

**FORMAT**  
**for**  
**PROJECT COMPLETION REPORT FOR**  
**RPS PROJECTS**

**File No.** : 8-116/RIFD/RPS/POLICY-3/2013-14  
(Annexure-I)

**Date of Sanction** : 23/12/2013

**Subject Area** : Food Process Engineering  
Under Biotechnology/Chemical Engineering

1	Principal Investigator : (Name & address)	Dr. Manuj.Kumar Hazarika Associate professor, Department of Food Engineering and Technology Tezpur University mkhazarika@tezu.ernet.in
2	TITLE OF THE PROJECT	Development Of Technology For Quick Cooking Rice Production Through Up-Gradation Of A Traditional Method
3	Date of Commencement of the Project	January, 2014
4	Amount Sanctioned by AICTE	16,50,000.00
5	Amount released by the AICTE	15,50,000.00
6	Details of Expenditure	
	A. Non recurring	
	(1) Digital moisture meter <b>MA100C, Sartorius</b>	4,13,500.00
	(2) Laboratory Scale rice mill (husker, Model TR 230 and polisher, Pearlest, from Kett)	1,35,000.00
	(3) Low temperature Chamber	1,44,000.00
	(4) Vacuum oven system	5,77,450.00
	(5) Fluid bed dryer	1,69,126.00
	(6) Steamer	59,052.00
	Total-A	14,98,128.00
	B. Recurring	
	Paddy samples, chemicals etc	51,827.00
	Total-B	51,827.00
	Total of A + B	15,50,000.00
5	Duration of the Project	03 years (2014 – 2016)
6	Date of Completion	31 <sup>st</sup> march, 2017
7	Objectives of the Project	1) To identify an alternate pathways of

		<p>production of traditional quick cooking rice (<i>Komal Chawal</i>) in order to reduce the cooking time to the acceptable norm of quick cooking rice.</p> <p>2) To develop a process technology for the production of quick cooking rice with reduced cooking time through up-gradation of the traditional method.</p>
8	Salient Research Achievements	
	8.1 New Findings/Achievements/IPR Potential	<p>Two pathways alternate to traditional method for parboiling for production of (<i>Komal Chawal</i>) is investigated:</p> <p>(1) Application of brown rice parboiling method, instead of paddy parboiling method for production of (<i>Komal Chawal</i>). A systematic investigation on soaking kinetics, and subsequent steaming and drying, were modeled in to mathematical equation enabling time estimation for process completion time. Improvement in product quality was noted. Rehydration (cooking) time at 65°C is 21 min, and at 100°C is 11 min.</p> <p>(2) Application of instant pressure drop technique as a mean of producing a swollen form of rice that will rehydrate quickly. Improvement in rehydration characteristics and milling quality was noted.</p>
	8.2 Product/Process Developed	<p>Two aspects were tested.</p> <p>(1) Process parameters for production of 'komal chawal' by brown parboiling method were established. Soaking at 60°C for 90 minutes, followed by open steaming for 20 minutes and drying at low temperature of 40°C, for 260-270 minutes as thin layers, lead to komal chawal of good rehydration characterstics. This was an improvement over the reported works of Dutta and Mahanta</p> <p>(2) A laboratory scale set up for Instantaneous controlled pressure drop (Figure in Annexure-II) was developed based on the literature. The set up was tested for producing komal chawal by parboiling of unhusked paddy. The komal chawal has got rehydration time of less than 9 min at 100°C.</p>

