International Journal of Engineering and Advanced Technology (IJEAT)
ISSN: 2249-8958 (Online), Volume-8 Issue-6, August, 2019

Shelf Life Assessment of Banana Pseudostem Cutlet

Sandra K Raju, Philomena Joy Lindsey A, Emilin Renitta R

Abstract: ***Banana pseudostems are the biological wastes obtained in huge amounts during each harvest. Their vast quantity aids in difficult disposal. Researches then came up with innovative ideas to produce value added products from them. Based on the medicinal research on banana pseudostem and their rich therapeutic properties, banana pseudostem powders are used in various food products as a means of fiber fortification in biscuts and cookies.In this research, cutlets were produced with the addition of banana pseudostem flour at level 0%(control), 5%, 10%, 15%. Cutlets at level 10 % showed best results and therefore it was evaluated to determine its cooking yield, moisture analysis, ash content, crude fibre, pH and microbial and sensory analysis. Pseudostem powder addition in cutlets resulted in higher cooking yield (98.91%) for treatments in comparison to control while the pH value (6.38) was also higher than the control. The control retained high moisture content (43.33%), ash (2.48%) and crude fiber(0.45%). Sensory evaluation projected minimal differences in texture, colour, overall appearance in treatments on comparison with the controls on 0th, 7th and 14th day . The scores obtained were in the range of acceptability. Cutlet prepared with banana pseudostem powder gained better acceptability than control. This research is a contribution for food fortification. Bananapseudostem powder act as a neutraceutical with its promising medicial properties in enhancing the mineral intake. Utilization of waste into a commercial consumable product is the innovative insight of this study.***

Keywords: Banana pseudostem powder, cutlet, fortification, neutraceutical, therapeutic

I. INTRODUCTION

Banana is a significant global commodity grown in tropical regions. Musa acuminata and Musa balbisiana are two wild species of banana cultivated largely for its seedless property. India stands second in the production of banana adding 23% to its total world production. The biomass that is discarded as wastes contain pseudo stem of about 60 to 80 tonnes (avg)[1]. The stem of banana produces a single bunch of banana afterwhich the stem dies. The dead stem later develops in to a pseudo stem [2] which is normally wasted. More attention has been gained in recent years to utilize the waste. Bananas pseudo stem is been utilized for paper, furniture and forage material [3, 4]. Moreover, it has been reported that these banana waste materials are mineral and nutrient - rich, particularly dietary fiber [5]. The core and leaf fold of *Musa paradisiaca* and *Musa sapientum* pseudostem waste contains the minerals like sodium, potassium, chromium, magesium, zinc, copper, iron and phosphorus.The leaf fold contains only meager amount of lead. [6]. These minerals enhance the immune system providing a barrier against liable infectious diseases [7]. The inner part of the tender pseudo-stem is edible and has many medicinal properties as well. Pseudo-stem is fibrous and highly beneficial for those who are on a weight-loss programme. It is also a rich source of potassium and vit B_6 which helps in the production of insulin and haemoglobin. If consumed once in a week, it keeps high blood pressure under control. It is a diuretic and helps in detoxifying the body. Kidney stones desolve on consuming this extract and it also helps to maintain fluid balance in humans [8]. The pseudostem core helps to palliate stomach disorder and diabetes. Regular intake of this fibre rich pseudostem deprives obesity and body detoxification. Fresh juice of the pseudostem is consumed in south India as it scores out kidney stones [9].The banana pseudo-stem powder was prepared by different drying methods such as sun drying, tray drying at different temperatures for specific time periods. This powder can be fortified into any food product. In order to use pseudo - stem bananas, proper processing is required for its standard incorporation in food products to improve its nutritional and sensory aspect [10]. The objective of this study is the “Development of banana pseudo stem cutlets and to analyse its shelf life.

Revised Manuscript Received on October 30, 2019.

* Correspondence Author

Sandra K. Raju, Department of Food Processing Technology, Karunya Institute of Technology and Sciences, Coimbatore, Tamilnadu, India.

Philomena Joy Lindsey A., Department of Food Processing Technology, Karunya Institute of Technology and Sciences, Coimbatore, Tamilnadu, India.

Emilin Renitta R., Department of Food Processing Technology, Karunya Institute of Technology and Sciences, Coimbatore, Tamilnadu, India.

