J. Chemtracks 23 (1&2) 127-130, 2021

Abstracted / Indexed in
A division of the American Chemical Society
Chemical Abstract U.S.A.

ISSN 0973-239X
CODEN:JCOHF7
IMPACT FACTOR : 4.950

The influence of cesium fluoride on microbial biodegradation of molasses to alcohol by *S. cerevisiae* J-16

Jyoti Kumari[1] and S. M. Abdullah[2]

[1]Chemical Research Laboratory, Department of Chemistry, M.G. College, Gaya (Bihar) India

[2]Department of Chemistry, Allama Iqbal College Biharsharif, Nalanda (Bihar)

Manuscript received online 24 April 2021, accepted on 29 May 2021

Abstract : The influence of cesium fluoride on microbial bioconversion of molasses to ethanol by *Saccharomyces cerevisiae* J-16 has been assessed. It has been found that the mutagen under observation, i.e., cesium fluoride at its initial concentration i.e. 1.0×10^{-5}M has been found less effective in comparison to control. The initial molar concentration of cesium fluoride retarded the microbial bioconversion of molasses to ethanol by *Saccharomyces cerevisiae* J-16 to an extent of -14.7540% lower in comparison to control fermentor flasks, i.e., 6.10 ml/100mL in 55 hrs of incubation period, 5.1 pH and 30.5^0C temperature with 25% (w/v) molasses solution.

(**Keywords:** Molasses, ethanol, cesium fluoride *Saccharomyces cerevisiae* J-16)

Introduction

The most revealing findings[1-3] about mutation have come from the studies of mutagens as well as radiation energy. General reviews[4-10]shows that there is a rather widespread agreement as to the best strategy for a programme of strain development of screening designed to improve best and potent mutant of microbes. Mutation is related with a variety of chemicals and biochemicalsin several bacteria, fungi and yeasts e.g., nitrogen and sulphur mustards and other related compounds[11-14]. Singh[15] concluded that hydrazine sulphate enhances the yield of lactic acid, while p-nitrophenyl hydrazine, 2-4-dinitrophenyl hydrazine and lithium fluorids has been detrimental mutagens for L.acidophilus and production of lactic acid. Reeta Rani[16] concluded that methoxy caffeine enhances the production of ergot-alkaloids while sodium azide, hydrazine hydrochloride, and lithium fluoride has been detrimental and valueless for the fermentative production of ergot-alkaloids by the fungus *Claviceps purpurea*. A large number of chemical mutagens have been employed to generate the mutants of different microbes but still there are some chemical mutagens whose influence on alcoholic fermentation by *Saccharomyces cerevisiae* J-16 species have not been studied[13-47].

The present study was undertaken to assess and analyse the alcoholic fermentation by *Saccharomyces cerevisiae* J-16 exposed to cesium fluoride mutagenic chemical.

Experimental

The influence of cesium fluoride on microbial bioconversion of molasses to ethanol by *Saccharomyces cerevisiae* J-16. The composition of the production medium for microbial bioconversion of molasses to ethanol by *Saccharomyces cerevisiae* J-16 is prepared as follows : Molasses : 25% (w/v), Malt-Extract : 0.3% , Yeast-Extract : 0.3%, Peptone : 0.5% Distilled water : To make up 100 ml, pH : 5.1, Distilled water was added to make up the volume up to '100 ml'. The pH of the medium was adjusted to 5.1 by adding requisite amount of lactic acid.

Now, the same production medium for ethanol production by *Saccharomyces cerevisiae* J-16 was prepared for 99 fermentor-flasks, i.e., each containing 100 ml of production medium. These fermentor-flasks were then arranged in 10 sets

Table - 1
The influence of cesium fluoride on microbial biodegradation of molasses to alcohol by *S. cerevisiae* J-16

Concentration of mutagen used A X 10^{-x} M	Incubation Period in hours	Yield of ethanol* in ml/100 ml	Molasses sugars* left unfermented in g/100 ml	% Difference in yield of ethanol after 55 hours in comparison to control.
Control (-) Mutagen	55	6.10	1.403	–
1.0×10^{-5}M** (+) Mutagen	55	5.20***	2.227	– 14.7540
2.0×10^{-5}M (+) Mutagen	55	4.60	2.813	– 24.5901
3.0×10^{-5}M (+) Mutagen	55	2.71	4.730	– 55.5737
4.0×10^{-5}M (+) Mutagen	55	2.20	5.230	– 63.9344
5.0×10^{-5}M (+) Mutagen	55	0.70	6.731	– 88.5245
6.0×10^{-5}M (+) Mutagen	55	0.53	****	– 91.3114
7.0×10^{-5}M (+) Mutagen	55	****	****	****
8.0×10^{-5}M (+) Mutagen	55	****	****	****
9.0×10^{-5}M (+) Mutagen	55	****	****	****
10.0×10^{-5}M (+) Mutagen	55	****	****	****

* Each value represents mean of three trials. ** Optimum concentration of the mutagen used.
*** Optimum yield of ethanol in 55 hours. (+)Values indicate % increase in the yield of ethanol in comparison to control. Experimental deviation (±) 2.5–3.5%.
**** Insignificant value

each comprising 9 fermentor-flasks. The remaining 9 fermentor-flasks out of 99 fermentor-flasks were kept as control and these were also rearranged in 3 subsets each consisting of 3 fermentor flasks.

