

Eco-Friendly Method for the Production of Bioethanol

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Abstract: Bioethanol is a form of quasi-renewable energy that can be produced from agricultural feedstocks. It can be made from very common crops. Chemical fertilizers like di-sodium hydrogen phosphate, urea and ammonium sulphate or ammonium phosphate are generally used as nutrients in the fermentation of molasses because micro-organism yeast cannot grow and ferment well without minerals nitrogen and phosphorous present in these nutrients. Since earthworm cast is also the rich source of nitrogen and phosphorous, may be considered as alternative of chemicals fertilizers required for the growth of yeast during fermentation of various feed stocks like molasses, wheat, rice, potatoes and even deteriorated sugar. In the present investigation fermentation of deteriorated sugar was experimentally done in presence of earthworm cast.

Keywords: Earthworm cast, yeast, deteriorated sugar, ethanol

1. Introduction

The farmyard manure made from cow dung is an idea source for earthworm. The total effluent generated by 324 distilleries in India in a yeast contain 5200 tones of nitrogen and 3000 tones of phosphorus annually nitrogenous fertilizers generated as effluent in land can lead to accumulation of nitrate in the soil which are transferred to man through plants. Nitrates, being highly soluble, go into drinking ground water and become toxic when this concentration exceeded 90 ppm causing diarrhea and cyanosis (blue jaundice) in children. In human these nitrates and nitrites are converted to nitroso amines and nitroso compounds which are suspected as agents of stomach cancer. Phosphatic fertilizers are considered detrimental to crop production. It may lead to Fe, Cu and Zn deficiency in plants. Thus by using earthworm excreta in the distilleries we can save human from number undesirable effects^[1].

Our country needs to trap renewable energy sources to fulfill its requirements; deteriorated sugar which is usually unfit for human consumption and is generally disposed of by the factories at very low price, can solve the energy problem of the country if managed and utilized in a planned way. The production of ethanol in this manner has the potential to counter the sky rocketing prices of crude oil and emerge as an alternative to fossil fuel which is damaging the ecology. The large scale availability of earthworm excreta in rural areas can be used to produce ethanol from deteriorated sugar in an organized way and can serve an excellent nutrient replacing expensive chemical fertilizers which are creating substantial health problem to mark^{[2][3]}.

Ethanol is being used as renewable resource of energy. With depleting sources of fossil fuel the cost of oil and gas is bound to go up. Our use of fossil fuel is likely to go up from 70% to 90% and in 15-20 years, we will be facing a crisis. This had led the government to plan for a diversification of its energy generation sources. Ethanol is a bio-solar „home made“ fuel usable as a blend with gasoline in present day automobiles without any engine modification. An immediate

solution to help meet growing fuel oil scarcity and reduce automobile pollution. Electric cars are a good way to cut down consumption of fossil fuels. But where will the electricity to charge the car batteries come from? This will not reduce carbon emissions. On the other hand, in the case of corn based ethanol plant process atmospheric carbon dioxide turns into carbohydrate through photosynthesis. When car engine burn ethanol as fuel an equivalent amount of carbon dioxide is emitted and process from cultivation to consumption is therefore carbon neutral^{[4][5][6]}.

Thus government has allowed oil companies to supply 10% ethanol blended petrol across the country under its ethanol blended programme. By blending 10% ethanol, India stands to save 10 billion litres of petrol annually. The import price of ethanol is Rs. 21.50 a litre. Hence there will be little chance of importing ethanol^[7].

The raw materials for ethanol industry are generally cane juice, cane sugar, molasses, beets, potatoes, rice, barley, maize, etc. The Most widely used sugar for ethanol fermentation is blackstrap molasses which contains about 35-40% sucrose, 15-20 wt% invert sugars such as glucose and fructose, and 28-35 wt% sugar. After the pH of the mash is adjusted to about 4 - 5 with mineral acid, it is inoculated with the yeast, and the fermentation is carried out non-aseptically at 20-32°C for about 1-3 days. The fermented wine, which typically contains 8-10 wt% ethanol, is then set to the product recovery in purification section of the plant. The processes of conservation of sugars to ethanol under the influence of yeast bring about the conversion of sugars into ethanol^{[8][9]}.

2. Material and Method

14% (w/v) of deteriorated sugar solution in water was supplemented with 0.5% earthworm excreta. The solution was sterilized at 15 Psig for 15 minutes and cooled at room temperature. Addition of 0.05% active dry yeast was done in the solution and contents were fermented for 72 hours at 30°C.

The yeast cells were able to ferment the deteriorated sugar solution with 0.9% increase in ethanol yield. When supplemented with earthworm excreta^[10].

The measurement of Ethanol percent from the fermented deteriorated solution was done by Acetylation method^[11].

