TECHNICAL BULLETIN

ON

"A VALUE CHAIN ON CASHEW FOR DOMESTIC AND EXPORT MARKET"

NATIONAL AGRICULTURAL INNOVATION PROJECT (NAIP)

CASHEW EXPORT PROMOTION COUNCIL OF INDIA

KOLLAM, KERALA-691001

S. No.	Name of CPI/CCPI with Designation	Name of Organization and Address	Phone & Fax	Email
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1. Approved duration of the Sub-project from 1-04-2009 to 30-06-2012

2. Requested extension of duration from 1-07-2012 to 30.12.2013

3. Total sanctioned amount for the sub-project (Rs in lakhs): 293.6244

Details of R&D achievements since 1-04- 2009

(A) New products developed:

1. **Pollution preventing system (PPS)**

The existing technologies for conditioning the raw nuts, drum/steam roasting, cooling, cutting, pealing, grading and packing is centuary old and some of the technologies needs improvement. Drum roasting of raw nuts releases CO2, nitrate and sulphate along with particulate matter leading to atmospheric pollution. Under the project of funded by the NAIP-ICAR at CEPC; developed a pollution preventing system (PPS) for cashew drums roasting units. The system consists of removing the particulate matter leaving only steam outside. Pollution preventing system was installed at India Food exports at Kuzhithurai at KK district TN. It was published in all leading newspapers in Malayalam and Tamil. 29 units have already installed the pollution preventing system. Modified version of the system is being tried in another cashew processing unit for preventing the smoke from the borma chimney. Patent registered.

2. **Mechanical peeler for the peeling of cashew kernel testa**

In cashew processing industries, peeling of cashew is done manually. In market the some of the peeling machine have been developed but it cost around 7-13 lakhs. So to reduce the cost, a simplest and cheaper peeler for cashew production has been manufactured using air blower and a brush. It will cost only below Rs.20,000/.

3. **Polymerised compound from residol for specialty applications**

Polymerization of residol was carried out in the presence of polymerizing agents like Urea and formaldehyde at various proportions and their characteristics were studied. It provides resistance to moisture and weathering, good green strength and surface finish to moulded articles. Different combinations were tried to select the best ones. A novel and cheaper liquid crystalline polyester has been synthesised that can substitute for polymer fibres and films in specialty applications.

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(B) New processing technologies developed

1. Simple, easy, non thermal and low cost extraction of Anacardic acid from Cashew Shell

Anacardic acid is a phenolic compound and it is a major component of cashew nut shell liquid. During thermal processing it gets converted into cardanol. The cashew nut shell liquid if obtained by low temperature treatment contains only anacardic acid and cardol with anacardic acid as the major component. Anacardic acids do have many industrial and medicinal applications with established anticancer activity and the cost of which falls on a higher side. It is very much demand in the international market. New extraction process for anacardic acid was developed without thermal application in salt form and can be stored as anacardate. The existing method for the extraction of anacardic acid was very costly and time consuming. But the newly developed method could overcome that problem. Moreover by using cashew shell as a raw material, the utilization of cashew industry by product into a very good foreign exchange earner compound conversion is possible. Since cashew nut shell is used as fuel in cashew processing system. Patent applied.

2. Development of new processing technology for cashew cutting and peeling

Incubating with certain type of hydroxyl ion producing mixture was found feasible for cutting the cashew shell as well as peeling the testa. The pre and post treated samples of cashew kernels did not show any significant change in the chemical and nutritional quality. This technology was standardized for cutting open the raw cashew nut without thermal application. Patent applied.

3. Production of *Cellulase* enzyme from cashew shell

It is estimated that about 8.5 lakh tone of cashew shell is being generated annually. A very small quantity is being used for extraction of cashew shell liquid. Another very insignificant quantity is used for hardboard making and similar applications. Cashew shell contains a good amount of cellulose which is difficult to separate. By applying microbes the cellulose is converted into *cellulase*. The *cellulase* is widely used in food industry and textile industry. Thus recycling of the cashew industry waste (cashew shell) is being affected. Patent applied.

4. Production of *Pectinase* enzyme from cashew shell

It is estimated that about 8.5 lakh tone of cashew shell is being generated annually. A very small quantity is being used for extraction of cashew shell liquid. Another very insignificant quantity is used for hardboard making and similar applications. Remaining shell is totally used for fuel. The pectin

content of the cashew shell is to the tune of 2.3-3.4% w/w. By the fermentation of microbes using cashew shell as substrate, can produce the enzyme *pectinase*. They are one of the important functional food ingredients in jams, jellies, fruit juices, confectionery products, bakery fillings and are used for stabilization of acidified milk drinks and yoghurts. Thus the utilization and conversion of cashew industry waste to a highly useful enzyme production can be possible. Patent applied.

