

A Value Chain on Aloe Vera Processing

Environmental and Social Safeguards Management

A. Basic Information

1. Project Statistics:

Component Code	:	2
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Name of Co-PI	:	Dr. P. Srinivasa Rao Assistant professor Agricultural & Food Engineering Department
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Consortium Partners	:	1. University of Agricultural Sciences, Dharwad, 2. M/s. Eternity Herbals, Gadag, Karnataka 3. M/s. Midnapore Cultural and Welfare Association, Midnapore, W.B.
2. Date of Start	:	April 1, 2009
3. Planned Duration	:	3 Years and 3 Months
4. Project Cost	:	Rs. 385.657 Lakhs

5. Project Objectives:

- Characterization and selection of suitable genotype(s) for processing.
- Development of mechanized systems for gel extraction.
- Process technology development for different aloe products and utilization of by-products.
- Development of pilot scale aloe processing facility and its economic analysis.
- Capacity building and skill development of the stake holders to improve value chain.

6. Brief project description:

The proposed project “A value chain on Aloe Vera Processing” will be undertaken by Indian Institute of Technology, Kharagpur (lead centre) and five partners, University of Agricultural Sciences, Dharwad (Raichur) (public institution) and M/s. Eternity Herbals, Gadag, Karnataka, M/s. Midnapore Cultural and Welfare Association, Midnapore, West Bengal, M/s. Criyagen Agri. And Biotech. Pvt. Ltd., Bangalore and M/s. Trishna Food Products, Amlagora, Pachim Midinipore, West Bengal (private partners). All these partners are carefully chosen for manageability and to deal on the targeted objectives of the sub-project. University of Agricultural Sciences, Dharwad (Raichur), College of Agricultural Engineering, Raichur has enormous experience and exposure in the field of aloe vera processing and marketing. M/s. Criyagen Agri. & Biotch. Pvt. Ltd. has a comprehensive knowledge of agriculture and foods and drugs and has over the five years of experience in USA in the area of domestic and global sales, brand awareness, business development, product development, training and certification of Aloe products in the global market. M/s. Eternity Herbals is a pioneer in botanical farming employing vedic literature and is also engaged in the field of botanical extracts and manufacturing of various aloe and health products in India. The company excels in maintaining its activities like product development, testing and marketing of aloe products for more than a decade. M/s. Midnapur Cultural and Welfare Association is a pioneer in adoption of innovative biotechnology in the field of agriculture, integrated rural development and is working with tribes to build and protect their culture and heritage. It is a leader in providing training and technology to rural women and youth entrepreneurs. The activities of M/s. Trishna Food Products include processing of locally available fruits and vegetables into value added fruit drinks, sauce, jam, jelly and pickles apart from imparting training of rural unemployed women with technical support from AICRP on PHT (ICAR) and Technology Travels to Villages (TTV) schemes at IIT Kharagpur. Its marketing channel is facilitated through NABARD. This consortium is experienced, committed and dedicated and will be helpful in achieving the objectives of the sub-project.

Broadly, the project consists of five components with different objectives under them. **The first objective** aims to characterize and select a suitable genotype(s) for processing. At present, aloe plants are cultivated in an unorganized manner without any genetic background and there is no appropriate technology available for gel processing. There is no data base regarding the quality of the gel (physical, chemical and biological activities) from Indian germplasms of *Aloe vera* L. The expanding aloe industry in India urgently requires a cost-effective gel processing technology and gel data base for product development and certification. One of the activities of the present proposal would be to characterize the Aloe gel during various stages of processing considering its physical, chemical and biological attributes. Though *Aloe Barbardensis*, *Miller* is the most commonly used *Aloe vera* species, its various genotypes show different biological activity and composition. Hence, the different genotypes available in the region will be screened based on their suitability for external and internal applications as well as development of various products.

Characterization of Aloe vera gel:

A) Physical characterization of aloe gel following evaluation of swelling, water retention and fat absorption capacity. Thermal analysis of gel to determine the glass transition temperature and enthalpy of gelatinization to optimize the process parameters.

