(20-149)

Final Report

of the R&D project

Studies on functional properties of dominant microflora found in rice beer of Assam

(DST No: No. 97/MFPI/R&D/2012, Dated 18th February, 2013)

Date of start: 13.05.2013

Date of completion: 12.05.2015

Submitted to

Ministry of Food Processing Industries
Panchsheel Bhawan, August Kranti Marg,
New Delhi – 110049

Submitted by

Prof. S. C. Deka
Principal Investigator
Dept. of Food Engineering & Technology
Tezpur University, Napaam
Tezpur, Assam, India

FINAL PROJECT COMPLETION REPORT (FPCR)

Submitted to the Joint Secretary, Ministry of Food Processing Industries, Paanchsheel Bhawan, August Kranti Marg, New Delhi- 110049

1. **Title of the Project** — Studies on functional properties of dominant microflora found in rice beer of Assam

2. **Date of Commencement:** 13.05.2013
   Termination: 12.05.2015
3. **Name and address of Principal Investigator**

Prof. S. C. Deka
Professor
Dept. of Food Engineering & Technology
Tezpur University, Napaam
Tezpur- 784028, Assam, India

4. **Total grant sanctioned and expenditure during the entire period**

Total cost of the project: Rs. 46, 02,000.00
Amount released till date: Rs. 40, 31,000.00
Committed Expenditure: Rs. 4,96,982.00
To be released from MFPI, New Delhi: Rs 5,71,000.00

A	Budget Head: Equipments			
Sl no	Name of the Equipment	TU purchase order no	Supplier	Amount in INR(Rs)
1	PCR Thermocycler	TU/11-15(Pur)/FPT/2013/1393 Dated 01.07.2013	Eppendorf India Limited,Chennai	12,00,000.00
2	CO_2 Incubator			
3	Gel Eletrophoresis unit with power pack for DNA and Protein with accessories	TU/11-15(Pur)/FPT/2013/1395 Dated 01.07.2013	PEQLAB Biotechnologie GmbH,Germany	2,95,223.00
		TU/11-15(Pur)/FPT/2013/1396 Dated 01.07.2013	DNR Bio-imaging Systems Ltd, Israel	3,54,322.00
		TU/11-15(Pur)/FPT/2013/1397 Dated 01.07.2013	Sigma SBI Biosolutions Pvt. Ltd., Guwahati	25,000.00

4	Ultrasonic Bath	TU/11-15(Pur)/FPT/2013/1398 Dated 01.07.2013	Inkarp Instruments Pvt, Ltd., Hyderabad	3,73,000.00
5	Anaerobic work station	TU/11-15(Pur)/FPT/2013/1394 Dated 01.07.2013	Don Whitley Scientific Limited,England	12,10,727.00
		TU/11-15/Pur/FPT/2013/2212-A Dated 05.09.2014	M/S Linnaeus Biosciences, Kharagpur, W.B.	99,769.00
B	Budget Head: Manpower (SRF)			
	Ms. Gitashree Das appointed as SRF	Till Date		407032.00
C	Budget Head: Consumables			
	Chemicals/glasswares/raw materials etc.			108751.00
D	Budget Head: Travel			
	Undertaken by SRF and PI			31,194.00
Total Expenditure (A+B+C+D)				4105018.00
Amount actually released till now				40,31,000.00
Additional expenditure				(-)74018.00
Committed Expenditure				4,96,982.00
To be reimbursed				5,71,000.00

5. Equipments purchased out of MoFPI grant

Sl no	Name of the Equipment	TU purchase order no	Supplier	Amount in INR(Rs)
1	PCR Thermocycler	TU/11-15(Pur)/FPT/2013/1393 Dated 01.07.2013	Eppendorf India Limited,Chennai	12,00,000.00
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		TU/11-15(Pur)/FPT/2013/1396 Dated 01.07.2013	DNR Bio-imaging Systems Ltd, Israel	3,54,322.00
		TU/11-15(Pur)/FPT/2013/1397 Dated 01.07.2013	Sigma SBI Biosolutions Pvt. Ltd., Guwahati	25,000.00
4	Ultrasonic Bath	TU/11-15(Pur)/FPT/2013/1398 Dated 01.07.2013	Inkarp Instruments Pvt, Ltd., Hyderabad	3,73,000.00

5	Anaerobic work station	TU/11-15(Pur)/FPT/2013/1394 Dated 01.07.2013	Don Whitley Scientific Limited,England	12,10,727.00
		TU/11-15/Pur/FPT/2013/2212-A Dated 05.09.2014	M/S Linnaeus Biosciences, Kharagpur, W.B.	99,769.00

6. Research fellow associated with scheme

Name & Designation	Date of Joining	Date of Leaving
Miss. Gitashree Das Senior Research Fellow	13.05.2013	12.5.2015

7. List of research papers published/communicated, based on the research work done under the scheme:

- Das, A. J., Khawas, P., Miyaji, T. and Deka, S. C. (2014). HPLC and GC-MS analyses of organic acids, carbohydrates, amino acids and volatile aromatic compounds in some varieties of rice beer from Northeast India.Journal of the Institute of Brewing.Volume 120, Issue 3, pages 244–252.