II. MATERIALS AND METHODS

A. Preparation of banana pseudostem powder

Banana pseudostem was collected from nearby market, washed and cleaned to be further processed at FPTC Laboratory, Karunya Institute of Technology and Sciences, and refrigerated to avoid browning. Banana pseudostem was cut into cubes of 1 x 1 cm using sterile knife, dried at 60 °C in the oven for 24 hours, cooled in dessicator and ground into powder. Then packed in airtight plastic pouches and stored in ambient temperature for further use. The various ingredients used in spice mix in the preparation of cutlets are given below in table 1. Salt was purchased from local market.

Control - (0%) pseudostem flour + (other ingredients)
Sample 1- (5%) pseudostem flour + (other ingredients)
Sample 2- (10%) pseudostemflour + (other ingredients)
Sample 3- (15%) pseudostem flour + (other ingredients)

Table 1: Composition of ingredients used for the formulation of banana pseudostem cutlets

Ingredients	Control	Sample 1	Sample 2	Sample 3
Pseudostem powder	-	10	20	30
Potato	80	70	60	50
Onion	70	80	80	80
Spices	30	22	22	22
Salt	4	2	2	2
Groundnut oil	16	16	16	16

B. Cutlet preparation

Raw materials were freshly brought from market. Potatoes were boiled and mashed. Onions along with the potatoes were fried until it turns brown. Condiment mix and salt were then added to impart taste. Pseudostem flour was then added to the cutlet mix and fried. The prepared cutlets were then precooked at 110°C for 12 minutes, vaccum packaged and stored at refrigeration condition (4°C). Figure 1 shows the prepared cutlet incorporated with banana pseudostem powder.

Fig. 1 Formulated banana pseudostem cutlet

Sample 2 showed better sensory perception based on the sensory evaluation. Therefore other analyses were done only for sample 2.

III. QUALITY ANALYSIS

A. Cooking Yield

By weighing the cutlets prior and after cooking, cooking yield can be determined for each sample. The ratio of cooked weight to raw weight gives cooking yield. It was then multiplied by 100 to express the result in percentage.

B. pH determination

The pH of banana pseudostem incorporated cutlet samples after their preparation was determined using a digital pH meter. To 50 ml of distilled water, 10 g of the sample was added into which the combined glass electrode of a digital pH meter was dipped to record the value [11].

C. Determination of moisture content

The moisture content of the sample was estimated as per AOAC [12] protocol using hot air oven. The oven was set to 105°C to dry the empty dish and the lid for 3 hours and cooled in a dessicator. The weight of empty dish and lid was taken. About 3 grams of sample was weighed in the dish, spread uniformly and placed in the oven again. After 3 hours of drying at 105°C, the dried sample was transferred to a dessicator so that the hot sample drops down to lower temperatures. Reweigh the dish and the dried sample. Moisture content is calculated as per the formula (1),

$$\text{Moisture content (\%)} = W2/W1 * 100 \quad (1)$$

where,
W1=Initial weight of the sample (g),
W2=Final weight of the sample (g)

D. Determination of total ash content

Total ash content of the sample was determined as described in AOAC [13]. A crucible added with 5 g of sample was placed in a muffle furnace for 5 h at 555°C. The crucible was taken out after the stipulated time and allowed to cool in a dessicator. Final weight was taken to calculate the percentage of ash content using the formula (2),

$$\text{Ash content} = (W1-W2) * 100/W1 \quad (2)$$

where,
W1= Initial weight of the sample,
W2= Final weight of the sample

E. Determination of crude fibre

AOAC [13] protocol was followed to determine the crude fibre content of the sample. 4g of the sample was defatted and mixed with 200 ml of 1.25% sulphuric acid held in 550 ml beaker. A glass rod should be dipped in the beaker during the process. After boiling for 30 minutes in a hot plate, the solution was filtered. Any loss in volume during boiling was made up with distilled water. The collected residue was then rinsed with distilled water for acid removal. To the residue, 200 ml of 1.25 % sodium hydroxide was added and boiled for 30 minutes. The liquor was filtered using a cotton cloth and the residue obtained was washed with distilled water until the residue attains alkaline nature.The residue was then dried at 105°C for 3 hours and weighed again. Crude fibre content in the banana pseudostem powder was calculated using the formula (3),

$$\text{Crude fibre (\%)} = W1/W2 * 100 \quad (3)$$

where,
W1=Weight of sample taken (g),
W2= Weight of crude fibre (g)

F. Microbial analysis- Total plate counts (TPC)

The total plate count for the precooked cutlets were determined following the standard method of Speck [14]. 10 g cutlet samples were ground using a sterile mortar and pestle by adding 90ml of sterile 0.1% peptone water. Appropriate serial dilutions of samples were prepared in 0.1% peptone water and plates were inoculated in duplicates by pour plate method. After 24 hours of incubation at 35±2°C, plates showing approximately 30-300 colonies selected and counted. The results were expressed as log CFU/g of samples.