8.3 Patent(s) Applied for/Taken, if any	No
8.4 B. Tech. Project / M. Tech Thesis / : Ph.D., if any	<p><b>(a) PhD projects:</b></p> <p>Two works are going on (registered in 2014)</p> <p>(i) 'Development of fortified 'komal chawal', by Wahangbam E Devi.</p> <p>This work extends the benefit from the developed method of brown rice parboiling to enhance the micro-nutrient content in komal chawal by conducting the soaking step in micronutrient rich solution.</p> <p>(ii) 'Upscaling of ICPD based drying system for production of quality rice' by S Chakraborty. (registered in 2016)</p> <p>This work involves a systematic study of the impact of batch size on product quality</p> <p><b>(b) M tech project</b></p> <p>Two works are carried out during 2016-17</p> <p>(iii) 'Effects of process conditions of swell drying on physicochemical properties of parboiled rice' by Pranjal Das (FPL 15005)</p> <p>(iv) 'Fortification of paddy during pneumatic pressure parboiling' by Kandarpa Samua (FET13008)</p> <p><b>(c) B tech project</b></p> <p>One project carried out during 2016-17</p> <p>(v) 'Kinetic modeling of paddy parboiling' by Sanjukta Das (FPB13015) and Shagufta Rizwana (FPB13016)</p>
8.5 Consultancy	None
9	<p>Conclusions Summarizing the Achievements Indicating the Scope for Future Work.</p> <p>(i) The project investigated two pathways for improvement of 'komal chawal' production process. While both the pathways showed improvement in product quality, it leaves with scopes for further work: <b>Brown Rice parboiling method for Komal Chawal Production:</b></p> <p>Summary :</p> <p>'Komal chawal', produced by brown rice parboiling method from a low amylose rice variety 'chokuwa', was investigated for physical, physico-chemical, morphological and structural properties. For this optimum conditions for hydration, steaming and drying were decided based on mathematical models. Komal chawal' in the laboratory was is produced by soaking the brown rice at 60°C for 90 minutes, followed by steaming for complete</p>

gelatinization and hot air drying to 12% moisture (wet basis). Two different steaming conditions used are: (i) open-steaming at atmospheric pressure for 20 minutes and (ii) pressure-steaming at 1 atm (gauge) for 10 minutes; and three different drying temperatures used are 40, 50 and 60°C. The product obtains a hardness value of cooked rice on soaking for 20 minutes at 60°C, as revealed by texture profile analysis (TPA). The extent of changes in the kernel and flour properties of 'komal chawal' as compared to raw form are affected by severity of steaming condition and by drying temperature. Products obtained by hot air drying has better quality than products obtained by higher temperature drying.

Scopes for future work:

- Brown rice parboiling method has the potential to be used as a mean for micronutrient fortification (remark: work is being continued as a part of PhD work)
- Brown rice parboiling method needs creating of a hygienic condition during drying as it is devoid of the husk as protecting coating from dirt and dust. To overcome it a low cost drying set up based on renewable energy may be recommended with due validation (remark: To be taken up in future as a PhD work)

**(ii) Use of Instantaneous Controlled Pressure Drop (ICPD) system for Komal Chawal Production:**

When paddy was treated with ICPD, there were improvements in the head rice yield, rehydration ratio, cooking time, change in degree of gelatinization as well as in the texture of the product. The parameters were optimized to obtain best responses in terms of rehydration ratio, cooking time head rice yield, degree of gelatinization etc. The three independent variables chosen were time (15-60 sec), pressure (0.5-5MPa) and bed thickness (0.5-2cm). The ICPD treated paddy gives higher amount of head rice yield (83.55%) as the broken were drastically reduced due to the improved drying rate of the product after being swelled, better rehydration ratio (4.92) because of the expanded pore structure, lesser drying time of the product (3.05 hours) due to the enlargement of the pore size, pore volume as well as improvement in terms of textural properties, pasting properties. The product obtains a hardness value of cooked rice on soaking for 17 minutes at 60°C.

- There is a need to establish ICPD treatment time requirement with due consideration of bulk thickness etc as it involves steam penetration to the bulk of grains to effect starch gelatinization. (remark: work is continued as a part of PhD work).

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List of Publications Arising from the Project  
(please give Author (s), Title, Journal and Year)


In communication:

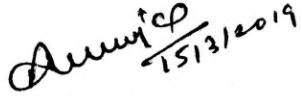
1. Wahengbam E D, Abdul, S and Hazarika, M K. Water Uptake in Brown Rice during Soaking for Production of No-cooking Rice, Under review in Agricultural Engineering International: the CIGR Ejournal.
2. Wahengbam E D and Hazarika, M K. Quality of ready-to-eat komal chawal produced by brown rice parboiling method, Under review in Journal of food science and technology.
3. Wahengbam E D and Hazarika, M K. Drying characteristics of ready-to-eat komal chawal: processing and modeling, in communication with Journal of food science and technology.

