A REVIEW ON MANUFACTURING OF BIOFUEL FROM SPOILED FRUITS.

[1]Ku.V. H. Kale, [2]P. S. Wankhade, [3]Ku. A.A. Tonpe, [4]R. Khan, [5]Dr. P. R. Wankhade

[1,2,3,4] B.sc Final year student, Shri Shivaji College of Agril. Biotechnology, Amravati .

[5]Assistant professor, Dept. of Post harvest & food biotechnology, Shri Shivaji college of Agril. Biotechnology, Amravati.

Abstract

The fruit becomes spoiled due to improper handling, transportation and over ripened fruits in fruit market also fruits are more prone to spoiled due to their nature and composition. This spoiled fruits are profitably recycled, transformed and utilized in one or the other form as biofuels. The technology for the utilization of spoiled fruits is developed at the laboratory scale. An attempt was made for ethanol production from the spoil fruits using fermenter in the presence of *Saccharomyces cerevisiae.* Bioethanol production from different spoil fruits and different optimize conditions of a fermenter for maximize the biofuel production that were studied.

Keywords: Spoil fruits, waste, biofuels, fermenter and ethanol.

Introduction:

Biofuel (ethanol CH_3CH_2OH) is a renewable fuel that can be made from various plant materials, collectively known as "biomass.". Most ethanol is made from plant starches and sugars, but scientists are continuing to develop technologies that would allow for the use of spoiled fruits. The common method for converting biomass into ethanol is called fermentation. During fermentation, microorganisms (e.g., bacteria and yeast) metabolize plant sugars and produce ethanol.

In India 30-40% of the Total fruits producing losses is occurred because of, in relation to different pre and post getting together and insures about 92,651 corers per year, fruits has in it 65-95% of water and are quickly going bad [11]. The different reasons for the spoilage are careless putting one's hands on, not right making into a parcel, transport, longer shipping, place for storing and microbial attacks, these causes much loss in fruits. Use of these wastes produced for bioenergy production and reduces the possible pollution because of the spoiled fruit material. The results of this study have revealed that the spoiled fruits can efficiently be utilized for ethanol production with the help of *Saccharomyces cerevisiae* in a process of fermentation.

Literature review and related work

Kamlesh R. Shah*, Rani Vyas and Gayatriben Patel 2019[1] proposed that "The use of mixture of three fruits namely Banana, Grapes and Mango was used as a possible substrate for production of cel-lulosic ethanol by modifying parameters such as aeration. Pretreatment, hydrolysis and fermentation were carried out during this study. Mixed fruits pulp without sucrose produced 0.67% ethanol and fruits pulp with sucrose produced 1.32% ethanol.

Mohammad Jahid, Akanksha Gupta and Durlubh Kumar Sharma, 2018. [2] Present studies are directed towards finding cost effective ways to recover sugars from fruit wastes firstly without using any acidic or enzyme catalysts. Fruit wastes such as peels of banana (BP), pineapple (PAP), papaya (PP) and mango (MP) were used for studying their potential to yield total reducing sugars (TRS), pentose sugars (PS) and bioethanol. Simple soaking in water and steaming resulted in the recovery of free sugars. Enzymatic hydrolysis using cellulase and xylanase enzymes resulted in giving good yields of total reducing sugars and pentose sugars. BP and PAP were found to be the potential candidates for the production of bioethanol.

A.B.M.S.Hossain et al 2018[3] designed to utilize the rotten fruits for the production of biofuel and waste management purposes. The ethanol production from rotten fruits was compared with the data regarding fermentation of rambutan, mango, banana and pineapple for ethanol production. Rotten fruits were used to produce bioethanol by fermentation process. The maximum bioethanol production was obtained from the experiments conducted using pulp fruit part in pH 5 for 2 days producing ethanol 9.4 (v/v)%.

Thien Dao, Philippe Dantigny 2018[4] :discusses the effects of ethanol on the inhibition of growth and germination of fungi and on the inactivation of fungal spores. the main applications of ethanol in controlling fruit decay and increase the shelf-life of food products are reviewed.

M.N. Priyadharshini*, et al 2018[5] : to find the alternate substrate for the cheaper production of bioethanol so that even the common people can also produce bioethanol. The bioethanol can be produced by employing waste fruit pulp utilized by micro-organism like S.cerevisiae and C.albicans. They are the most prominent organisms for bioethanol production. The waste fruit pulp was subjected to fruit juice extraction. Fermentation was allowed to carried out using fruit juice extract as substrate using S. cerevisiae and C. albicans. The reducing sugar concentration was decreased gradually in the mixed fruit juices confirming the production of ethanol and ethanol concentration was determined using potassium dichromate method. The residence time was noted to be 6.4 minutes for the ethanol produced by Candida albicans.