G. Sensory Evaluation

The sensory attributes such as color, appearance, flavor, texture and overall acceptability were evaluated using an 8-point descriptive scale [15] where 8= extremely desirable and 1= extremely undesirable. The cutlets were fried using vegetable oil until it turns golden brown and served warm to a six member panel of students in the Department of Food Processing and Engineering, Karunya Institute of Technology and Sciences, to determine the sensory perception and likability. The procedure of the experiment was explained to the panelists without disclosing the identity of samples. Water was provided to rinse the mouth between the samples to percieve the raw taste of each cutlet. The panelists judged the samples for appearance, colour, flavor, taste, texture and overall acceptability.

IV. RESULTS AND DISCUSSION

A. Cooking yield

As per the studies, the cooking yield for the control and sample reduced on the 7th and 14th day when compared to 0th day. The results indicated that control showed lower cooking yield than sample. Increase in cooking yield might be attributed to the high ability of pseudostem flour to retain moisture and fat in matrix. Similar finding was reported by Saleh and Ahmed [16] for carrot powder incorporated in the comminuted meat patties. Huber *et al.* [17] also reported high levels of carrot fiber in emulsion type sausages due to its water binding capacity compared to other expensive binding agents.

B. pH

pH reduction occured in both control and sample. pH in control declined on 7th day but then remained constant on 14th day. Ph was higher in sample than control. Ph decreased as the storage days increased. This could be due to the occurence of mild sour taste and extended storage. The likelihood and incidence of bacterial growth increases when foods have high protein content and low in acid value. Spinach, potatoes and carrots are considered a low acid food (Ph of 4.6 – 7.0) and are all ingredients in the vegetable nugget [18].

C. Moisture content

Moisture content was low in the sample when compared to the control but remained constant from 0th day till 14th day as the cutlets were vaccum packaged. If vegetables are the main ingredient of the product, then the moisture percent would have become higher than 51%. Whole wheat breadcrumbs and brown rice constitute most weight of the product. Decrease in moisture is attributed to the low temperature during storage. At low temperatures, all the readily available moisture freezes to ice crystals rendering low available moisture for microbial growth. The moisture decrease was reported by Pilankar *et al.* and Praneetha *et al.*[19, 20] during frozen storage of fish cutlets.

D. Ash content

Ash content of the control reduced slightly on 14th day whereas it increased on 14th day for test sample. This shows that the mineral content does not deplete in accordance to the extension of storage days. Therefore, the minerals in the banana pseudostem powder are highly stable. The high potassium, magnesium and calcium levels have retained assuring biavailable mineral intake [21].

E. Crude fibre

Crude fibre content was less in both control and sample till the 14th day. Addition of breadcrumbs would have resulted in lower amount of fibre content because regular breadcrumbs are not considered a whole wheat product [22].

F. Microbial Analysis

Total plate count (TPC) increased from day 0th to 14th day in sample as well as in control. The exponential bacterial growth points that the vegetable nugget must be either frozen or refrigerated until preparation. They should be reheated to an internal temperature of 165˚F during preparation. The increase in TPC could be due to power fluctuation during storage or improper packaging or hygiene practices during cutlet preparation. Similar results were obtained by Praneetha *et al.* [20] during TPC determination of fish cutlets stored for 15 days. Table 2 represents the results of quality analysis of banana pseudostem cutlets.