B) Chemical characterization with mineral analysis through atomic absorption spectroscopy and determination of total phenolics, carbohydrates, proteins and lignins.

C) Biological activity evaluation consists antioxidant assay through DPPH, free radical scavenging activity, super oxide radical scavenging activity, metal chelating activity and total reducing power; wound healing potential study through fibroblast proliferation and migration; anti-diabetic property assay in mice model.

The second objective aims at development of mechanized systems for gel extraction. The existing suitable equipment for leaf grading and washing will be selected from the appropriate source based on their performance evaluation. The edge trimming equipment may be developed or selected if available in the market. The gel extraction equipment available has certain disadvantages like contamination of gel with sap (yellow liquid) which contain most aloin. Hence, a multi-channel Aloe vera filleting machine will be developed based on the previous studies conducted at the lead centre. Upon the performance evaluation, the whole system will be assembled and finally, developed into pilot scale processing system for Aloe vera gel processing. This objective focuses on selection and/or procurement of systems for various pre-processing operations viz., leaf grading, washing, edge trimming etc. Design and development of multi-channel, continuous type gel filleting machine, optimization of machine parameters for gel filleting, development of processing systems for gel stabilization, desiccant dehydration and cryogenic grinding. The performance evaluation of the machineries will be carried out.

The third objective aims at process technology development for different aloe products and utilization of its by-products. The novel aloe products i.e. most biologically active stabilized gel, desiccant dehydrated powder and aloe based fruit beverages blended with different fruits will be developed. The physical and biological characterization of aloe vera gel during various stages of processing will be done to optimize the process parameters.

Stabilized gel: The extracted pure gel will be processed using appropriate stabilization techniques viz. thermal treatment, acidification, addition of natural preservatives, lowering moisture content through minimal processing and alternative preservation techniques etc. Physical and biological characterization, thermal analysis, mechanical and visco-elastic properties of aloe gel during various stages of processing to optimize the process parameters will be taken up. The storage studies will be carried out under different storage and packaging conditions.

Development of process technology for aloe based fruit beverages: Standardization with respect to aloe gel and fruit pulp ratio, sugar content, pH, processing conditions to retain maximum bio-active compounds and nutritive value will be undertaken. The developed products will be stored under different packaging and storage conditions to evaluate their

shelf life and retention of biological, sensory and nutritive qualities. The fruits selected for punching into aloe gel juice may include amla, jamun, Watermelon, mango and pineapple depending on their natural composition and taste parameters.

Development of process technology for Aloe vera gel powder: Aloe vera gel with maximum solids (Muco-polysaccharides) content and minimum aloin will be selected for developing dehydrated products. A novel process technology desiccant air dehydration and cryogenic grinding will be developed and optimized for production of aloe powder at low air temperature and compared with freeze-dried samples suitable for applications in food, pharmaceutical and cosmetic purposes. The developed product will be studied for storage stability under different packaging and storage conditions. The loss of biological activity at different stages of processing and storage will be studied to ensure the maximum retention of active compounds.

Development of a method for conversion of aloe powder to aloe gel: The gelation behavior of the dry Aloe powder will be thoroughly investigated by dispersing it (either by sonication or by heating) in distilled water. The optimum gelation condition will be determined through studies of the effect(s) of temperature, pH, and salt concentration on the gelation process. This objective also focuses on the utilization of rind, which is a major by-product in aloe vera gel processing. The formulation of veterinary medicine, insect resistant pesticide/fungicide and its applications in manure will be worked out.

The fourth objective aims at development of pilot scale aloe processing facility and economic analysis. The various processing equipment for primary and secondary processing of Aloe vera will be developed/procured and a pilot scale processing facility will be established at the lead centre, IIT Kharagpur. The plant will have quality testing and certification laboratory. The economic feasibility of the developed products and plant during pilot scale operation will be carried out under this objective. The plant will focus on the HACCP standards in manufacturing of various aloe products.