Now, M/1000 solution of cesium fluoride was prepared and 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, and 10.0 ml of this solution was added to the fermentor-flasks of first 10 sets respectively. The control fermentor-flask contained no cesium fluoride. The total volume in each fermentor-flask was made upto '100 ml' by adding requisite amount of distilled water.

Thus, the concentration of cesium fluoride in first, second, third, fourth, fifth, sixth, seventh, eighth, ninth and tenth subsets were approximately as given below :

$A\times10^{-x}$M, 1.0×10^{-5}M to 10.0×10^{-5}M respectively. Where, A= amount of cesium fluoride in ml, ie; from1.0 ml to 10.0 ml.
x = molarity of the cesium fluoride solution.

The fermentor-flasks were then steam sterilized, cooled, inoculated, incubated at 30.5^{0}C and analysed colorimetrically after 33, 55, and 75 hours for ethanol[48] formed and molasses sugars[49] left unfermented.

Results and Discussion

The influence of cesium fluoride

The influence of cesium fluoride has been recorded in the table-1. It is evident from the results that casium fluoride has insignificant effect on microbial biodegradation of molasses to alcohol by *S.cerevisiae* J.16. Cesium fluoride was found much detrimental to the alcoholic fermentation in the lower concentrations because in the beginning initial concentrations of cesium fluoride (CsF), the concentration of fluoride ions F^- are very less and cesium may plays the role of micronutrient for the growth and activity of the yeast *S.cerevisiae* J-16; but it seems from the results that like other useful micronutrients cesium has no significant requirement for the yeast thus not required and F^- ions dominates to deactivate the enzymes of alcoholic fermentation. However, at higher concentration of CsF, production of alcohol was found to be very negligible and in some cases (at 7.0×10^{-5}M to 10.0×10^{-5}M) no alcohol was formed. The toxic effect of CsF at higher concentrations can be also explained on the fact that F^- ions becomes sufficient in number to deactivate the enzymes and suppress the growth of the yeast and thus at higher concentration of CsFalcohol in trace is formed and at much higher concentrations it is almost nil.

The maximum yield of alcohol in the presece of CsFwas found to be 5.20 ml/100ml at 1.0×10^{-5}M in 55 hours of incubation period which is 14.7540% less in comparison to control i.e., 6.10ml/100ml.

References

1. F.M. Wetkins, *Annual Rev. Microbiol.* **23**, 487 (1969a).
2. V. I. Kalinina, I.G. Bogatyreva, and A.M. Lysenko, *Prikl. Biokhim. Microbiol.* **135**, 715 (1977).
3. R.W. Thoma, *Folia Microbiol*. **16**, 197 (1971)
4. S.I. Alikhanian, *Adv. Appl. Microbiol*. **4**, 1 (1962).
5. Sermonti: Genetics of Antibiotics Producing Organism. Willey Interscience, London (1969).
6. O.L. Daview, *Bionnetries*, **20**, 576 (1964).
7. C.T. Calm, "Methods in Microbiology" (Norrie, J.R. and Ribbons, N.W. Ed.) vol. 3A, Chapt. VII, p. 435, Academic Press, New York (1969)
8. S. I. Alikhanian, Yugolsav. Academy of Sciences and Arts Zagrebp. 69 (1969).
9. S.G. Bredley, *Adv. Appl. Microbiol.* **8**, 29 (1966).
10. C.T. Calm, *Progr. Ind. Microbiol*. **5**, 1 (1964)
11. E.L. Tatum, *J. Cellular Comp. Physiol*. **35**, suppl. **1**, 119 (1950).
12. K. Arima, and S. Abe, *J. Antibiotics*, **4**, 342 (1951).
13. H. Miller, and W.D. McFlcoy, *Science* 107, 193 (1948).
14. C.M. Stevens, and A. Mylorie, *Am. J. Bot.* **40**, 424 (1953).
15. R. Singh, Ph.D. Thesis ChemistryMagadh University, Bodh-Gaya pp. 112 (1990).
16. Reeta Rani Ph.D. Thesis Chemistry Magadh University, Bodh-Gaya pp. 74 (1991).
17. D. Wild, *Mutat Res.* **56**, 319 (1978)
18. D. W. Frank, R. J. Trzos and P. I. Good, *Mutat Res*. **56**, 311 (1978)
19. T. E. Wheldon, J. Kirk, J.S. Orr. J. Paul & D. Conkie, *Cell Tissue Kietic*s **7,** 181 (1974)
20. J. Paul, D. Conkie, & R. I. Freshney *Cell Tissue Kinetics* **2,** 283 (1969).
21. R.G. Tarbutt & R. J. J. Cole, *Embryol Exp. Morph.* **24**, 429 (1970).
22. De Serres F. J. *Mutat Res.* **41**, 43 (1976).
23. S. P. Singh, B. Pratap, B. K. Ambasta, R. K. Pandey, A. C. Sinha and A. Prasad , *Asian. J. Chem.* **6**, 753 (1994).
24. S. P. Singh, C. K. Singh, D. Narayan, M. A. Khan, and R. Kumar *J. Chemtracks*, **5**, 51 (2003).