3. Results and Discussion

- **Carbon neutral-**

Earthworm excreta bring about the conversion of sugar to ethanol in presence of yeast. Atmospheric CO₂ turns into sugar through photosynthesis. When car engine burns ethanol as fuel an equivalent amount of CO₂ is emitted of and process from cultivation to consumption is therefore carbon neutral.

- **Saving carbon tax –**

Hence we can save carbon tax at \$ 25 per tone CO₂ emitted to fight global warming

- **Green fuel-**

Ethanol is also known as green fuel because it reduces both CO₂ and NO_x levels in emissions.

- **Green flights-**

Airlines also go bio-fuels to counter the fluctuating ATF prices this alternate source can bring nutrition in aviation.

- **Bio-fuels set to boom in Karnataka-**

Currently 1,400 out of 7,000 KSRTC buses run on ethanol blended diesel and it will upgraded to 5,000 buses soon.

- **Vermi compost increases yield of sugarcane-**

Vermi compost prepared by using cow dung to inoculate earthworms

- **Earthworm excreta increases yield of ethanol-**

By using excreta, 0.9% increases in ethanol was observed.

4. Conclusion

- 1) The result obtained shows that the earthworm cast is fully capable of producing significant amount of ethanol, from the deteriorated sugar.
- 2) The result obtained is encouraging.
- 3) Earthworm cast may be considered as viable option to reduce cost of commercial production of bio fuel from feedstocks other than deteriorated sugar.
- 4) Detailed studies and extensive test runs on ethanol blended fuels shown that in ethanol we have a motor fuel which, in spite of its limitations, can provide the low knock fuel with power to withstand high compression ratios and give reduced exhaust emissions.
- 5) Capable of being produced within the country from a wide variety of available raw materials including by-products of tropical zones, this “Home Grown” fuel provides as satisfactory motor spirit at minimum cost in imported low-knock fuels.
- 6) Its use in present-day automobiles in the form of ethanol-gasoline blends can be an immediate mid-term measure to help reduce vehicular pollution in Delhi and at the same time add more energy to automobile energy supply and stretch the fast dwindling gasoline availability.

References

- [1] Fundamentals of photochemistry, new age international publishers, K. K. Rohatgi-Mukherjee, New Delhi, 2002, P.P. 275.
- [2] A bovine replacement of chemical fertilizers for the production of fuel ethanol Gutpa A.K., **Khan Mohammad Azhar** Bartiya Vigyan Sammelan. (2009). Indore.
- [3] Application of nano-technology in the enhancement of bio-technological fuel ethanol. Gutpa A.K., **Mohammad Azhar Khan**, Nandita Gupta & Aparna Awasthi., Proc. of National symposium on materials for Advanced Technology NSMAT-2011.
- [4] Ethanol from direct sugarcane and juice by sacchromyces cerevisiae, *Giri Rupa, Leela wasti, B.S. Kundu & Kushal Raj.*. Proce. of 70th – 29th August, 2009 Udaipur(Rajasthan), India.
- [5] Yardstick enhancement of ethanol yield using ferric oxide nano material along with gallionella microorganism. By **Mohammad Azhar** Madhya Pradesh council of science and technology(2015)
- [6] Application of pheretima castings for the production of fuel alcohol. By **Mohammad Azhar & Mahendra Kishore Bhatnagar** Journal of Environmental Research and Development (JERAD), Vol-2, No-2, (July 2014)
- [7] Effect of iron-oxide nano particles on the production of ethanol. By **Mohammad Azhar & Mahendra Kishore Bhatnagar** National Seminar on Present Advances in Chemical Research (RACR-14), Department of Chemistry, Rajiv Ghandhi University, Rono Hills, Doimukh, Itanagar, A.P., India (Feb. 2014)
- [8] Benchmark Enhancement of Ethanol Yield Using 50 nm Iron-Oxide Nano. By Anil Kumar Gupta, Sudhir Gupta & **Mohammad Azhar Khan** journal of Teaching and Research in Chemistry an International Journal Vol-18, 27-30, Bhubanashvar (Dec.2013)
- [9] Globalization of ethanol production by the use of nanomaterial. By A.K. Guptaand **Mohammad Azhar** (Silver medal winner) Gen. and co product (36-41) Proceeding of The sugar Technolgists Association of India (STAI) Hyderabad, (Andhra Pradesh) (2012)
- [10] Earthworm excreta: A new approach for the production of ethanol. By A.K. Gupta, **M. K. Bhatnagar & Mohammad Azhar** Journal of teaching and research in chemistry; Vol-19, page 55-57 Bhubaneswar (Udessa) (Dec.2012).
- [11] Invention of Acetylation method for measurement of fuel ethanol percent in fermented liquid, *Gutpa A.K.*, Proc. of 70th Annual Conv. of STAI: 35 – 39. (2009).