- Das A.J., Seth, D., Miyaji, T. and Deka, S.C. (2015).Fermentation optimization of probiotic rice beer and its application for cassava and plantain beer production. Journal of the Institute of Brewing (Accepted).

- Das, A. J., Khawas, P., Miyaji, T. and Deka, S. C. (2014). Effect of various microbial starters for amylolytic fermentation on some quality attributes of rice beer. International Food Research Journal 21(6), 2443-2450.

- Das, A.J., Deka, S. C., Miyaji, T., Khawas, P., Sit, N. and Badwaik, L.S. (2013). Quality assessment of twelve different varieties of starter cakes used for rice beer preparation in Northeast India. Paper presented in the International Conference on Innovations in Food Processing, Value Chain Management & Food Safety (IFpvs) January 10- 11, 2013 at National Institute of food technology entrepreneurship and management (under MOFPI, New Delhi), Kundli, Haryana

- Das, A. J., Das, G., Khawas, P., Miyaji, T. and Deka, S. C. (2013). Phytochemical estimation and HPLC analysis of polyphenols in few plant species used for rice beer preparation in Assam. Presented at the 7th International Food Convention, IFCON 2013 wef 18-21 December, 2013(venue CSIR-CFTRI, Mysore, India), Organized by AFSTI, Mysore, CSIR-CFTRI, Mysore, MoFPI, New Delhi, NIFTEM, Haryana, and DFRL, Mysore. (Page 188 of Souvenir)

- Das, A. J., Das, G., Miyaji, T. and Deka, S. C. (2014). Purified polyphenols and their in vitro oxidation activities from four plant species used in rice beer

preparation in Assam, India. (Page 106). Paper presented in the International Conference on Disease Biology and Therapeutics, 3rd-5th December, 2014, Organised by Institute of Advanced Study in Science and Technology (IASST), Vigyan Path, Paschim Boragaon, Garchuk, Guwahati-781035, Assam

- Das, A. J. and Deka, S. C. (2014).Rice beer preparation of North-East India: A myriad of starter cultures used. In: Indigenous Fermented Foods of South Asia, Published by CRC Press Taylor and Francis Group [(http://www.crcpress.com/product/isbn/9781439887837) Series: Fermented Published: December 15, 2014 by CRC Press Content: 640 Pages, 150 Illustrations Editor(s):V.K. Joshi, ISBN 9781439887837, Hardback $199.95]
- Das, A. J., Das G., Khawas, P. and Deka, S. C. (2014).Probiotic properties of some lactic acid bacteria isolated from rice beer prepared in Assam, India. Paper presented at Vth Scientific workshop 18th -20th September, 2014, Organised by DBT AAU Centre, Assam Agricultural University, Jorhat-785013.

8. Details of new products developed/apparatus or equipment designed or constructed/ test developed etc during the investigation

- Microbial strains with promising functional properties involved in the production of rice beer in Assam have been identified (Details in Enclosure II).
- Standardized methodology for preparing rice beer has been developed (Details in Enclosure II)
- Fuzzy methodology developed for the sensory evaluation of rice beer (Enclosure II).

9. The likely impact of the completed work on the scientific/ technological potential in the country (This may be attached as Enclosure I).

Attached as Enclosure I

10. Whether work for patenting had been initiated? Yes/No: If Yes, what action has been taken and if not, its reason thereof:

Yes, work had been initiated for patenting and is guidance is being currently taken from the Intellectual Property Rights (IPR) cell of Tezpur University, Assam. The improvised technology for preparing rice beer and the new starter cultures developed

using the identified microbial strains and *Albizia* extracts will be considered for patenting.

