International Journal of Tropical Agriculture
Volume 41, Numbers (1-2) • 2023 : pp. 81-88
ISSN: 0254-8755

Use of vacuum assisted microwave dehydration for the development of instant soy paneer- green peas curry mix

A. Bal*, O.P. Chauhan and A.D. Semwal

Defence Food Research Laboratory, Siddarthanagar, Mysore 5700011
**E-mail: atreyee.bal@gmail.com*

Abstract: The study was conducted to develop an instant curry mix that not only fulfils the requirements of a busy lifestyle but is a rich source of nutritional components. Vacuum-assisted microwave drying is one of the most suitable technologies for heat-sensitive materials due to its faster drying rate, better rehydration qualities, and retention capability of color, texture, and nutritional profiles. Vacuum-assisted microwave drying took a considerably shorter drying time for the soy paneer (3 min) and green peas (4min) at 600W microwave power and 250 mbar vacuum pressures. The product showed excellent rehydration characteristics due to the porous structure in the dried products which was achieved by the application of vacuum in microwave drying. The instant curry mix was prepared using dehydrated soy paneer and green peas along with spice mix. The developed product showed 6 min rehydration time in boiling water and a shelf life of 12 months when packed in PP pouches based on the sensory scores.

Keywords: Soy paneer; Vacuum; Microwave; Drying, Rehydration.

INTRODUCTION

Soy paneer, commonly known as tofu, is the most versatile product made from soybean by curdling soy milk so that its protein coagulates and then pressed into a soft to firm sliceable cake. It is a natural, inexpensive, nutritious food with a mild taste and porous texture and is often considered as a meat analog or dairy substitute, hence called "Soy paneer is meat without bone" [1]. On a moisture-free basis, soy paneer has a protein content of around 50%, a fat content of 27%, and carbohydrate and mineral content of the remaining components. Soy paneer is classified as the best alternative plant-based protein source because it has a wealth of proteins, minerals, and PUFA and is devoid of cholesterol with a good balance of all nine essential amino acids, beneficial lipids, and bioactive compounds (especially isoflavones, saponins and phytosterols). There is increasing consumer demand for high quality convenient and instant food products which has led to an increase in the commercial production of an instant form of food products made from soy paneer because of its potential to contribute to overall public health and booming acceptability towards alternative meat-free meals as part of a varied diet. Instant foods are one of the major advancements in the field of food technology. Preference for instant food products has been greatly influenced by rapid urbanization and busy lives. Instant food or ready-to-cook food is available as partially cooked and can be utilized very conveniently within a short period. Ready-to-reconstitute foods also featured as instant foods, can be distinguished as those that have undergone extensive manufacturing processes such that they require little or no cooking before consumption.

The shelf life of soy paneer is very low at room temperature [2]. High moisture content and high water activity (aw) of soy paneer lead them to be highly perishable since moisture content and water activity are critical variables for the growth of many microbes. The biggest challenge for such highly perishable products is

Article History: Received: 21 January 2023; Revised: 15 February 2023; Accepted: 14 March 2023; Published: 20 June 2023

to keep maintaining their freshness to maintain their nutritional value, however, most storage techniques need low temperatures which are challenging to manage throughout the supply chain. Therefore, drying could be a suitable alternative. The major advantages of drying are longer shelf life, reduced packaging and storage costs, lighter transportation, improved sensory characteristics, preserves flavors, and nutritional content [3]. Among the various types of dryers, vacuum-assisted microwave drying is putting incrediblebreadthforthegenerationofbestquality dried products [4]. Vacuum-assisted microwave drying of potato cubes was done by Chauhan et al. [5], and they concluded that vacuum-assisted microwave drying can be employed for the dehydration of potato cubes having good rehydration qualities. Bal et al. [6] successfully experimented vacuum assisted microwave drying in order to achieve an instant paneer-type product made of groundnut. They stated in their report that vacuum-assisted microwave drying used for the dehydration of groundnut paneer resulted in excellent rehydration characteristics maintaining the quality of color properties, textural characteristics, and sensory attributes.