Parameswari K, Hemalatha.M, Priyanka.K and Kishori B, 2015[6] studied isolation of yeast and production of ethanol using papaya (Carica papaya) and grape (Vitis vinifera) pulps with isolated yeast. the yeast strains were isolated from

fruit pulps and by using selective medium and differential tests were applied for identification of the yeast. % of yield of ethanol and effect of nutrient supplements for the production of ethanol was studied.

Venkatachalapathy Girish, et al 2015[7] Reported possibilities of bioethanol production from decaying fruits like Citrus sinensis, Citrus limetta and Ananas comosus were studied. The production of ethanol was higher in Ananas comosus (13%) than the other two Citrus limetta (12%), Citrus sinensis (10%) which was calculated by distillation method. The aim of this research was to investigate the feasibility of Spoiled fruits for bio ethanol production.

J. Itelima, et al, 2014[8] observed wastes from fruits such as banana, plantain and pineapple peels which are available in large amount and do not interfere with food security. If these waste subjected to simultaneous saccharification and fermentation for 7days by using, *A. niger* & *Saccharomyces cerevisiae.* Biomass yield, cell dry weight, reducing sugar concentration and the ethanol yield were determined at 24 hours interval. after 7 days of fermentation, pineapple peels had the highest biomass yield of 1.89 (OD), banana peels 1.60 (OD), and plantain peels 0.98 (OD). The reducing sugar concentrations was 0.27 – 0.94 mg/cm3 for pineapple, 0.20 – 0.82 mg/cm3 for banana and 0.16 – 0.45 mg/cm3. Ethanol yields were 8.34% v/v, 7.45 % v/v and 3.98 % v/v for pineapple, banana and plantain peels respectively. Spoil fruits that contain fermentable sugars converted to useful products like bio-ethanol.

Rajkumar V. Raikar , 2012[9] : present the experimental results on the production of ethanol from grape waste using Saccharomyces cerevisiae (baker's yeast) and Benzyl penicillin. The findings of the experiments are used to present effect of various parameters such as pH, Benzyl penicillin, temperature, initial sugar concentration and specific gravity on the quantity of ethanol produced. The addition of Benzyl penicillin during fermentation enhanced the quantity of ethanol produced. The production of ethanol was increased with the progress of fermentation and reached the maximum value at 48 h of fermentation.

V.A. Shinde1* and R.B. Patil2 , 2012[10] : Reported production of valuable substance from some agro waste through the microbial fermentation process. Fossil fuels create a negative impact on our environment as greenhouse gas emissions are harmful. Production of ethanol (as an alternative fuel) from food and agricultural waste were studied. Wastes from fruits, such as banana, orange peels were subjected to simultaneous saccharification and fermentation for 7 days using *Saccharomyces cerevisiae.* The ethanol yield was determined after 24 hours interval.

Table No. 1 different process conditions for biofuel production from spoiled fruits

Serial no.	Title of Research Paper	Name of Author	Remark
1.	Bio-ethanol production from pulp of fruit.	Kamlesh R. shah, Rani vyas and Gayatriben patel	Reported the production of bio-ethanol using cheaper substrates, and optimization of growth conditions for the fermentation process. * Temp. of fermentation- 28ºc * optimum days of fermentation- 4 days * optimum pH of fermentation- 6.0
2.	Production of Bioethanol from Fruit wastes (banana, papaya, pineapple and mango peels) under milder conditions.	Mohammad jahid, akanksha gupta and durlubh kumar sharma	Proposed various conditions for production of bio-ethanol and study of enzymatic hydrolysis using cellulose and xylanse enzyme resulting in giving good yields of total reducing sugars and pentose sugars. * Optimum pH- 6.0 * Optimun Temperature- 30ºC * Cellulae activity of fermentation- 25 hrs * Duration of fermentation- 6 days * Ethanol yield- 1) Banana peels= 36% (3.82g/l) 2) Pineapple peels= 33% (2.75g/l)
3.	Comparative studies of bio-ethanol production from different fruits biomass.	A.B.M.S. Hossain, A. Hadeel, K. Mseddi, Nasir A. Ibrahim and Vajid N.V	Reported to determine the proper enzymes for different rotten tropical fruits in view to bio ethanol production optimum temperature to produce bio-ethanol and determine the engine properties and emission from produced bio-ethanol. * Optimum pH- 4-6 * Optimum days of fermentation- 2-4 days * Ethanol yield from pulp- 1) rambutan= 9.96% 2) Mango= 7.695 3) pineapple=8.73%
4.	Control of food spoilage fungi by ethanol.	Thien dao, Philippe dantigny	Established brief survey on the impact of spoilage fungi on the food quality and application of ethanol in controlling decay.
5.	A comparative study on the alternate substrate for the production of cost effective Bio-ethanol using saccharomyces	M.N. Priyadarshini, V. Dhivya, G. Devi, K Muthukumaran, D. Angaline Kiruba, T. Malarvizhi.	Reported production of bioethanol using mixture of fruit juice by fermenting them with the help of microorganisms. *Candida albicans* produces a yield of 84.63 % whereas

