

Awareness on Calcium Carbide Ripened Fruits and Recommendations for Toxic Free Artificial Ripening of Fruits



D Ramesh Babu, Ram Deshmukh, K V Narasimha Rao, M Rajya Laxmi, Kafila, T Sabita

Abstract: Fruit ripening using calcium carbide became a bad practice by the fruits sellers. Unfortunately calcium carbide being a low priced alternative available to the fruit traders/cold store operators/farmers, other safe methods are not practiced by the fruit producers/sellers. In spite of ban on usage of calcium carbide for the purposes of fruit ripening, several farmers and traders use calcium carbide due to its easy availability and non-awareness of its toxicity on human health. Study is conducted on awareness of these factors among the fruit consumers. About 190 literates gave the feedback, based on which recommendations made for making safe and healthy fruits available in the market for consumers. Initiatives of government of India on these aspects are also discussed. Technical details on ethylene ripening chambers and its maintenance are also presented.

Key words: Fruit ripening, Calcium carbide, safe ripening practices, mango and banana ripening chambers, Ethylene.

I. INTRODUCTION:

Fruits are ripened traditionally by farmers and traders on the basis of plucking at right maturity. However in last two decades, due to better transportation facilities availability, fruits are transported to long distances, south states to north states in India. This makes the need to pluck the fruits before they fully mature. When fruits are harvested at pre-matured state or under-matured state, they will not ripe on their own, due to the fact that they are climacteric in nature. This makes the necessity of artificial ripening of fruits before selling.

Consumers prefer colored fruits, i.e., ripening state. Typical fruits like mango, banana and papaya turn to yellow when they ripe.

Sellers found using calcium carbide (a chemical agent otherwise used for gas welding in manufacturing activities) for making fruits ripe artificially. Several farmers/traders/cold store operators/sellers use this banned chemical for ripening purposes. However scientific reports prove this chemical to be toxic and harmful for human health in long run.

Study was conducted to find the awareness of carbide ripened fruits among literates who consume fruits normally. The purpose of this study is to find the responses of people on the ripening practices in fruits.

II. LITERATURE OVERVIEW:

Ramesh Babu et al (2019) studied in detail about the design of ripening chambers for banana and mango. The insulation, refrigeration, humidity and ethylene requirements are given by them in detail. Ethylene generation and maintenance along with protocol of carbon dioxide control are given. Ethylene (C₂H₄) being the natural ripening agent will be helpful in safe ripening of fruits. Parameters need to be controlled are temperature, Relative Humidity (RH) and C₂H₄ levels. They have also given full details of cost of equipment and machinery, technical design details of refrigeration systems, chamber construction. Financial viability also studied and reported.

Prasanna et al (2007) reported the ripening aspects of fruits and its bio-chemical changes. Natural process of ripening with in the fruits is discussed.

Narasimha Rao et al (1993) reported the process of pre-cooling spherical fruits for better shelf life. Narasimha Rao et al (1992) studied the heat transfer aspects of fruits during pre-cooling and its usefulness for fruit preservation and research. Ramesh Babu et al (2018) discussed about the advanced techniques and technologies for fruit storage, in terms of using controlled atmosphere storage, control of gases in CA chambers, etc.,

Sadashive Gowda (1997) conducted experiments on spherical fruits and made parametric study on bulk pre-cooling of fruits.

Kader (2002) discussed the fundamental aspects of fruits physiology and ripening process. Changes in physico-chemical, bio-chemical parameters are thoroughly discussed. Maduwanthi and Marapana (2019) reported about different ripening agents of banana fruits in detail. Effect of ripening agents on the ripening behavior of banana are discussed.

Revised Manuscript Received on December 30, 2019.

* Correspondence Author

***D Ramesh Babu**, Dept of Mechanical Engineering, S R Engineering College, Warangal, Telangana & Research Scholar, Dept of Mech Engg, Koneru Lakshmaiah Education Foundation, Vaddeswaram, Guntur, AP. rameshdamarla2009@gmail.com

Dr Ram Deshmukh, Dept of EEE, S R Engineering college, Warangal, Telangana.