Vacuum-assisted microwave dehydration has been the focus of the food technology research field in recent years. Thus keeping in mind the changing lifestyle, and increased demand for instant foods, the present study was carried out to develop a nutritious instant soy paneer-green peas curry mix. The proposed investigation is to optimize the process while meeting the quality requirements. There is no other similar product development has been reported so far.

MATERIALS AND METHODS

Good quality soy beans and green peas were purchased from the local market of Mysore, India. Soy beans and green peas were stored at roomtemperature and cold room respectively until further processing.

Preparation of soy paneer

The making of soy paneer involves two main steps: 1) Soy milk preparation, 2) Coagulation of soy milk to form curd which is further then pressed to form soy paneer. In the production of soy paneer, a Soy cow machine was used. Soy cow is a batch processing machine that yields high-quality soymilk. Cleaned and graded soybeans (2kg) were soaked in water of 1:5 ratios for 8 hours at room temperature to swell the beans. Soaked soybeans were de-hulled and ground with a 1:6 soybean water ratio. The resultant slurry was kept at a heating temperature of around 110-120 °C for 3 minutes while being pressure cooked at 1.1 kg/cm2 with culinary steam. In order to eliminate the unpleasant beany flavor from soymilk, the cooked slurry was deodorized under a vacuum pressure of 400 mm of Hg generated by a vacuum pump in the deodorizing machine. The produced soy slurry was collected in a filter bag placed within the perforated cylinder of the filter press unit to extract soymilk from the soy slurry. The soy slurry was compressed so that the soy milk oozes out of the filter press through the bottom aperture and was collected into a large container. In order to coagulate the freshly prepared hot soy milk, calcium chloride (2%) solution was added, and the temperature was kept between 80 and 85 °C. The solids were allowed to precipitate for 20 minutes. The coagulum was transferred to a paneer press specifically made for the purpose along with muslin cloth and the muslin cloth was then folded over the top. After covering the press unit with a cover plate and progressively tightening the screw to let the water flow out, the curd block was squeezed for about 30 minutes. The obtained soy paneer was dipped into cold water until further use.

Preparation of green peas

Green peas were peeled, weighed and washed with plenty of clean water then were put in a blanching basket and dipped in boiling water. The temperature of boiling water was constantly maintained at 100°C. As soon as the blanching was complete, blanched green peas were quickly cooled in ice water to stop further cooking. The green peas are then strained from water to drain out extra water.

Preparation of curry paste

Palm oil was heated in a stainless steel vessel to 120 and onion paste, ginger-garlic paste, and

green chilli paste were added accordingly and cooked for 5 min. Tomato puree was added and cooked for further 5 min. A quantity of cumin powder, coriander powder, garam masala powder, and red chilli powder along with salt and turmeric were added and cooked until the curry paste becomes concentrated with frequent stirring. Once the cooking of curry paste is over, it was set aside to cool down.

Vacuumassisted microwave dehydration

The drying experiments were performed using a vacuum-assisted microwave dehydration unit developed by Energy Microwave System, Bangalore, India (Model PTF 2712). The paneer was cut into cubes of 1.5 × 1.5 × 1 cm size. Microwave dehydration of the paneer samples, green peas, and curry paste was performed at 600 W microwave power and 250 mbar vacuum level. Samples were evenly spread as a single layer on the base of the sample holder in vacuum assisted microwave system. Moisture loss was recorded by taking out the samples and weighing them on a digital balance periodically of 0.001 g accuracy until a moisture content of about 5%–6% (wet basis) was reached. Each experiment was replicated three times and the mean value and standard error were calculated in moisture content at each experiment. Later, the dehydrated paneer cubes (10 g), green peas (10 g), and curry paste powder (30 g) for a 50 g quantity of instant soy paneer-green peas curry mix were stored at room temperature (25°C ± 1°C) in PP (polypropylene) pouches for further studies.