	cerevisiae and condida albicans.		*Saccharomyces cerevisiae* produces a yield of 81.38 % which is lower than the first case.
6.	Isolation of yeast and ethanol production from papaya (Carica papaya) and grape (Vitis vinifera) fruits.	Parameswari K, Hemalatha M., Priyanka K., an Kishori B.	Proposed that higher amount of ethanol is produced by addition of sucrose in additional supplement also the adaptive technology with biochemically characterized yeast isolated from fruit pulps. * Optimum pH- 5.0 * temperature- 30±0.5ºC * optimum sugar amount- 1) in grape= 10.3g/100g 2) in papaya= 14.6g/100g
7.	Estimation of sugar and bio-ethanol from different decaying fruits extract.	Venkatachalapathy, Girish, Krishnappa ravi kumar, and Sirangala thimmappa Girisha.	Proposed the study of improved ethanol production using suitable technologies i.e. genetically engineered strain that are capable of converting multiple sugars into ethanol. * temp. of fermentation- 30±2ºC * optimum day of fermentation- 9 days * ethanol extracted- 200ml/lit. * Ethanol in % 1) Ananas comosus= 13% 2) Citrus limetta= 12% 3) Citrus sinensis= 10%
8.	Bio-ethanol production from Banana, Plantain and Pineapple peels by Simultaneous Saccharification and Fermentation Process.	J. Itelima, F. Onwuliri, Issac Onyimba, and S. Oforji.	Studied the simultaneous saccharification and fermentation waste materials from fruits to ethanol by a mixture of starch digesting fungus A. Niger and non-starch digesting sugar fermentor (S. Cerevisiae) is feasible. * Days of fermentation- 7 days *distillation temp.- 70ºC * Ethanol yield in- 1)pineapple peel= 8.34% 2) banana peel= 7.45% 3) paltain peel= 3.98%
9.	Ethanol production of Ethanol from Grape Waste.	Rajkumar V. Raikar	Reported effect of various parameters such as pH, Benzyl penicillin, temperature, specific gravity on quantity of ethanol produced. * optimum pH- 5.0 * Yeast added- 0.05mg/lit. * Benzyl penicillin- 0.05mg/lit

			* Urea added- 0.5gm *Optimum fermentation duration- 48 hrs. ethanol obtained% - pH **6.9% = 4** 6.7% = 5 ethanol concentration - Temperature 6.5% = 25ºC **7.8% = 35ºC** 6.8% = 40ºC
10.	Production of ethanol by saccharomyces cerevisiae using Orange Peels and Banana peels.	V. A. Shinde and R. B. Patil.	Worked on production of valuable substance from some agro waste through the microbial fermentation process. * days of fermentation- 7days *yeast added- 5% v/v *Optimum pH- 5.5 Optimum temp.- 28ºC * Ethanol yield by- 1) Banana- 8.34% 2) Orange- 7.45%

Conclusion

Spoil fruits like Papaya, Grape, Banana, Orange, Pineapple, Mango etc. Could be used to produce bio-fuel effectively. enzymatic hydrolysis or acid hydrolysis treatment is necessary and Optimization of fermentation conditions is required such as yeast % v/v, temperature, pH, for increase bio-fuel yields.

References

1) Kamlesh R. Shah*, Rani Vyas and Gayatriben Patel (2019) ; Bio-ethanol production from pulp of fruit. Biosci, Biotech, 12(2) 464-471

2) Mohammad Jahid, Akanksha Gupta and Durlubh Kumar Sharma. (2018) ; Production of Bioethanol from Fruit wastes (banana, papaya, pineapple and mango peels) under milder conditions. Bioprocess Biotech 2018

3) A.B.M.S.Hossain1,2*, A Hadeel 2, K. Mseddi 1, Nasir, A Ibrahim 1 & Vajid N V (2018) ; Comparative studies of bio-ethanol production from different fruits biomass.

4) Thien Dao, Philippe Dantigny* (2018) ; Control of food spoilage fungi by ethanol. Food Control 22 (2011) 360-368

5) M.N. Priyadharshini*, V. Dhivya, G. Devi, K. Muthukumaran, D. Angeline Kiruba, T. Malarvizhi (2018) ; A comparative study on the alternate substrate for the production of cost effective Bio-ethanol using saccharomyces cerevisiae and condida albicans. Chemical and Pharmaceutical Sciences.

6) Parameswari K, Hemalatha.M, Priyanka.K and Kishori B (2015) ; Isolation of yeast and ethanol

production from papaya (Carica papaya) and grape (Vitis vinifera) fruits. Engineering Research, Volume 6, Issue 2, February-2015.