Dr K V Narasimha Rao, Dept of Mech Engg, Koneru Lakshmaiah Education Foundation, Vaddeswaram, Guntur, AP.

Dr M Rajya Laxmi, Dept of Business Management, S R Engineering college, Warangal, Telangana.

Kafila, Dept of Business Management, S R Engineering college, Warangal, Telangana.

T Sabita, Dept of Business Management, S R Engineering college, Warangal, Telangana.

© The Authors. Published by Blue Eyes Intelligence Engineering and Sciences Publication (BEIESP). This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>)

Asif M (2012) studied the harmful effects of calcium carbide as ripening agent and residual analysis is reported.

Ashraf et al (2008) emphasizes on healthy habits of people especially on “what are we eating” related to fruit ripening. They discussed the harmful and carcinogenic effects of artificially ripening of using toxic and non-permitted substances.

The toxic potential of calcium carbide is reported by Danish et al (2015). They reported the chemical substances causing toxicity and its further affect on possible human health. Several technical and food processing project details are given by researchers.[20-25]

III. MATERIALS AND METHODS:

Measurement of responses was done using google form. Specific data were obtained from the literate people who normally consume fruits. About 190 responses were obtained and analyzed using Microsoft excel.

Results and discussion:

Table 1: Awareness on the ripening fruits with calcium carbide.

1	OPTION	AWARENESS ON RIPENING FRUITS WITH CARBIDE
	YES	64%
	NO	20%
	MAY BE	16%

From table 1, it can be seen that 64% of people are awareness of fruits ripened with calcium carbide. About 20% people are not aware about using of harmful carbide by the traders. 16% people are not clear whether carbide is used or not. This indicates the good awareness among people about this harmful carbide ripening bad practice.

Table2: Data on awareness on consumption of carbide is harmful to health

2	OPTION	CONSUMPTION OF CARBIDE IS HARMFUL TO HEALTH
	YES	74.70%
	NO	12%
	MAY BE	14.70%

From table2, a clear indication is observed about the harmful effect to the health due to carbide ripened fruits. 74.7% of consumers clearly understand the health hazards of carbide ripening. However, there appears the difficulty to find alternative among the consumers

Table3: Data on the awareness about alternate solutions availability

3	OPTION	ARE THE ALTERNATE SOLUTIONS AVAILABLE
	YES	58%
	NO	10.70%
	MAY BE	31.30%

The data from table3 clearly mentions the awareness about alternate solutions for the carbide ripened fruits. Only 58% people are aware of the alternate solutions for this harmful ripening practice. All remaining consumers needed guidance and information on alternative solution of ripening chambers with ethylene. Ramesh Babu et al 2019 gave the technical details of usefulness, design and equipment for installing ripening facility can give insights on the healthy ripening of fruits.

Table4: Awareness on “Natural ripening” with ethylene

4	OPTION	AWARE OF "NATURAL RIPENING" WITH ETHYLENE
	YES	38%
	NO	50%
	MAY BE	12%

Awareness about natural ethylene ripening is given in table 4. About 38% of consumers know about the natural ripening process. However 62% of people are not aware of the natural ripening process, which gives the indication for the need of creating awareness on the natural and healthy ripening practices by government through agriculture marketing departments, retail chains selling fruits, shopkeepers, cold store operators, ripening chamber operators, vendors of fruits, etc.,

Table5 Data on the opinion on discarding “Carbide ripening practices”