The fifth objective aims at capacity building and skill development of the stake holders for improvement of the value chain. It focuses on establishment of primary processing centre in the production catchment area for promoting aloe vera cultivation. The various activities include transfer of technology to rural entrepreneurs through demonstrations of pilot scale processing facility, development of linkages for marketing of developed products, training on operation and maintenance of the pilot plant, marketing of aloe products in the domestic and international market and popularization of aloe products.

The total fund required is Rs. 385.657 Lakhs

7. Environmental category issues in the subproject

- Social
- Environmental

8. Safeguard Policies Triggered (World Bank Policies)

	Yes	No
Environmental assessment (OP/BP 4.01)	[X]	[]
Natural habitats (OP/BP 4.04)	[]	[X]
Pest Management (OP 4.09)	[]	[X]
Cultural property (draft OP 4.11-OPN 11.03-)	[]	[X]
Involuntary resettlement (OP/BP 4.12)	[]	[X]
Indigenous people (OD 4.20)	[]	[X]
Forests (OP/BP 4.36)	[]	[X]
Safety of dams (OP/BP 4.37)	[]	[X]
Projects in disputed areas (OP/BP 7.60)	[]	[X]
Projects on international waterways (OP/BP 7.50)	[]	[X]

B. Risk analysis and related issues

- Testing and certification for aloin content and purity of aloe products.
- Emergence of new markets of Aloe vera products in future.
- Adoption of mechanized system for gel extraction may create unemployment problem to rural women and youth.
- Marketing of aloe products may be difficult unless the better quality is maintained and prices are lower than the existing market prices
- Training programmes on Aloe vera processing among the un-organized and unskilled people
- Consumer preference and acceptability of developed aloe vera products
- Crop diversification
- Conflict of interest in using aloe vera for internal applications and external applications vis-à-vis aloe vera for food uses in future.
- Active promotional exercises to create awareness in consumers.

9. Impact assessment

Extent of enhancement in the income due to adoption of the technologies developed under this project will be assessed and studied through consultant engaged for this purpose.

Given below, and adequately addressed

10. Potential indirect and/or long term impacts due to anticipated future activities in the project areas (assessment of anticipated conflict/complimentary with the current as well as those proposed for the next five years in the area of activities of the sub-project)

- Aloin free aloe products export market will help not only to Indian population but will also be useful across the continents, besides for internal applications.
- While potential direct impact would be an ingredient in food, cosmetic and pharmaceuticals, it will also be helpful in creating livelihood through replication of processing and marketing on aloe vera value chain
- The health, economic and social status of targeted population may improve through Aloe vera products consumptions keep and thus many diseases and disorders at bay.
- Intake of Aloe vera product like aloe beverage will help the disease prone populations both in urban and rural areas due to their therapeutical value.
- The indirect benefit will be sustainability of aloe vera cultivation in dry land and waste land regions of the country.
- Important indirect benefit will be better utilization of aloe vera rind, a by product in Aloe vera processing.
- Awareness created among farmers will bring better returns with improved marketing approaches.
- Rural entrepreneurship in Aloe vera processing and marketing will help in reducing migration to urban areas through enhanced employment and income generation.
- Increased aloe vera cultivation will better utilize the in dry and waste land of the country with better economic return
- The increased use of aloe products in the preparation of traditional medicine, will, inturn, enhances the health and life style of rural people.