7) Venkatachalapathy Girish, Krishnappa Ravi Kumar and Sirangala Thimmappa Girisha (2015) ; Estimation of sugar and bio-ethanol from different decaying fruits extract. Advances in Applied Science Research, 2014, 5(1):106-110.

8) J. Itelima, F. Onwuliri, E. Onwuliri, Isaac Onyimba, and S. Oforji (2014) ; Bio-ethanol production from Banana, Plantain and Pineapple peels by Simultaneous Saccharification and Fermentation Process. Environmental Science and Development, Vol. 4, No. 2, April 2013.

9) Rajkumar V. Raikar (2012); Ethanol production of Ethanol from Grape Waste. ENVIRONMENTAL SCIENCES Volume 3, No 2, 2012.

10) V.A. Shinde1* and R.B. Patil2 (2012) ; Production of ethanol by saccharomyces cerevisiae using Orange Peels and Banana peels. Current Microbiology and Applied Sciences, Volume 5 ,Number 8.

11) Anshu Singh, Arindam Kuila, Sunita Adak, Moumita Bishai, Rintu Banerjee (2012) ; Utilization of Vegetable Wastes for Bioenergy Generation. Agric Res (July–September 2012) 1(3):213–222.

12) BC Akin-Osanaiye, HC Nzelibe, AS Agbaji, " Ethanol production from Carica papaya (Pawpaw) fruit waste,"Asian J. Biochem. Vol. 3, no. 3, pp. 188-193, 2008.

13) Grohmann K, Baldwin EA, Buslig SB (1994). Production of ethanol fromenzymatically hydrolyzed orange peel by yeast Saccharomyces cerevisiae. Appl. Biochem. Biotechnol. 45/46: 383-388.

14) Grohmann K, Cameron GR, Buslig SB (1995). Fermentation of sugars inorange peel hydrolisates to ethanol by recombinant E. coli KO11.Appl. Biochem. Biotechnol. 51/52: 383-388.

15) Grohmann K, Cameron GR, Buslig SB (1996). Fermentation of orange peelhydrolysates by ethanogenic E. coli: effects of nutrient supplements. Appl. Biochem. Biotechnol. 57/58: 383-38

16) K Manikandan, V Saravanan* and T Viruthagiri(2008). Kinetics studies on ethanol production from banana peel waste using mutant strain of Saccharomyces cerevisiae Indian Journal of Biotechnology Vol 7, January 2008, pp 83-88.

17) Ban-koffi L, Han YW (1990). Alcohol production from pineapple waste. World J. Microbiol. Biotechnol 6: 281-284

[18) Akin-Osanaiye, B. C., Nzelibe, H.C., and Agbaji, A.S., "Ethanol production from Carica papaya (pawpaw) fruit wate", Asian Journal of Biochemistry, vol 3. (3), pp. 188-193, 2008.

19) J. Goettemoeller, A. Goettemoeller (2007). Sustainable Ethanol: Biofuels, Biorefineries, Cellulosic Biomass, Flex-Fuel Vehicles, and Sustainable Farming for Energy Independence (Brief and comprehensive account of the history, evolution and future of ethanol). Prairie Oak Publishing, Maryville, Missouri. ISBN 9780978629304.

20) Reddy, V., "Production of ethanol from mango (Mangifera indica L) fruit juice fermentation", Research Journal of Microbiology, vol.2, (10), pp.763-769, 2007.

21)Arumugam R., Manikandan M. (2011): Fermentation of Pretreated Hydrolyzates of Banana and Mango Fruit Wastes for Ethanol Production .biol. sci.; 2(2): 246-254.

22) Gosavi P., Chaudhary Y. and Durve-Gupta A. (2017): Production of biofuel from fruits and vegetable wastes. European Journal of Biotechnology and Bioscience. 5(3): 69-73.

23) Zainab B. and Fakhra A. (2014): Production of Ethanol by fermentation process by using Yeast Saccharomyces cerevisae. International Research Journal of Environment Sciences Vol. 3(7): 24-32.

24) Janani K., Ketzi M., Megavathi S., Dr.Vinothkumar D., Dr. Ramesh Babu N.G. (2013): Comparative Studies of Ethanol Production from Different Fruit Wastes Using Saccharomyces cerevisiae. International Journal of Innovative Research in Science, Journal Engineering and Technology; 2(12): 2319-8753.

25) Kowshik B. R. Vinay (2018): Comparative Studies of Ethanol Production from Different Fruit Wastes Using Saccharomyces cerevisiae [http://prezi. Com 28 January 2018]

26) Malhotra G. (2013): Alcohol Production from Fruit and Vegetable Waste. International Journal of Applied Engineering Research 8(15):1749-1756.