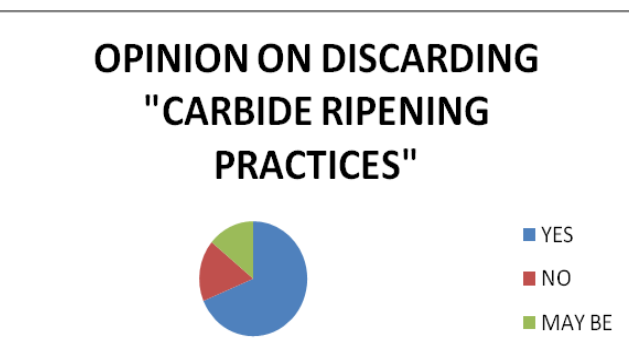
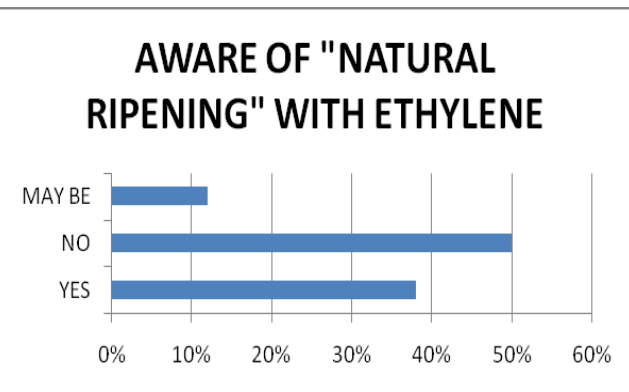
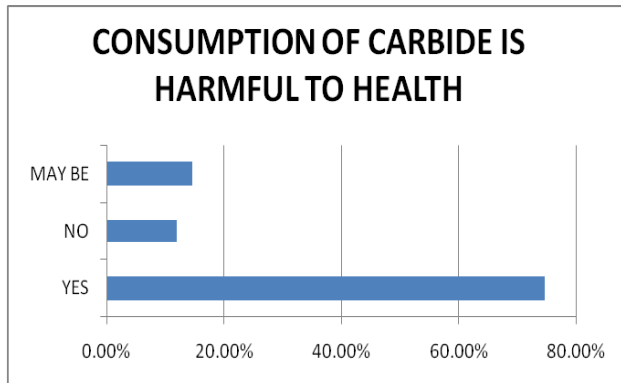
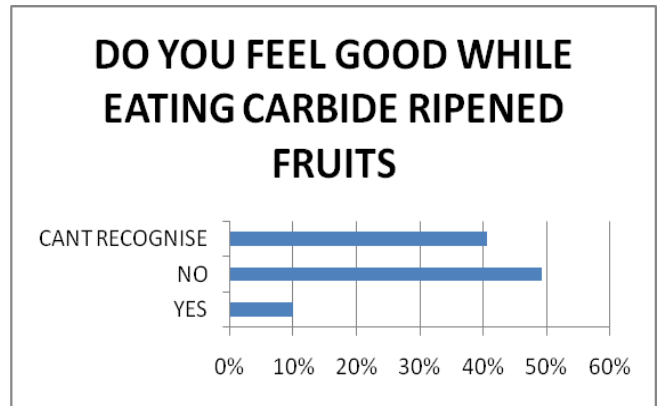
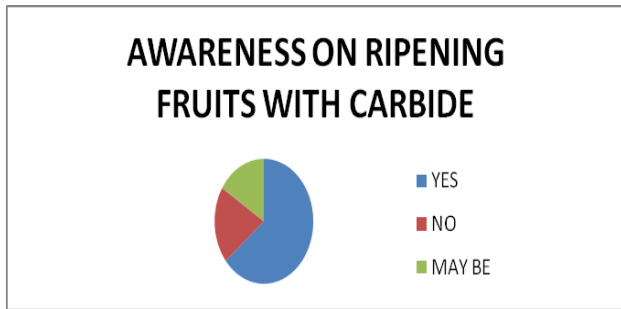
5	OPTION	OPINION ON DISCARDING "CARBIDE RIPENING PRACTICES"
	YES	68.70%
	NO	17.30%
	MAY BE	14%

From table5 it can be seen that 68.7% consumers feel that carbide ripening practice must be discarded, which is a good sign on the health consciousness of people.