Table 2: Composition, cooking yield and microbial analysis of control (C) and test sample (T)

Treatments	Cooking yield (%)	pH	Moisture content (%)	Ash (%)	Crude fibre (%)	Microbial analysis (CFU/g)
C (0th day)	98.91	6.32	47.70	2.70	0.64	1 x 10^6
C (7th day)	97.23	6.31	47.70	2.66	0.64	3 x 10^6
C (14th day)	96.17	6.31	47.70	2.63	0.62	6 x 10^6
T (0th day)	98.91	6.38	43.33	2.48	0.45	1 x 10^6
T (7th day)	98.11	6.33	43.33	2.49	0.44	3 x 10^6
T (14th day)	97.32	6.29	43.34	2.94	0.42	6 x 10^6

G. Sensory evaluation of banana pseudostem cutlets at 4°C

Color and appearance were same in both categories in the beginning. Appearance showed decreasing trend with increasing levels of pseudostem powder which might not be satisfactory or appealing. Flavor remained constant in all trials from 0th to 14th day and a good texture prevailed in the sample than in control due to the addition of pseudostem flour. However, overall acceptability was high in the sample than in control. The significant reduction is due to the extended storage period as mentioned in Praneetha *et al.*[20]. Figures 2 and 3 represent the sensory evaluation report.

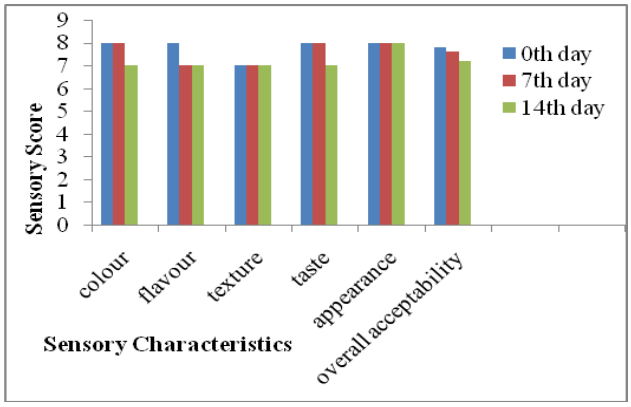

Fig. 2 Effect of sensory characteristic on sensory score for Control

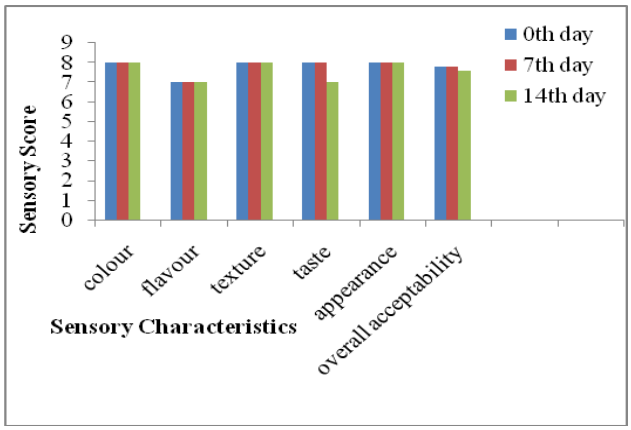

Fig. 3 Effect of sensory characteristic on sensory score for Sample

V.CONCLUSION

The results of this investigation indicate that the cutlets containing banana pseudostem powder improved cooking yield and taste than the control. The incorporation of banana pseudostem powder at 10 % level in cutlets for increasing fibre content while maintaining physiochemical and sensory properties were proved possible. Crude fibre was found lower for control sample in comparison to cutlet formulated with 10% banana pseudostem powder. Banana pseudostem cutlet sample gained better overall acceptability. Pseudostem powder is proved to be a rich source of carbohydrate, crude fibres and minerals. Incorporation of pseudostem in cutlets could help to overcome the fibre deficit in actual human diet, act as a remedy for stomach troubles like diarrhoea, dysentery and urinary disorders. It also aids in controlling obesity and the removal of kidney stones. Through this reseach, utilization of banana pseudostem powder incorporated in cutlets is suggested as a palatable and healthy food in human diet and safe for consumption. In the developing urban life style, working people are prefering ready to eat foods most likely. This research could help such consumers in meeting their demands and could aid them a nutrituous life style which is unbalanced through the unhealthy junk foods.

ACKNOWLEDGEMENT

The author(s) are thankful to the Department of Food Processing and Engineering, Karunya Institute of Technology and Sciences, Coimbatore for providing the necessary facilities for the successful completion of this research.