5. Production of *Tannase* enzyme from cashew testa

The cashew shell is about 0.3 cm thick, having a soft feathery outer skin and a thin hard inner skin. Between these skins is the honeycomb structure containing the phenolic material known as CNSL. Inside the shell is the kernel wrapped in a thin skin known as the testa. Testa is the good source of tannins. Tannins act as the sole source of carbon and to degrade the tannins, microbes were introduced and the microbes produced *tannase.* Tannase is extensively used in the food, feed, beverage, brewing and pharmaceutical industries. The major applications of tannase are in the manufacturing of instant tea and the production of gallic acid. Gallic acid is the key intermediate required for the synthesis of the antibacterial drug trimethoprim used in the pharmaceutical industries. In food industries, *tannase* is utilized as a clarifying agent of various beverages like wine, fruit juice, and coffee flavoured drinks. Patent applied.

(C) Improvement in existing production process

1. Improvement from the existing thermal or steam cooked cashew shelling by a novel non thermal method for processing:

In cashew processing unit a big amount of energy is utilized for drum roasting as well as steam cooking of raw cashew nuts. Atmospheric pollution is one of the major problems with drum roasting cashew processing units in India. The cashew processing centre and inhabited areas are contaminated due to heavy fall out of the CNSL and as these phenolic compounds are highly polymerizable, it forms complex with soil and dust and takes the shape of thick mat on the surfaces of the processing ground. This process will cause the health problems due to this compound. The contamination by these phenolic compounds is highly risky both for human health, mainly for women workers as well as for the ecological balance. An effort has been made to develop eco-friendly and less time consuming technique to cut open raw cashew nut without using thermal energy. Using Hydroxyl ion radicals, a non thermal and non-enzymatic scission of cashew nut shell is possible and thus creating a green atmosphere.

(D) Energy conservation

2. Non thermal cashew cutting and peeling.

CEPC has developed an eco-friendly and less time consuming technique to cut open raw cashew nut without using thermal energy. Using Hydroxyl ion radicals, a non thermal and non-enzymatic scission of cashew nut shell is possible which is less energy consuming; compared to the existing drum roasting and steam cooking techniques for cashew peeling.

(E) Pollution control

(1) Pollution preventing system:

The main objective of the invented pollution preventing system (PPS) is to minimize the air pollution rate at all drum roasting cashew processing factories, inhabited areas and save the industry as well as extracting/Recycling of the carbon waste produced during operation by immobilized technologies.

(2) Bioremediation of CNSL in cashew processing unit:

Identified potent organisms for the bioremediation of CNSL in cashew industries and CNSL contain phenolic compounds are irritant and allergic to human beings. Bioremediation used with potent identified organism could effectively help in the degradation or removal of the irritant and sticky CNSL from the floors of the processing units. This study is significant with respect to the pollution control of the processing units; that are contaminated through CNSL.

(3) Non thermal cashew cutting and peeling.

The eco-friendly and less time consuming technique to cut open raw cashew nut without using thermal energy; using Hydroxyl ion radicals will help in creating a green atmosphere.

(f) Seminars/symposia attended by R&D staff:

(1) Seminars conducted by CEPC-NAIP-ICAR at CEPC lab, Kollam on 5th July and at Kuzhithurai, Tamil Nadu on 12th July 2010

"Participatory rural appraisal workshop for middle level factory supervisors"

(2) Workshop on "Preparation of value added products of cashew apple" at CEPC lab on 16th and 17th February 2012

(3) World congress on biotechnology conducted by the OMICS group conferences at Hyderabad 21st to 23rd March 2011.

(g) Number of papers published:

1.Sabna Prabha S., Sisu Pramod S and Potty V. P. (2011) Isolation, identification and methanogenesis of cnsl degrading bacteria and immobilized bioremediation techniques of CNSL and its contaminated water from cashew industry, Middle-East Journal of Scientific Research 10 (3): 327-331, ISSN 1990-9233, © IDOSI Publications.

2.Sabna Prabha S., Muneer A. M and Potty V. P. (2011) Shelf life of cashew kernels stored under different antioxidants, International Journal of Agriculture and Food Science Technology (IJAFST), Vol.2, Number 1, pp.29-33, ISSN 2249-3069.

3. Sabna Prabha S and and Potty V. P. (2011) Thermal stability of CNSL by TGA and HPTLC, International Journal of Biotechnology and Biochemistry, Volume 7, Number 5, pp. 607-616, ISSN 0973-2691

4. Sabna Prabha S., Sisu Pramod S., Muneer A. M and Potty V. P. (2011) Recycling of waste water from cashew industry using isolated *escherichia coli* strain by using immobilised bioremediation techniques, International Journal of Applied Biotechnology and Biochemistry (IJABB), Volume 2, Number 2 (2012) pp. 87-93, ISSN 2248-9886

5. Prabhakumary C., *Potty*., *V.P.,* Rekha Sivadasan (2011). Effectiveness of gamma radiation for the control of *Tribolium castaneum*, the pest of stored cashew kernels.. Current Science, 1533. Vol.101, N0.12, 25 December