Table6: Data on awareness about feel good factor while eating carbide ripened fruits

6	OPTION	DO YOU FEEL GOOD WHILE EATING CARBIDE RIPENED FRUITS
	YES	14%
	NO	49.30%
	CAN'T RECOGNISE	40.70%

From table6, we can see the data about, how the consumers felt about feel good factor while eating carbide ripened fruits. 49.3% consumers clearly stated that “they don’t feel good”. A critical observation is “they can’t recognize whether fruits are ripened by carbide or ethylene ripened”. This gives much scope to create tools and methods to recognize if the fruits are ripened using ethylene.



IV. CONCLUSIONS AND RECOMMENDATIONS:

This study shows the results of awareness about the use of harmful chemicals (calcium carbide) during ripening of fruits. The data was collected from the educated people who responded on google survey form. An observable and alarming remark observed about the “do you feel good while eating carbide ripened fruits”. People could not recognize the fruits between carbide ripened and safe ripened. This gives rise to identification of need to conduct research in the areas mentioned below.

1. Creation of more awareness on harmful effects of carbide-ripened fruits and their toxic affect on human health.
2. Develop methods to identify whether a fruits is ripened by using carbide or non-carbide by devising tools to detect carbide on fruits.
3. Training the traders and farmers on using safe ripening practices like “ethylene ripening chambers”
4. Promoting the concept of “Safe ripening using ethylene ripeneing chambers” with uniform ripening and chemical free methods
5. Subsidizing the prices by government on fruit sale/fruit ripening chamber/storage plant expenditure, who ever are following safe ripening practices
6. Quality confirmation with a quality tag/ sticker mentioning “SAFELY RIPENED” similar to color sticker for “Veg and Non-veg caterogory foods printed with Green and Brown respectively.

Need to mention here is about safe and artificial ripening using “ethylene” is very cost effective and only creation of awareness among people is required. The technical requirements, construction details, maintenance practices are easy to do. Any refrigeration contractor or company having knowledge and experience installing ripening chambers can install the ripening facility for farmers, traders or cold store operators. An indicative list of companies are M/sBlue Star, M/s Nilkamal, M/s Voltas Ltd, M/s Snowcool etc.,. Complete project details to install ripening chambers and maintenance aspects are given by Ramesh Babu et al (2019) Acknowledgement: Authors like to thank Mr. D K Das Gupta and A S Bawa, Ex Scientists, Defense Food Research Laboratory, DRDO,

Mysore for inspiration to take up studies in fruit and vegetable processing and research.

REFERENCES:

1. Ramesh Babu D, Satish Kumar, M. V., Mahesh, V and Sambasiva Rao, N (2016) Entrepreneurial opportunities in horticulture products, Proceedings of International conference on next Generation Education for Entrepreneurial Engineers ICNGE3-2016, SREC, Warangal. ISBN 978-93-85477-76-8.
2. Sadashive Gowda, B., Narasimham, G. S. V. L. and Krishna Murthy, M. V. (1997). Forced-air precooling of spherical foods in bulk: A parametric study. *International Journal of Heat and Fluid Flow*, 18(6), 613–624. doi:10.1016/s0142-727x(97)00028-3
3. Narasimha Rao, K. V., Narasimham, G. S. V. L. and Krishna Murthy, M. V. (1993). Parametric study on the bulk hydraircooling of spherical food products. *AIChE Journal*, 39(11), 1870–1884. doi:10.1002/aic.690391114.
4. Narasimha Rao, K. V., Narasimham, G. S. V. L. and Krishna Murthy, M. V. (1993). Analysis of heat and mass transfer during bulk hydraircooling of spherical food products. *Int. J. of Heat and Mass Transfer*, 36(3), 809–822. doi: 10.1016/0017-9310 (93)80056-z.
5. Narasimha Rao, K. V., Narasimham, G. S. V. L. and Krishna Murthy, M. V. (1992). Analysis of co-current hydraircooling of food products in bulk. *Int. J. of Heat and Fluid Flow*, 13(3), 300–310. doi:10.1016/0142-727x(92)90044-a
6. Ghafir SAM, Gadalla SO, Murajei BN, El-Nady MF. (2009). Physiological and anatomical comparison between four different apple cultivars undeRar cold storage conditions. *Afr J Plant Sci.*; 3:133–138.
7. Wright A.H. et al., (2015), The trend toward lower oxygen levels during apple (*Malus x domestica*Borkh) storage – A Review, *Journal of Horticultural Science & Biotechnology*, 90 (1) 1-13.
8. Ramesh Babu D, (2015), Agripreneurship-Issues and opportunities with a simple case study on handling and post harvest management of fruits and vegetables, proceedings of International Conference on Next Generation Education for Entrepreneurial Engineers, ICNGE3-2015, SREC, Warangal.
9. Asif M.(2012) Physico-chemical properties and toxic effect of fruit-ripening agent calcium carbide. *Ann Trop Med Public Health* 2012;5:150-6
10. Mohd. Danish, Ambreen Fatima,Saba Khanam,Smita Jyoti,Smita Rahul,Fahad Ali,Falaq Naz,Yasir Hasan Siddique(2015) Evaluation of the toxic potential of calcium carbide in the third instar larvae of transgenic *Drosophila melanogaster* (hsp70-lacZ)Bg9, *Chemosphere*. 2015; 139: 469
11. K. Brinson, P. M. Dey, M. A. John, and J. B. Pridham, (1988)*Post-harvest changes in *Mangifera indicamesocarp* cell walls and cytoplasmic polysaccharides, ” *Phytochemistry*, vol. 27, no. 3, pp. 719–723, .
12. V. Prasanna,T. N. Prabha &R. N. Tharanathan, (2007) Fruit Ripening Phenomena–An Overview, *Critical reviews in food science and nutrition*, 45(1) pp 1-19.
13. Babu, D. Ramesh and Kumar, B. Satish (2017). Viscoelastic behavior of alginate texturized muskmelon (*Cantaloupe*) pulp. *Int. J. Agric. Engg.*, 10(2): 638-642, DOI: 10.15740/HAS/ IAE/10.2/638-642.
14. Kader, A. A. (2002). *Postharvest technology of Horticultural crops* (3rd ed.). University of California Press.
15. Chauhan, Sandeep Kumar and Babu, D. Ramesh (2011). Use of botanicals: A new prospective for enhancing fruit quality over chemicals in an era of global climate change *Asian J. Environ. Sci.*, 6(1): 17-28.
16. Ramesh Babu D, (2014), Technological aspects of controlled atmosphere storage – Implementation for Indian produce by FHEL/CONCOR, proceedings of National conference on “Innovations and challenges in processed food in India”, Indo-American chamber of commerce, New Delhi. https://scholar.google.co.in/citations?user=t_LqilkAAAAJ&hl=en.
17. Ashraf-Ur-Rahman, Fazle Rabbi Chowdhury, Md. Billal Alam, (2008) Artificial Ripening: What We Are Eating, *J Medicine*; 9 : 42-44.
18. D. Ramesh Babu, K. V. Narasimha Rao,M. V. Satish Kumar & B. Satish Kumar(2018). Handling of apples during sorting-grading operation and measuring the mechanical properties firmness after controlled atmosphere storage *International Journal of Mechanical and Production Engineering Research and Development*Vol. 8, Issue 6, Dec 2018, 617-634.
19. S. D. T. Maduwanthi and R. A. U. J. Marapana (2019). “Induced Ripening Agents and Their Effect on Fruit Quality of Banana.” *International Journal of Food Science*, vol. 2019, Article ID 2520179, 8 pages, 2019. <https://doi.org/10.1155/2019/2520179>.