REFERENCES

1. R. L. Thorat and H. P. Bobade, "Utilization of banana pseudo-stem in food applications," *International Journal of Agricultural Engineering*, vol. 11, no. Special, pp. 86–89, Apr. 2018. http://www.researchjournal.co.in/upload/assignments/11_86-89-99999.pdf
2. B. A. Anhwange, T. J. Ugye and T. D. Nyiaatargher, 'Chemical composition of Musa sapientum (banana) peels', *Journal of Food Technology* vol. 8, no. 6, pp. 437-442, 2009.
3. S. Uma, S. Kalpana, S. Sathiamoorthy, and V. Kumar, "Evaluation of commercial cultivars of banana (*Musa* spp.) for their suitability for the fibre industry", *Plant Genetic Resource Newsletter*, vol. 142, pp. 29-35, 2005.
4. R. Buragohain, G. Kalita and K. Sarma, "Nutritional significance of banana as swine feed", *Indian Veterinary Journal*, vol. 87, no. 3, pp. 301-302, 2010.
5. N. A. A. Aziz, L.-H. Ho, B. Azahari, R. Bhat, L.-H. Cheng, and M. N. M. Ibrahim, "Chemical and functional properties of the native banana (*Musa acuminata×balbisiana Colla cv. Awak*) pseudo-stem and pseudo-stem tender core flours," *Food Chemistry*, vol. 128, no. 3, pp. 748–753, 2011. https://www.sciencedirect.com/science/article/pii/S0308814611005012
6. U.D. Akpabio, D.S. Udiong and A.E. Akpakpan, "The Physicochemical Characteristics Of Plantain *(Musa Paradisiaca)* And Banana *(Musa Sapientum)* Pseudostem Wastes", *Advances in Natural and Applied Sciences*, vol. 6, no. 2, pp. 167-172, 2012.
7. L. Ho, N. Aziah, and R. Bhat, "Mineral composition and pasting properties of banana pseudo-stem flour from *Musa acuminata X balbisiana cv. Awak* grown locally in Perak, Malaysia," *International Food Research Journal*, vol. 19, no. 4, pp. 1479–1485, 2012. http://www.ifrj.upm.edu.my/19%20(04)%202012/27%20IFRJ%2019%20(04)%202012%20Noor%20Aziah%20(005).pdf
8. K. P. S. Kumar, D. Bhowmik, S. Duraivel, and M. Umadevi, "Traditional and Medicinal Uses of Banana," *Journal Journal of Pharmacognosy and Phytochemistry*, vol. 1, no. 3, pp. 2668735–5, 2013. http://www.phytojournal.com/vol1Issue3/Issue_sept_2012/9.1.pdf.
9. D. Ambrose and R. Naik, "Development of a Process for Utilisation of Banana Waste," *International Journal of Research in Applied, Natural and Social Sciences (IMPACT: IJRANSS) ISSN (P*, vol. 4, no. 6, pp. 83–88, 2016. http://oaji.net/articles/2016/491-1468576017.pdf.
10. D. C. P. Ambrose, R. Lakshman, and R. Naik, "Studies on the drying kinetics and quality assessment of banana pseudostem waste for effective utilization as a value added product," *International Journal of Farm Sciences*, vol. 6, no. 2, pp. 276–285, 2014. http://www.indianjournals.com/ijor.aspx?target=ijor:ijfs&volume=6&issue=2&article=041.
11. E. D. Strange, R. C. Benedict, J. L. Smith, and C. E. Swift, "Evaluation of Rapid Tests for Monitoring Alterations in Meat Quality During Storage," *Journal of Food Protection*, vol. 40, no. 12, pp. 843–847, 1977.
12. "AOAC. (1990). Official methods of analysis of the AOAC, 15th ed. Methods 932.06, 925.09, 985.29, 923.03. Association of official analytical chemists. Arlington, VA, USA.," *Sciepub.com*, 2014. http://www.sciepub.com/reference/51747.
13. "AOAC (2000) Official Methods of Analysis. 17th Edition, The Association of Official Analytical Chemists, Gaithersburg, MD, USA. Methods 925.10, 65.17, 974.24, 992.16. References - Scientific Research Publishing," *Scirp.org*, 2016. https://www.scirp.org/(S(351jmbntvnsjt1aadkposzje))/reference/ReferencesPapers.aspx?ReferenceID=1687699.
14. M. L. Speck, "*Compendium of Methods for the Microbiological Examination of Foods"*, 2nd Ed., American Public Health Association, Washington,DC, 1984. : https://lib.ugent.be/en/catalog/rug01:001211748.