Book Chapter:

1. 'Effect of Non – conventional Drying Techniques on Food Quality' in preparation for the book 'Innovations In Food Processing Technologies' Editors: N Sit, L S Badwaik and A B Das.

Dated:

  
(M K Hazarika)  
Principal Investigator

  
15/3/2019  
Dean, R & D/ Registrar  
Tezpur University

**Dean**  
**Research & Development**  
**Tezpur University**

NAME OF THE PROJECT: AICTE – RPS “Development of Technology for Quick Cooking Rice Production through Up-gradation of a Traditional Method”, Tezpur University  
Utilization Certificate for the period: till 31/03/2017

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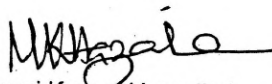
Name of the Scheme under which Grant was sanctioned: **AICTE - RPS** “Development of Technology for Quick Cooking Rice Production through Up-gradation of a Traditional Method”

Sl. No.	AICTE - RPS Sanction Order/Letter No. & Date under which grant was sanctioned	Amount (Rs.)	
	8-116/RIFD/RPS/POLICY-3/2013 dated: 23/11/2013	Rs. 15,50,000.00	Certified that out of the grant-in-aid Rs. 15,50,000.00 sanctioned by the AICTE during the financial year 2013-14 in favor of Registrar, Tezpur University as per letter mentioned in the margin, Rs. NIL on account of unspent balance of previous year, a sum of Rs. 15,50,000.00 has been utilized.

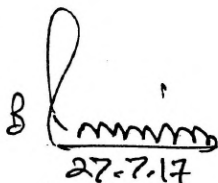
Certified that I have satisfied myself that the conditions on which the grant-in-aid was sanctioned have been duly fulfilled and that I have exercised the following checks to see that the money was actually utilized for the purposes for which it was sectioned.

Kinds of checks exercised:-

1. Receipt and payment account
2. Periodical progress Reports.



(Dr. Manuj Kumar Hazarika)  
Principal Investigator  
University



(Bani Pathak)  
Finance Officer, Tezpur University  
**Finance Officer**  
Tezpur University



(Dr. Biren Das)  
Registrar, Tezpur  
**Registrar**  
Tezpur University

Signature of Chartered Accountant

Name of Chartered Accountant

Membership

Full Address with Seal

(Mandatory for Self Financing Institutes)

For SURAJIT CHAKRABORTY & CO.

CHARTERED ACCOUNTANTS

Place:

Date:



CA. SURAJIT CHAKRABORTY  
(Proprietor)


Membership No.- 305054

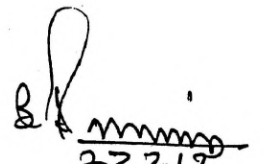
Note: Each page should be signed by all the concerned

Statement of Expenditure Incurred during 2016-17 (Up to 31-03-2017)

Title of the Project : AICTE-RPS " Development of Technology for Quick Cooking Rice Production through Up-gradation of a Traditional Method"  
Funding Agency : AICTE  
Name of PI : Dr M K Hazarika

Fund received	Expenditure incurred (up to 31-03-2017)			Unspent amount
Rs. 15,50,000.00	Equipment	15,00,000.00	14,98,128.00	1,872.00
	Recurring	50,000.00	51,872.00	- 1,872.00
<b>Total = 15,50,000.00</b>			<b>15,50,000.00</b>	<b>NIL</b>

  
(M. K. Hazarika)  
PI

  
22.7.17  
(B. Pathak)  
Finance Officer, TU  
**Finance Officer**  
**Tezpur University**

  
(B Das)  
Registrar, TU  
**Registrar**  
**Tezpur University**