6. Sabna Prabha S., Sisu Pramod S., Muneer A. M and Potty V. P. Effect of storage temprature and humidity on moisture, carbohydrate, protein, fat, peroxide value and iodine value of raw cashew nuts, Bayero journal of pure and applied sciences (Accepted)

7. Sabna Prabha S., Sisu Pramod S., Muneer A M., Vinod Viswanath., Vincent Vineeth Leo and Potty V. P. (2011). Isolation, Identification and efficiency of new *Escherichia coli* bacterial strain for the degradation of CNSL and its contaminated water from cashew industry. J Chem Eng Process Technol, OMICS group, Volume S1: 021(2011) /Special Issue 2011,doi: 10.4172/2157-7048.1000001

8.Vincent Vineeth Leo., Vinod Viswanath., Sabna Prabha S., Muneer A. M and Potty V. P (2011). Production purification and characterization of tannase from cashew testa using *Aspergillus niger.* Journal of Microbial and Biochemical Technology (JMBT), OMICS group**,** Volume S1: 034(2011) /Special Issue 2011, doi: 10.4172/1948-5948.1000001

9. Sabna Prabha S, Vincent Vineeth Leo, Muneer A M, Vinod Viswanath and Potty V P (2011). A new processing technology for cashew cutting and peeling, *Proceedings of 21st swadeshi science congress*, pp: 12-14, Nov 6-9, CEPCI, Kollam, ISBN 81-901740-2-10

10. Muneer A M, Sabna Prabha S, Vincent Vineeth Leo, Vinod Viswanath and Potty V P (2011). Causes for offtaste and off flavour in cashew, *21st swadeshi science congress*, Nov 6-9, CEPCI, Kollam, ISBN 81-901740-2-10

11. Vincent Vineeth Leo, Muneer A M, Sabna Prabha S, Vinod Viswanath and Potty V P (2011). Production and purification of Cellulase from cashew shell cake using *Aspergillus niger*, *Proceedings of 21st swadeshi science congress*, pp: 23-28, Nov 6-9, CEPCI, Kollam, ISBN 81-901740-2-10.

12. Vinod Viswanath, Sabna Prabha S, Vincent Vineeth Leo, Muneer A M and Potty V P (2011). Production and purification of *Pectinase* from cashew shell cake using *Aspergillus niger*, *Proceedings of 21st swadeshi science congress*, pp: 29-39, Nov 6-9, CEPCI, Kollam, ISBN 81-901740-2-10.

(h) Number of R&D personnel who attended R&D training

SI No:	Training programme	Date	Attended
1	One week training programme on "Flexible packaging" at Hyderabad-Indian Institute of Packaging.	23rd to 28th November 2009	Mrs.Haseena M (Senior Scientist)
2	Corporate training entitled "Advance techniques in enzymology, molecular biology and HPLC" at BEST BIOTECH, Bangalore.	18th to 30th March 2010	Mr.Sisu Promod (SRF) and Dr Sabna Prabha (RA)
3	Training on "Food safety management system" by BSI India in Kochin	25th to 29th April 2011	Dr. Maya Rani (Asst. Principal Scientist)
4	Training on "Food safety fundamentals and the new india regulations" at AIB in NewDelhi	14th to 15th March 2011	Mrs Sandhya C Nair (Research assistant) and Mrs Resmi K I (Research assistant)
5	Training on "Measurement uncertainty in testing and calibration" organized by CETE at Bangalore.	2nd -3rd June 2011	Mrs Kavitha Kumar P (Senior Scientist)and Mrs.Haseena M (Senior Scientist)
6	Training on "ISO 17025 internal audit" by CETE at Bangalore.	23rd to 26th May 2011	Dr V P Potty (Principal Scientist)
7	Training on "Advanced Molecular Biology Techniques" at Amnion Biosciences PVT Lmtd, Bangalore	23rd to 26th May 2011	Dr Rekha Sivadasan and Dr Anitha Jose (Research assistant)
8	Training on "Nanotechnology, Genomics and Proteomics" at INSITE, Trivandrum	5th March to 7th April 2012	Dr Sabna Prabha (RA)
9	Training on "Modern methods of food analysis" Lund University, Sweden	22nd September to 5th October 2011	Mr Muneer AM (Research Assistant)

(i) News and events

CAC MEETINGS:

Serial No.	Date	Venue
1.	06/07/2009	Vaidya Hotel, Kollam
2.	11/01/2010	CEPC Lab, Kollam
3.	17/08/2010	CEPC Lab, Kollam
4.	06/04/2011	CEPC Lab, Kollam
5.	06/02/2012	DCR, Puttur, Karnataka

CIC MEETINGS

1.	13/01/2009	CEPC Lab, Kollam
2.	18/08/2010	CEPC Lab, Kollam
3.	07/04/2011	CEPC Lab, Kollam
4.	07/02/2012	DCR, Puttur, Karnataka