Physico-chemical analysis

AOAC [7] methods were used to determine the moisture, protein, fat, and ash content and the results are reported as a percentage of wet basis. Carbohydrate was determined by deducting the total moisture, protein, fat, and ash from 100 [8]. The factors for protein (4 kcal/g), fat (9 kcal/g), and carbohydrate (4 kcal/g) were used to obtain the gross energy value (kcal/100 g). Titratable acidity and mineral content using standard procedure were determined as suggested by Ranganna [9]

Color measurement

MiniScan XE Plus (Model No. 45/0-S, Hunter Associates Laboratory, Inc.) colormeter was used to measure the L* (lightness/darkness), a* (redness/greenness), and b* (yellowness/blueness) values of the experimented samples using a D-65 illuminant and 100 observers. Standard white and black tiles were used as a reference. Each sample had three measurements collected, and the mean values were used to analyze the data.

Rehydration properties

Rehydration properties were tested in triplicate for the vacuum assisted microwave dried soy paneer-green peas curry mix by reconstituting a 50 g sample in boiling water for five minutes. The sample wasthen weighed. The weight of the sample before and after rehydration was used to assess the rehydration properties of dehydratedsoy paneer-green peas curry mix.

$$\text{Rehydration ratio} = W_r / W_d$$

Where,W_r = Weight of the rehydrated sample (g); W_d = Weight of the dried sample (g).

Texture profile analysis

The texture profile analysis was carried out using TAHDi(Stable Micro Systems Ltd. London, UK) texture analyzer system with a 25 kg load cell, and the data was calculated using computer-supported software (Texture Expert, Version 1.22, Stable Micro Systems Ltd. London, UK). By applying two successive compressions using a flat plate or a cylindrical probe with dimensions greater than the sample dimensions, the experimented samples were crushed to 75% of their original height. The crosshead speed was maintained at 1mm/s. The waiting time was set between the two-cycles of the TPA tests for 5 sec. Each time before the TPA testing, the texture analyzer was calibrated for force and height. The samples were carefully detached from the probe before the return to its starting position after completion of second compression cycle. Three sets of data were evaluated, and their means were used for final data analysis.

Microbiological analysis

(a) Using nutritional agar at an incubation temperature of 37±1 °C, the total viable count technique was employed to count the viable bacteria.AOAC [10]

(b) Potato dextrose agar was used for the yeast and mold Count which was counted after 48 hours of incubation at a temperature of 25±1 °C. AOAC [10]

(c) Violet red bile agar was used for the coliform count which was counted after 48 hours at an incubation temperature of 37±1 °C. AOAC [10]

Sensory evaluation

Reconstituted instant soy paneer-green peas curry was prepared by mixing 50 g of instant soy paneer-green peas curry mix with 300 ml of boiling water. The reconstituted instant soy paneer-green peas curry and freshly prepared soy paneer-green peas curry was subjected to sensory evaluation. The sensory evaluation was carried out by 12 trained panelistson a 9- point hedonic scale; 9 indicating highly acceptable and 1 as least acceptable [11].

Statistical analysis

The data obtained were subjected to the analysis of variance (ANOVA) technique to determine significant differences if any at $P<0.05$ significance level using Statistica 7 software(Stat Soft, Tulsa, OK, USA).

RESULTS AND DISCUSSION

Physico-chemical compositionof soy paneer

The experimental findings of physico-chemical composition of fresh and vacuum-microwave dried soy paneer are presented in Table 1. The Moisture content of soy paneer samples was found to be around 76.8%. The results show that produced soy paneer is a good source of protein and calcium minerals. The protein, fat, ash, fiber, and carbohydrate content were found to be 15.57%, 4.29%, 1.33%, 0.20%, and 2.01% in the developed soy paneer, which is in line with the reported result by Ojha et al. [12]. The physico-chemical composition of vacuum-assisted microwave dried soy paneer shows as a rich source of protein (21.01%). The increased values of some constituents may be due to an increase in the concentration of these constituents resulting from drying.