11. Identify the key stakeholders and describe mechanisms for consultation with and to them done/disclosure so far done including pre-project consultations with stake holders workshop before formulating the full proposal, discussing the full proposal with some stake holders before submission to the PIU

Public institutions

- 1) Indian Institute of Technology, Kharagpur
- 2) University of Agricultural Sciences, Dharwad (Raichur),

Private Partners

- 1) M/s. Eternity Herbals, Gadag, Karnataka
- 2) M/s. Midnapore Cultural and Welfare Association, Kotebazar, Medinipur, West Bengal

Associate partners

- 3) M/s. Criyagen Agri. And Biotechnologies Pvt. Ltd., Bangalore
- 4) M/s. Trishna Food Products, Amlagora, Pachim Midinipur, West Bengal

Preliminary discussions and meetings were held with stakeholders to finalize the project objectives and to discuss the environmental, social safeguards and other related

management aspects. They were briefed about the NAIP project, its objectives and expected output and impact. The final modalities will be worked out after the project approval.

12. Chronology of meetings/ activities held in connection with preparation of the concept note and full proposal

S. No.	Date & Location	Programme	Participants	Remarks
1	23-25 August, 2008 IIT Kharagpur	Discussion on the concept note submitted and development of core programme of research	IIT KGP and UASD	Action plan was approved for developing a core programme of research
2	4 th Sept. 2008 IIT Kharagpur	Product development aspects, utilization of byproducts and marketing of aloe products in eastern region of India	IIT KGP, MCWA and TFP	Aloe products and utilization of byproducts were finalized and the marketing strategy plan was discussed
3	24 September, 2008, College of Agril. Engg, Raichur	Marketing aspects of aloe products in southern part of India	UASD, EH and CAB	Marketing strategies were finalized and the action plan was discussed.
4	25-27, September, 2008 NAARM, Hyderabad	Interactive workshop on developing a winning proposal	IIT KGP, UASD and CAB	Objectives and methodologies were finalized and the action plan was taken to develop a full proposal.
5	3 rd October, 2008 IIT Kharagpur	Socio-economic and marketing aspects of the developed technologies	IIT KGP, MCWA and TFP	Action plan for promotion of aloe cultivation and aloe products processing finalized and the marketing strategy plan was discussed
6	6 th October, 2008 IIT Kharagpur	Finalization of project proposal	IIT KGP, UASD, MCWA and TFP	Cumulative budgetary and action plan discussed and finalized
7.	6 – 7 th November 2008 New Delhi	Action plan on changes suggested by the expert committee during presentation	IIT KGP and UAS Dharwad	Responsibilities of each centre in the action plan
8.	14 th November 2008 IIT Kharagpur	Socio-economic and marketing aspects of the developed	IIT KGP, MCWA and TFP	Action plan & mode of implementation for promotion of aloe

		technologies and their implementation.		cultivation and aloe products processing finalized was discussed
9.	29-30 th December, 2008 New Delhi	RPC and Cost committee meetings	IIT KGP and UASD	Project was discussed thoroughly for its merits and changes required. Budget requirements were reassessed.

13. Measures to Address the Issues

A document on safeguard related issues has been prepared. Farmer's awareness programs and training on the adoption of Aloe vera crop, sub-sequent product development, best management practices and marketing related issues will be conducted for the participating farmers and self help groups in the sub-project.

Awareness of risk related factors will be communicated to the stakeholders through orientation/ awareness sessions on topics such as adoption of Aloe vera crop as an alternative to the existing cropping system, improved package of practices for Aloe crop, utilization of Aloe vera gel, new products development and related health benefits, marketing related issues etc. They will be educated about the present pattern of utilization for cosmetic industry, safeguard the conflicting interests of food and pharmaceutical / neutraceutical uses vs. cosmetic industry. Issues such as utilization of by-products so developed, dumping of rind, utilization of rind and associated aloin, labour and risk minimization by introduction of mechanization in the Aloe processing, training of farmers, entrepreneurs, unemployed youth etc. as far as possible will be addressed so as to take care of environmental safe guards and management etc.

14. Consultation/ Disclosure to be Done in Future

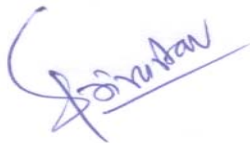
Need based changes either in the processing technologies or design of the equipment will be done with discussion, consultation with the TAG if required. Due permission will be obtained to disclose the details of the project after completion of the project.