20. E. Ramesh, D. Ramesh Babu and P. Ramchandrarao,(2018) The Impact of Project Management in Achieving Project Success-Empirical Study, *International Journal of Mechanical Engineering and Technology*, 9(13), pp.237–247, <http://www.iaeme.com/IJMET/issues.asp?JType=IJMET&VType=9&IType=13>
21. Siva Rama Krishna, L, Mahesh, V, Sandeep Dulluri and Rao, C. S.P. (2010) Implementation of an online scheduling support system in a high mix manufacturing firm, *International Journal of Engineering, Science and Technology*, Vol. 2, No. 11, pp. 90-103.
22. S Dulluri, V Mahesh, CSP Rao,(2008) A heuristic for priority-based scheduling in a turbine manufacturing job-shop, *International Journal of Industrial and Systems Engineering* 3 (6), 625-643.
23. Suman Kumar Naredla, P.V. Raja Shekar, D Ramesh Babu and Sridhar Condoor, (2018). Uniquely Addressing Customer Pain Points - the Case Study of Agritech App, *International Journal of Mechanical Engineering and Technology*,9(11),pp.2306–2314.http://www.iaeme.com/IJMET/issue_s.asp?JType=IJMET&VType=9&IType=11.
24. P Sammaiah, D Ramesh Babu, L Radhakrishna, and P Rajendar (2019). Kinetics of Moisture Loss during Dehydration of Drum Stick Leaves (*Moringa Olifefera*) In a Bio-Mass Tray Dryer. *International Journal of Engineering and Advanced Technology (IJEAT)* ISSN: 2249 – 8958, Volume-8 Issue-6, August, 2019.
25. D. Ramesh Babu, K. V. Narasimha Rao & Syam Kolati (2019) The Design of Refrigeration, Thermal Insulation and an Equipment for Healthy Ripening of Mango and Banana Without Using Harmful Chemicals. *International Journal of Mechanical and Production Engineering Research and Development (IJMPERD)*, ISSN (P): 2249-6890, Vol. 9, Issue 1, Feb 2019, 423-434.

AUTHOR’S PROFILE



D. Ramesh Babu, is a Senior professional with over 24 years of experience in manufacturing, research, maintenance, consultancy and project management.

He was graduated in Mechanical Engineering from JNTU College of Engineering, Hyderabad in the year 2000 and obtained MBA in production and operations management from MDU,Rohtak. He also obtained his MTEch in Advanced Manufacturing from JNTU,Hyderabad. He has got expertise in refrigeration, fruit preservation and food processing. He is presently working as Assistant Professor in Mechanical Engineering at S R Engineering college, Warangal since year 2014. He has four years of experience in refrigeration equipment manufacturing at Voltas Limited, seven years of experience in fruit preservation at Defence food research laboratory, DRDO-Mysore and worked for eight years at cold chain project of CONCOR before joining teaching.

He is a recipient of DRDO cash award in the year 2003. He was nominated by CONCOR for eight days visit to ISRAEL as part of cold chain project for preservation of apples in the year 2011. He has published 4 research papers in SCI indexed journal and 9 papers in SCOPUS indexed journals and 6 in ICI indexed journals. He also presented numerous papers at various International and national conferences. His paper got best paper award by the TJPRC for the paper on “The Design of Refrigeration, Thermal Insulation and an Equipment for Healthy Ripening of Mango and Banana Without Using Harmful Chemicals.” published in IJMPERD.

He has filed one patent in the year 2019. He is currently pursuing his PhD in Mech. Engg at KLEF, Vijayawada. He is a life member of Condition Monitoring Society of India and Graduate member of Institute of Engineers (India).



Dr Ram Deshmukh is Professor and Head of Electrical and Electronics Engineering Department. He has completed his Under graduation at Nagpur University, PhD in the area of Energy Efficient Machines in 2007 from Cardiff University, United Kingdom. He has 12 years of Industrial Experience and 5 years of teaching experience in the UK. He was as Chief Engineer in ATB Laurence Scott, Senior Design Engineer in Brush Electrical Machines Ltd, Electrical Engineer in Corus Construction and Industrial Ltd (TATA Steel UK). He was lecturer in University of Sunderland. He is an international qualified teaching professional with PG Certificate in Higher Education from University of Sunderland.