Table 1: Physico-chemical composition of soy paneer

Constituents	*Fresh soy paneer*	*Vacuum-microwave dried soy paneer*
Moisture (%)	75.20±0.22	4.19±0.15
Protein (%)	15.57±0.58	21.01±0.34
Fat (%)	4.29±0.08	6.08±0.10
Ash (%)	1.33±0.17	2.67±0.21
Carbohydrate (%)	2.01±0.14	66.05±0.66
Fibre (%)	0.20±0.05	0.59±0.12
Energy (Kcal/100g)	108.93±0.11	402.96±0.08
Titratable acidity (%)	0.30±0.24	-
Calcium (mg/100g)	350±0.62	374±0.42
Iron (mg/100g)	5.2±0.22	5.5±0.07

Physico-chemical analysis of dried green peas and curry mix

The physico-chemical composition of dried curry mix and green peas is shown in Table 2. The instant curry mix sample had 5.79% moisture, 2.32% ash, 7.11% protein, 28.58% fat, 7.70% fiber, 56.20% total carbohydrate, and 510.46 Kcal energy per 100 g. The developed product showed significantly less moisture content this is because of the drying technique which is used to help in reducing moisture content and increase the shelf life. Green peas are a good source of protein, fiber, and are rich in minerals. It was seen in the result that the vacuum-assisted microwave dried green peas contain a higher content of protein, fiber, calcium, potassium, and magnesium.

Table 2: Physico-chemical composition of instant curry mix

Constituents	*Vacuum-microwave dried green peas*	*Instant curry mix*
Moisture (%)	4.45±0.43	5.79±0.32
Protein (%)	17.65±0.18	7.11±0.24
Fat (%)	1.19±0.26	28.58±0.07
Ash (%)	1.63±0.56	2.32±0.13
Carbohydrate (%)	75.08±0.19	56.20±0.38
Fibre (%)	13.20±0.09	7.70±0.12
Energy (Kcal/100g)	381.63±0.07	510.46±0.12
Titratable acidity (%)	0.25±0.28	1.23±0.22
Calcium (mg/100g)	72.08±0.47	-
Iron (mg/100g)	6.82±0.33	-
Magnesium (mg/100g)	105.21±0.28	-
Potassium (mg/100g)	854±0.35	-

Drying characteristics

Figure 1 illustrates the drying curve for soy paneer, green peas, and curry mix and explains the correlation between drying time and moisture content (db.). The figure clearly indicates that during the constant rate period of drying, there was rapid moisture removal from the samples, but as drying time increased, later on, showed decrement. This was most likely because the product was having more free moisture available during the first stage of drying, which evaporated more rapidly. But in the falling rate period of drying, only capillary moisture remained, therefore it took longer time to remove moisture from the product [13]. The soy paneer samples took 3 minutes for drying at 600W microwave power and 250 mbar vacuum pressure. While the green peas took 4 min for drying and the curry mix took a higher drying time than the others i.e., 6 min. The porous structure of soy paneer may have facilitated the moisture diffusion while the low moisture content of green peas could be responsible for faster drying.

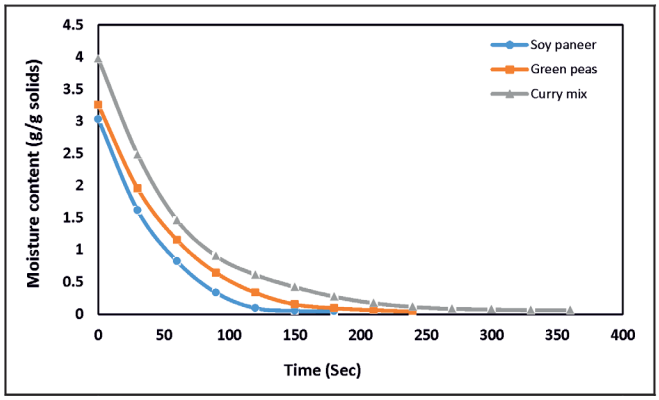

Figure 1: Drying curve of soy paneer, green peas and curry mix w.r.t. time and moisture content

Rehydration characteristics

The drying procedure may have an impact on the rehydration capability. It is an important parameter to determine drying quality as its complex procedure indicates the chemical and physical changes caused by drying treatments [14, 15]. Due to the innate elasticity of the cellular structure, the cell wall of the material softens by absorbing water during the rehydration process and then returns to its former shape by drawing water into the inner cavities. The generation of vacuum during microwave dehydration of soy paneer enhanced the puffiness of the dehydrated cubes resulting in a lighter product. The blanching treatment of vegetables before drying improves the drying efficiency, rehydration ratio, and product quality [16]. In support of this, blanching of green peas before being subjected to vacuum-microwave dehydration may have facilitated to higher rehydration rate. The rehydration ratio of soy paneer, green peas, and curry mix is presented in Table 3.