25. S. P. Singh, F. R. Faizi, M. A.Khan, Md. Irfan, A. P. Kumar and P. K. Chaurasia, *J. Chemtrack*s **5**, 37, (2003)
26. Shalini Singh, *J. Chemtrack*s **7**, 125, (2005)
27. E.Freese and E.B. Freese : *Radiation Res. Suppl.* **6**,97,(1966)
28. E.Freese In " Molecular Genetics" J. M.Taylor Ed. pp.207 New York (1963)
29. S. Kumari, F.R. Faizi, G.K. Mishra, K. Ahmad and S.P. Singh *J. Chemtracks* **8,** 103(2006)
30. Savita Kumari, Dharmendra Kumar, Gajendra K. Mishra, Khursheed Ahmad and S. P. Singh, *J. Chemtracks* **9,** 177-180 (2007)
31. Anurag Singh and Shalini Singh, *J. Chemtracks* **10,** 49-52 (2007)
32. Anurag Singh and Shalini Singh *J. Chemtrack*s **10** (1&2), 149 (2008)
33. R. Kumar , Jyotimala, C.K. Singh, B. Singh, B. Kumar and S. P. Singh *J. Chemtrack*s **10** (1&2), 129 (2008)
34. P. Kumari, V. Kumar, D. Kumar, S. R. Sharma, K. Ahmad and S.P. Singh *J. Chemtrack*s **10** (1&2), 333 (2008)
35. Jyotimala, A. Prasad, C. K. Singh, K. K. Singh, N. Rathor and S. P. Singh, *J. Chemtrack*s **11** (1), 277 (2009)
36. Shalini Singh and Anurag Singh *J. Chemtrack*s **12** (1), 7 (2010)
37. Jyotimala, S. D. Yadav, V. Kumar, F.R. Faizi, R. Kant and S. P. Singh *J. Chemtrack*s **11** (1), 97 (2010)
38. S. Kumar, V. Kumar, F. R. Faizi, K. Ahmad, O. P. Srivastava and S. P. Singh *J. Chemtrack*s **12** (1), 157 (2010)
39. P. K. Pathak, M. Kumari, R. Bala, L. Kumar S. Kumar and S. P. Singh *J. Chemtrack*s **12** (1), 169 (2010)
40. S. Kumar R. K.Bharti,S.Ranjan,Md. S. Akhtar S. D. Yadav and S. P. Singh *J. Chemtrack*s **12** (2), 331 (2010)
41. A. Kumar, V. Mandal, K. Ahmad, L. Kumar, A. Kumar and S. P. Singh *J. Chemtracks* **13**(1), 75 (2011)
42. S. Kumari, S. Shahzada, R. K. Bharti, Md. S. Akhtar, R. Bala and S. P. Singh *J. Chemtracks* **13**(1), 87 (2011)
43. V. Mandal, A. Kumar, R. Raushan, D. Kumar, S. Kumar and S. P. Singh *J. Chemtracks* **13**(1), 169 (2011)
44. S. Singh and A. Singh *J. Chemtracks* **13**(1), 185 (2011)
45. Md. Shahid Akhtar, Md. Tanweer Alam, Shashi Ranjan Kr. Singh, Satyendra Prasad, Amarendra Kumar and S.P. Singh *J. Chemtracks*, **13** (2), 493 (2011)
46. M. S. Prasad, S. K. Srivastava, R. Pd. M. Imam, R. Kumar and S. P. Singh *J. Chemtracks* **13**(1), 231 (2011)
47. Md. Shahid Akhtar, Basundhra Kumari and R.N. Singh, *J. Chemtracks* **22** (1&2) 65 (2020)
48. L. P. Mccloskey and L. L. Replogle *Am.J. Enol. Vitie* **25**, 194 (1974).
49. M. Dubois, K. A. Gills, J. K. Hamilton, P. A. Rebers and F. Smith, *Anal. Chem*. **28**, 350 (1956).

An International Peer Reviewed Research Journal of Chemistry
Abstracted / Indexed in : Chemical Abstract U.S.A.
JC- 1450/2K21 (ISSN:0973-239X), INDIA
Journal Chemtracks Vol. 23 (1&2), 127-130, January to December 2021