11. **Detailed account of the work carried out in terms of the objective(s) of the project and how they have been achieved; results and discussions should be presented in the manner of a scientific paper/ project report in about 5000 words; and this should be submitted as Enclosure-II in this report.** Attached as Enclosure II

12. **An abstract of research achievements in about 200-500 words, suitable for publication.**

Lactic acid bacteria (LAB) were isolated from rice beer and their characterization was done. Good antibiosis and antioxidant activities were exhibited by some of the isolates and they were identified as *Lactobacillus pentosus, Pediococcus pentosaceus, Lactobacillus casei* and *Lactobacillus plantarum.* Yeast strains were isolated from rice beer and their characterization was also done. High ethanol tolerance capacities in some isolates and they were identified as *Saccharomyces cerevisiae* and *Saccharomyces bayanus.* High saccharification ratio and good glucoamylase and α amylase production capability were observed in some mould isolates also. The optimal conditions for the production of probiotic beer using starchy substrates and particular fermenting microbes were established, and these conditions were successfully applied in the production of beer from cassava and plantain. These optimal conditions obtained can thus be successfully applied in the production technology for a wide variety of beers from starchy substrates. This study also broadens the prospects of the particular bacterial and yeast strains to be utilized in the preparation of fermented alcoholic beverages. Fuzzy logic and the linguistic variables were implied to rank five beer varieties and beer made from rice clearly shown better sensory characteristics and acceptability as compared to the beer made from other substrates. Beer prepared from infusion of rice with cassava and *kachkal* evinced better sensory characteristics compared to substrates cassava and *kachkal* alone. The ranking of the beers shown rice beer under "very good" category, *kachkal* beer, *kachkal* rice beer and cassava rice beer under "satisfactory" category and cassava beer under "fair" category. A procedure for sensory evaluation, capable of describing the sensory profile of different varieties of beer was being elucidated and will help in precise documentation of the sensory properties and perception of the products prepared from various substrates. The brewing industry has immense interest for effective and quicker sensory evaluation techniques for its products. Therefore, the fuzziness which is associated with the panellists' perception in the characterization of sensory profile of beers could be well represented using fuzzy logic and will make important contribution towards product development. In the shelf life study, five different types of rice beer will be prepared using different starter culture combination. Increased shelf life stability was observed in case of rice beer prepared with *Aspergillus oryzae*, *Saccharomyces cerevisae* and phytochemicals extracted from *Albizia myriophylla.*

13. Mention here whether or not the unspent grant had been refunded to MFPI.

Not refunded

14. UC as per Annexure- D submitted? Yes/No:

Yes

Signature of PI

Date: April 21, 2015

Professor
Deptt. of Food Engineering & Technology
Tezpur University, Napaam-784028
Dist-Sonitpur (Assam)

Head of Institute/ Organization

Registrar
Tezpur University
Napaam, Tezpur

PROPFORMA AS PER GFR 19-A

See Rule 212 (1)

Form of Utilization Certificate

SI No.	Letter No. & Date	Amount (Rs.)
1	97/MFPI/R&D/2012 dated 18.02.2013	40,31,000.00
Total		40,31,000.00

Certified that out of **Rs.40,31,000.00** of grants-in-aid sanctioned for the project entitled 'Study of the functional properties of the dominant microflora found in rice beer of Assam' during the financial year 2013-14 in favour of the Registrar,, Tezpur University, Napaam-784028, Sonitpur, Assam under this Ministry's letters No 97/MFPI/R&D/2012 dated 18.02.2013, given in the margin and Rs.NIL on account of unspent balance of the previous year, a sum of Rs.**41,05,018.00** has been utilized for the purpose of the purchase of equipments, chemicals/consumables, glasswares, stationery, raw materials and expenses on manpower and tour expenses for which it was sanctioned, that the excess expenditure of **Rs. 74,018.00** will be adjusted towards the grants-in-aid payable during the F.Y.2015-16.

2. Certified that I have satisfied myself that the conditions on which the grants-in-aid was sanctioned have been duly fulfilled and that I have exercised that following checks to see that the money was actually utilized for the purpose of which it was sanctioned.

Kinds of checks exercised.

1. Accounts audited by qualified Chartered Accountant appointed by this University as Internal Auditor
2. All the equipments, chemicals, consumables etc purchased from the grant are entered in the stock.

(S.C Deka)
Professor & PI

Professor
Deptt. of Food Engineering & Technology
Tezpur University, Napaam-784028
Dist-Sonitpur (Assam)

27.4.15
Finance Officer
Tezpur University

Registrar
Tezpur University

STATEMENT OF EXPENDITURE

Summary

1.	**Fund Sanctioned**	Rs. 46, 02,000.00
2.	**Fund released**	Rs. 40, 31,000.00
3.	**Expenditure incurred**	Rs. 41,05,018.00
4.	**Committed Expenditure**	Rs. 4,96, 982.00
5.	**To be released**	**Rs. 5,71, 000.00**

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To be reimbursed				5,71,000.00

(S.C Deka)
Professor & PI

Professor
Dept. of Food Engineering & Technology
Tezpur University, Napaam-784028
Dist-Sonitpur (Assam)

22.4.15
Finance Officer
Tezpur University

Registrar
Tezpur University