15. J. T. Keeton, E. A. Foegeding, and C. Patana-Anake, "A Comparison of Nonmeat Proteins, Sodium Tripolyphosphate and Processing Temperature Effects on Physical and Sensory Properties of Frankfurters," *Journal of Food Science*, vol. 49, no. 6, pp. 1462–1465, 1984. http://onlinelibrary.wiley.com/doi/10.1111/j.1365-2621.1984.tb12821.x/abstract.
16. N. T. Saleh and Z. S. Ahmed, "Impact of natural sources rich in provitamin A on cooking characteristics, color, texture and sensory attributes of beef patties," *Meat Science*, vol. 50, no. 3, pp. 285–293, 1998. https://www.sciencedirect.com/science/article/pii/S0309174098000035.
17. W. Huber, W. Vogan and Y. le Minter Y, "Carrot fiber as apportunity", *Fleischwirtschaft International*, vol. 4, pp. 13-15, 2002.
18. "Food Safety Education," *Uri.edu*, 22-May-2012. https://web.uri.edu/foodsafety/.
19. A.S. Pilankar, B.V. Gaikwad and S.T. Sharangdher, "Sensory Evaluation and Biochemical Changes of Fish Cutlets, made from Dhoma *(Otolithus* sp) Fish during Frozen Storage", *International Journal of Science, Environment and Technology*, vol. 5, no. 6, 2016.
20. S. S. Praneetha, K. Dhanapal, G. V. S. Reddy, A. Balasubramanian, and G. Praveen Kumar, "Studies on the Quality of Fish Cutlet Prepared from Rohu (*Labeo rohita*) during Refrigerated Storage," *International Journal of Current Microbiology and Applied Sciences*, vol. 6, no. 12, pp. 3262–3271, 2017.
21. T. H. Emaga, R. H. Andrianaivo, B. Wathelet, J. T. Tchango, and M. Paquot, "Effects of the stage of maturation and varieties on the chemical composition of banana and plantain peels," *Food Chemistry*, vol. 103, no. 2, pp. 590–600, 2007. https://www.sciencedirect.com/science/article/pii/S0308814606007023.
22. WholeGrains, the Inside Story, *Nutrition Action Newsletter*; Center for Science in the Public Interest, vol. 33, no. 4, pp. 3-7, 2006. https://cspinet.org/topics/whole-grain.

AUTHORS PROFILE

First Author

Name: Sandra K. Raju

E-mail: sandraraju24@gmail.com

Address: Department of Food Processing Technology, Karunya Institute of Technology and Sciences, Coimbatore, Tamilnadu, India

Education:

- **Postgraduate Program:** Food Processing Technology, Karunya Institute of Technology and Sciences, Coimbatore, Tamilnadu, India.
- **Undergraduate Program:** Food Processing Technology, Karunya Institute of Technology and Sciences, Coimbatore, Tamilnadu, India.

Research areas:
Functional foods and neutraceuticals, Formulation of food products.

Second Author

Name: Philomena Joy Lindsey A.

E-mail ID: apjlindseygct@gmail.com

Address: Research Scholar, Department of Food Processing Technology, Karunya Institute of Technology and Sciences, Coimbatore, Tamilnadu, India.

Education:

- **Ph. D** in Agriculture and Food Processing at Karunya Institute of Technology and Sciences, Coimbatore, Tamilnadu, India. (Pursuing)
- **Postgraduate Program:** Food Technology, ACT Campus, Anna University, Chennai, Tamilnadu, India.
- **Undergraduate Program:** Industrial Biotechnology, Government College of Technology, Coimbatore, Tamilnadu, India.

Research areas:
Phage therapy, Enzyme kinetics, Functional foods

Third Author- Corresponding Author

Name: Dr. Emilin Renitta R.

E-mail: emilinrenitta@gmail.com

Address: Assistant Professor (SG)
Department of Food Processing Technology
School of Agriculture and Biosciences,
Karunya Institute of Techology and Sciences,
Coimbatore, Tamilnadu, India.

Current position:

Assistant Professor (SG)
Department of Food Processing Technology,
KITS, Coimbatore

Education:

- Ph.D – 2006 (Microbiology)
  Suganthi Devadason Marine Research Institute,Tuticorin, Affliated to Manonmaniam Sundaranar University, Tirunelveli.
- Master of Science – 2001 (Microbiology) Centre for Marine Science and Technology, Manonmaniam Sundaranar University, Rajakkamangalam, Kanyakumari District.
- Bachelor of Science – 1999 (Microbiology) - University of Madras

Area of specialization:
General Microbiology, Food Processing and Preservation,

Teaching and research experience: 12 years and 6 months

Papers published:
National Journals - 6
International Journals - 15