

STUDIES ON AVAILABILITY AND UTILIZATION OF ONION STORAGE WASTE IN A RURAL HABITAT

by
(DHANANJAI KUMAR SHARMA)
Centre for Rural Development and Technology

Submitted
in fulfillment of the requirements of the degree of **Doctor of Philosophy**
to the



Indian Institute of Technology, Delhi
February, 2002

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Mr. Dhananjai Kumar Sharma worked under our guidance and supervision and has fulfilled the requirement for the submission of this thesis, which to our knowledge has reached the requisite standard. The results contained in this thesis have not been submitted in part or in full to any other university or institute for the award of any degree or diploma.



(Dr T.R. Sreekrishnan)

Department of Biochemical Engg & Biotech.



(Dr. Santosh)

Centre for Rural Development & Technology

Indian Institute of Technology, Delhi

New Delhi-110016

Acknowledgements

SATYAM SHIVAM SUNDRAM is a very simple mantra but very difficult to practice. The *Bhava* (meaning) associated with *Shiva* is *Kalyan* (welfare). The power, which functions for the welfare of all the livings and the non-livings, will not deny the existence of any thing. The outcome of such thought is that *NOTHING IS WASTE*. At the outset I pray Lord *Shiva* for his blessings.

Unlike other vegetable crops, the storage of onions is of very different nature. Hence problems of onion farmers are very peculiar and require an entirely new approach to address the issues involved. Infact searching suitable solution to these problems needs deep understanding of subtle interlinkages prevailing in the rural habitat.

I have immense respect for Dr. Santosh, her holistic vision in R & D, zeal, deep involvement and dedication towards such tasks in general and present research work in particular. I wholeheartedly thank her for giving a direction to this piece of work. My heartfelt thanks to Dr T.R.Sreekrishnan for his invaluable comments, deep involvement and supervision throughout my thesis work and especially courses taught by him. Infact his all activities and actions are directed towards the welfare of students' community and has inspired me during my stay at the campus.

In true sense, the efforts of Dr Santosh and Dr. T.R. Sreekrishnan, my Ph.D. supervisors through this Ph.D. work would give a new direction to the onion farmers of *Parnala* village where a social transformation may take place. Infact my vocabulary fails to express my gratitude to both of them. The cooperation and support extended by the


village Pradhan and farmers during survey study had been very valuable in understanding the ground realities related to the research topic. I am thankful to all of them.

I am grateful to Prof. Rajendra Prasad, and Prof. R.C. Maheshwari of Center for Rural Development and Technology and Prof. G.P. Aggarwal, Head, Deptt. of Biochemical Engineering and Biotechnology for providing me all the necessary research facilities. I express my gratitude to Prof. Padma Vasudevan, Prof. V.S. Bisaria, and Prof. Subash Chand for giving valuable comments and suggestions. Thanks are also due to concerned HAU authorities to allow me to complete my Ph.D. work.

I would like to extend my appreciation to Mr. Didar Mal, Mr. J.A. Khan, Mr. D.V. Sharma, Mr. Keshav Prasad, Mr. Mukesh Anand, Mr. Bhagwan Singh, Mr. G.P. Yadav, Ms. Neeru Verma, Mr. Rajbir Singh, Mr. Sanjeev for providing me necessary assistance as and when required. Along with them, I am thankful to Mr. Jadhon and Mr. R. Manchanda for the repairs of gas chromatograph and spectrophotometer during the crucial stage of this research work. My special thanks are to Mr. Vineet Rana for designing and sparing pilot scale bioreactors.

I remember Dr. Jasmedh Kaur, Dr. Muna Ali, Mr. Sanjeev Kumar Singh, Mr. R. Vijayandren, Ms. Ashish Navani and Mr. Rajiv Thakur for the help they rendered during the initial stages of this work. Mr. Tayal, Mr. Jyoti Kumar, Mr. Rohit Jindal, Mr. Atul Gupta and Mr. Siddartha Jain helped a lot for the development of logical and rational thinking. Finally the help rendered by Mr. Rakesh Kumar, Mr. Mausam Verma, Mr. Asheesh K.Yadav, Mr. E. Ashok and Ms. Yadvika, at the final stage of thesis submission cannot be explained in words.

Last but not the least, I am indebted to my parents for bearing all the inconvenience caused by me. As desired by them, I would make efforts to become *Sharvan Kumar*. I am grateful to my wife, Richa for reminding me the story of *Balmiki*. I always love to read the work of *Bharathari*. I own full responsibility for not doing sufficient care (due to work pressure) to my lovely daughters Sunidhi and Supreeti.



Dhananjai Kumar Sharma

Abstract

Onion is one of the oldest vegetable crops grown in India and forms an important part of the diet for both rich and poor. One can find its mention as medicinal herb in the Ayurvedic health care system. Onion crop being seasonal, there is a demand-supply equation which drives the market value of this perishable product down during the crop harvest. Unlike developed countries, commercial processing of onions for different products is not common in India. Therefore, farmers generally tend to store their produce in temporarily erected structures in the field itself resulting in large amount of onion losses (40%-50%). All this results in economic losses on one hand and severe environmental pollution on the other. Literature survey reveals that while some R&D efforts have been made to develop improved storage designs, Onion Storage Waste (OSW) utilisation aspect is not attempted.

The thesis entitled “ Studies on the availability and utilization of onion storage waste in a rural habitat” (organised in five chapters) starting with a brief introduction and literature review on the theme, presents ground realities through a field study in Parnala Village (a representative onion growing village in Haryana State). The interesting facts revealed by the data analysis are very useful in planning and execution of the experimental work related to OSW utilisation (anaerobic digestion) and designing an optimal onion storage system.

The major problem related to drastic reduction in pH due to rapid acidification of OSW was overcome by mixing cattle dung with OSW in a suitable ratio so that medium is well buffered to take care of acid accumulation. By extensive experimentation carried out in 2 litre capacity batch reactors, optimum parameters concentration of OSW for acidogenesis and methanogenesis was worked out. Then it was tested in a 20 litres batch reactor. Finally, to address the field conditions, pilot scale study in 400 litre reactors charged with cattle dung and supplemented with about 1% OSW was carried out for longer duration of 5 months. Interestingly 40-80% increase in biogas production was recorded without resorting to any external pH control. It was established that upto 5% OSW supplementation of the feed slurry in the conventional biogas plants can be adopted with as high as ~ 80% or even more increase in gas production, thus solving the OSW disposal problem to a significant extent. To ensure the regular availability of OSW for biogas plants, a new simple method has been developed for preserving the OSW as well as for its handling due to acute foul smell.

Based on the experimental findings two models for OSW utilization i.e. in family level and community level biogas plants have been worked out. Calculations indicated that ~ 90 % of the total OSW generated in the habitat can easily be utilized for energy production. An attempt is also made to design an optimal system for onion storage for different farmer's categories by integrating improved designs in the traditional system. Preliminary techno-economics of the proposed system indicates that inspite of the increased cost of the improved storage structures, the overall monetary benefits could be significant.

It is hoped that the research findings of the present study would prove a boon to the onion growing farmers in Haryana State. Further research work on assessing the quality of effluent slurry (in terms of plant nutrients) produced by OSW supplementation, understanding the mechanism of enhancing biogas production etc. is warranted. Also, before making specific recommendations, the newly developed model needs to be tested in different onion growing regions in the country.

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