He have achieved many international awards that includes Dennis Hatfield memorial Prize for Best Article in UK Magnetic Society magazine ,UKMAG, Business Contribution Award in Corus Steel UK, Excellent contribution as Design Mentor in Smart India Hackathon- Hardware Edition, Kharagpur, India. He received award from Steel Authority of India Ltd for Solving their Industry Problem during his undergraduate Studies. He also received Best presentation Award in Magnetism and Magnetic Conference, San Diego, USA. He have published technical research papers in reputed International Journals viz. IEEE Transactions of Magnetic Material, Journal of Applied Physics, Journal of Magnetism and Magnetic Material. He is the Director in a company named “Real Pandu”, a fruit ripening company.



Dr K. V. Narasimha Rao, is a senior Professional with over 26 years experience in Academic, Consultancy and Industry and has been working as Professor in the Department of Mechanical Engineering with KLEF (Deemed to be University), Vaddeswaram (Andhra Pradesh) since 2 September 2016. Dr Narasimha Rao was graduated in Mechanical Engineering from Regional Engineering College, Warangal during 1986 and went on to obtain Master’s and Doctoral degrees from the Indian Institute of Science, Bangalore during 1990 and 1995 respectively in the field of Thermal Engineering. He worked for seven years during 1995-2002 as Research Associate and Fellow, Industrial Energy Group at Tata Energy Research Institute (teri), Southern Regional Centre, Bangalore before moving into Academic, Research and Administration during 2002. Dr Rao has published 28 scientific papers (three in SCI Journals) and numerous technical reports for various National/International Agencies. Dr Rao has filed 14 patents in different areas (since 2017), out of which four have been published so far. Dr Rao’s Areas of Specialization include: Energy Auditing, Energy Conservation & Management, Heat Transfer, Refrigeration and Air-conditioning and Renewable Energy Sources. Dr Rao is a Recipient of 'National Merit Scholarship' during 1980-85 (6 Years). Dr Rao was the Team Leader for the Consultancy Assignment on Energy Efficiency Services-Phase-III (3 May–30 November 1998), for the Ministry of Industry, His Majesty’s Govt. of Nepal, Industrial Energy Management Component of the Power Sector Efficiency Project (PSEP) – IDA Credit No. 2347-NEP, World Bank. He has developed and Demonstrated “Performance Contract for Industrial Energy Management” for Indian Scenario, sponsored by Canadian International Development Agency during 2000-01 (while working at TERI, Bangalore).



Dr M Rajya Laxmi, is currently working as Head of the Department, Business Management at SR Engineering College, Warangal. She has expertise on Human Resource Management. She has obtained her PhD from JNT University, Hyderabad in the year 2019. Dr Rajya Laxmi has published eight research papers in UGC and Scopus indexed journals. She has got 10 years of experience in teaching.



Kafil, is currently working as Assistant Professor in Dept of Business Management at S R Engineering College, Warangal. She is also pursuing her PhD. She has 14 years of experience in teaching, research and administration. She obtained her Management Degree from Kakatiya University, Warangal in 2005, Qualified UGC-NET and APSET in the year 2012. She published 7 papers in International journals 2 in International conferences and 2 papers in National Conferences. She played various roles such as Academic Coordinator, Disciplinary Committee co-ordinator, and Training and Placement co-ordinator. She has an expertise in Accounting, Finance, Research Methodology, Economics, Statistics and Security Analysis. Besides teaching the above courses she engaged in Course Designing, organized conferences, workshops and seminars.



T Sabita, is currently working as Teacher (PRT-contractual) in Kendriya Vidyalaya, No1-Golkonda, Hyderabad. She did her Diploma in elementary education (D. El. Ed) from St Mary’s Teacher Training Institute, Jangoan, and currently pursuing Integrated MBA. She has published one research paper on “awareness on food processing entrepreneurship among engineering faculty” in IJEAT - a scopus indexed journal in August 2019. Her research interests are in food and technology Agriculture.