |

Cost Profit Analysis of Bagasse based Power Generation:

Bagasse is a fibrous residue of the cane stalk left after crushing and extraction of juice. Bagasse production is seasonal so it must be stored over the period when production is stopped. In processing of one Metric tonne of sugarcane produce 300 kg bagasse. Production of bagasse is depending on fiber in sugarcane. Generally 30 percent fibers are in sugarcane. There are various options in case of bagasse (a) it can be selling in the market (b) use for production of paper and (c) used for co-generation. In Karnataka, paper mills as a by-products were not successful. Paper mills were closed, due to financial problems in the market; bagasse can be used for co-generation.

In the first stage we have calculated the economic situation, when bagasse sold in the market. It can be depicted from above table no. 2 that the production of bagasse depends upon the quantity of sugar cane crushed. The fluctuating trend in bagasse production is seen throughout the study period. Thus ex-mill price of bagasse always varied from year to year. Average selling price of bagasse is of about Rs. 1600 per MT. At the time of selling of bagasse excise duty/GST/VAT is collected by the sugar factory and then deposited to government accounts. Hence, the amounts of such taxes are not considered while calculation of bagasse selling price.

1 MT of bagasse has a potential of generating power of around 100 KWhr with 75 KWhr surplus power for export. In Karnataka, when one MT of sugarcane crushed around 300 kg of bagasse is generated out of which major amount of bagasse is used up for heating purpose in boilers and around 70kg of bagasse becomes surplus that can be used for generation of electricity. If that 70 kg of bagasse is used to generate power at co-generation unit it can produce 43 KWhr with Rs.2 conversion cost per KWhr. From the table 5 and 6 it is clear that for net revenue of around Rs 184 per 1 MT of cane crushed is generated from the production and sale of surplus power of 43KWhr. The co-generation of power in sugar industry results in the net profit of Rs. 72 every 1MT of sugarcane crushed with 64 percent raise in the net profit as compared to the revenue generated from direct sale of bagasse.

Cost Profit Analysis of Molasses based Alcohol Production:

Molasses is a residue of sugar industry and obtained after the sucrose has been crystallized and centrifuged from evaporated cane juice. Molasses contain sucrose, invert sugar, salt and the entire alkali soluble non sugar ingredient. 45 Kg. molasses is obtained from crushing of 1 M.T. cane. Molasses are used in different by-product as a raw material. Rectified spirit, country liquor, fuel oil use molasses as a raw material. Molasses can be sold in the market or it is used in production of above by-products.

The average selling price of molasses is Rs 5,000 per M T (Table 4). However, at the time of selling of molasses excise duty/GST/VAT is collected by the sugar factory and then deposited to government accounts. Hence, the amounts of such taxes are not considered while calculation of molasses selling price.

1 MT of molasses has a potential of generating alcohol of around 235 Kilo litres of alcohol. In Karnataka, when one MT of sugarcane crushed around 45 kg of molasses which can produce 10.5 litres of alcohol with Rs.10 conversion cost per litre. From the table 5 and 6 it is clear that for net revenue of around Rs 339 per 1 MT of cane crushed is generated from the production and sale of 10.5 litres of alcohol. The production of alcohol at distillery unit of sugar industry results in the net profit of Rs. 114 for every 1MT of sugarcane crushed with 50 percent raise in the net profit as compared to the revenue generated from direct sale of molasses.

Cost Profit Analysis of Pressmud based Biocompost Production:

The precipitated impurities contained in the cane juice, after removal by filtration, form a cake of varying -moisture content called press muds. This cake contains much of the colloidal organic matter anions that precipitate during clarification, as well as certain non-sugars occluded in these precipitates. The weight of wet press muds (80 percent water) averages about 3.4 percent cane. Press mud can be explored as biocompost when it is mixed with appropriate amount of other residues spent wash, yeast sludge and fly ash. After the drying in the open field the mass reduces to 50% of the pressmud. As per table 5 and 6, the processing of press mud to biocompost is not economically significant but pressmud along with other residues generated in sugar industry viz spent wash, yeast sludge and fly ash causes environment pollution. However, the processing of pressmud to biocompost offers two advantages one is reduction of pollution and another is as it can be sold back to sugarcane farmers on subsidies as manure. Biocompost contains, on a dry basis, about 1 percent by weight of phosphate (P_2O_5) and about 1 percent of nitrogen.

Conclusion:-

Production of by-product helps in generation of additional income that can help the sugar mills to make up the accumulated losses. The cost-profit analysis gives the details about the income generated by sugar mills of Karnataka. The study reveals the comparison between of sugar factory and their by-product unit profit and losses. The selling price of sugar has kept fluctuating throughout the study period and also due to seasonal nature of sugar industry, the industry has been running into the losses. Processing of by-products has led to earning of profits which have been diverted towards the sugar factory as a result of which the factories have been able to make up their losses and earn profit. The profit earned can be diverted towards sugar factory. This will help to the sugar industry of Karnataka to serve adequately the interest of the farmers in terms of payment of cane price and development of the area concerned.

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