Local disclosure through mechanisms such as launch workshop, interfaces during the implementation stage of the subproject for sharing the results and soliciting feed-back, one will circulate the project brochures and implementation progress time to time, putting up annual reports on the web site and annual stakeholder workshops wherever feasible.

The consultation/disclosures will be done as per NAIP guidelines depending up on the progress of the project. Training demonstration programmes and workshop on various themes relevant to farming, primary processing, value added product preparation, operation and maintenance of aloe processing machineries, marketing aspects etc. The project findings (brochures/CD's/videos/ literatures) will be disclosed time to time and necessary

feed back will be collected for further improvement and better implementation. Assistance of different organizations will be taken.

- Demonstration of mechanized processing and new products preparation to stake holders.
- Popularization through information dissemination on safety of developed products to the consumer.
- Information dissemination through mass and print media on food, pharmaceutical and cosmetic benefits of newly developed aloe products to stake holders, targeted groups especially disease prone rural consumers and health conscious urban consumers.
- Transfer of technology of value added aloe products and mechanization of aloe vera processing to stake holders.
- Dissemination of holistic crop management and extension services to farmers through other partners.
- Dissemination of information and sensitization of line departments of state and central governments to policy makers, planners and project partners for enhancement of Aloe vera products consumption.
- Linkages with public, private and financial institutions will be enabled so that as and when requested the Aloe vera processors are adequately financed for their commercial activities. Both print and voice media will be fully utilized to attain the desired goals and objectives.
- Information dissemination on testing and certification for content and purity of Aloe vera products in domestic and international market.



Consortium PI

National Coordinator

National Director

Annexure-I: Environmental Safeguard: Activities, Issues, Impact and mitigation Measures

Activities	Issues	Anticipated level of Impacts		Mitigation Measures (Negative Impact)
		Positive	Negative	
Characterization and selection of suitable genotype(s) for processing.	Screening best genotypes with appropriate composition	4		
Development of mechanized systems for gel extraction.	High capacity, Effectiveness of rind separation with minimum loss, improved gel quality and operational ease, drudgery elimination	4		
Process technology development for different aloe products and utilization of by-products.	Market driven aloe products with increased income, better marketability, health aloe health products Improved value chain	5		
Development of pilot scale aloe processing facility and economic analysis.	Technology demonstration Accumulation of waste materials	4		Waste generated will be converted into organic manure
Capacity building and skill development to the stake holders for improvement of value chain.	Entrepreneur development, promoting aloe cultivation and processing Higher income for rural mass	4		

Annexure-II: Social Safeguard: Activities, Issues, Impact and mitigation Measures

Activities ¹	Issues ²	Anticipated level of Impacts ³		Mitigation Measures (Negative Impact) ⁴
		Positive	Negative	
Characterization and selection of suitable genotype(s) for processing.	Screening best genotypes with appropriate composition	3		
Process technology development for different aloe products and utilization of by-products.	Market driven aloe products with increased income, better marketability, health aloe health products Improved value chain	4		
Development of pilot scale aloe processing facility and economic analysis.	Technology demonstration Adoptability of aloe process technology, economical production employment generation	4		
Capacity building and skill development to the stake holders for improvement of value chain.	Entrepreneur development, promoting aloe cultivation and processing, higher income for rural mass	5		

Environmental and Social safeguard framework is a tool in making good decisions: to screen projects efficiently for their environmental impacts; to understand what is needed for sustainable projects; and to design them effectively. The purposes of the Bank's policy and procedures for environmental assessment are to ensure that development options under consideration are environmentally sound and sustainable and that any environmental consequences are recognized early and taken into account in project design.

¹ List the objective wise activities/interventions proposed in the project

² List the possible issues according to the project interventions

³ State the likely impact (Positive or Negative) of activities/interventions on the level of issues identified. Put in a scale of 0-5 (very low , low, moderate, high, very high)

⁴ State the mitigation measures planned to be taken to address the negative impact