Table 3: Rehydration characteristics of vacuum assisted microwave dried soy paneer, green peas and curry mix

Sample	*Rehydration ratio*	*Drying time*
Soy paneer	3.2±0.02	3 min
Green peas	3.0±0.04	4 min
Curry mix	2.9±0.02	6 min

Color characteristics

Color changes are often considered a measurement of the quality and freshness of food materials [6]. Color changes are very significant when food products undergo various thermal treatments. Table 4 shows the color differences between fresh and reconstituted soy paneer, green peas, and curry mix samples. The result indicates color stability in terms of lightness (L*). Lower oxygen availability and lower temperature during vacuum drying under low pressure can be attributed to the observed results. The enzymatic browning reaction, which is the principal contributor to color deterioration in dried samples, is relatively weak under these conditions [17]. However, redness (a*) has shown increased values in the reconstituted samples of soy paneer and curry mix, while in the case of green peas the greenness (-a*) has decreased. The yellowness (b*) has shown a significant difference for all the reconstituted samples. The redness (a*) and yellowness (b*) are found to be dependent on drying conditions and the color differences may be associated with Maillard reaction [18].

Table 4: Instrumental colorvalues of vacuum-microwave dried soy paneer, green peas and curry mix

Color parameters	*Soy paneer*		*Green peas*		*Curry mix*	
	Fresh	*Reconstituted*	*Fresh*	*Reconstituted*	*Fresh*	*Reconstituted*
L*	63.15±0.72[a]	59.76±1.17[b]	44.34±1.22[a]	39.87±0.87[b]	53.71±1.12[a]	63.29±0.91[b]
a*	1.12±0.68[a]	11.64±0.91[b]	-20.60±1.01[a]	-10.72±1.21[b]	15.08±1.30[a]	24.62±1.25[b]
b*	7.48±0.81[a]	20.03±1.03[b]	25.11±0.94[a]	41.27±0.88[b]	28.44±1.02[a]	40.55±1.31[b]

*Values with different superscripts in a row for a commodity differ significantly($p<0.05$)

Textural characteristics

The textural properties of the finished product are considered one of the most crucial criteria concerning consumer acceptance. For the rehydrated samples, a compression plate probe is used to analyze the textural qualities including hardness, cohesiveness, adhesiveness, springiness, and chewiness. Peak hardness was determined from the curve recorded from textural profile analysis data of fresh and rehydrated samples. Insertion of vacuum during microwave dehydration further facilitated the generation of porous structure which ultimately led to a puffed and crisp texture [5, 19]. Textural profile analysis of reconstituted soy paneer and green peas (Table 5) shows considerably lower values of textural properties which in turn are near to the values of fresh materials.

Table 5: Textural profile analysis of soy paneer and green peas

Textural properties	*Soy paneer*		*Green peas*	
	Fresh	*Reconstituted*	*Fresh*	*Reconstituted*
Hardness (g)	135.71±1.19[a]	167.38±1.02[b]	7.91±0.73[a]	8.33±0.61[b]
Springiness (s)	1.63±0.85[a]	1.49±1.12[b]	0.94±1.20[a]	1.25±0.57[b]
Cohesiveness	0.59±1.03[a]	0.61±0.82[a]	0.47±0.81[a]	0.49±1.01[a]
Gumminess (g)	80.16±1.21[a]	102.10±0.93[b]	3.71±1.32[a]	4.08±0.27[b]
Chewiness (g.s)	130.51±0.79[a]	152.13±1.01[b]	3.49±0.95[a]	5.10±0.74[b]

*Values with different superscripts in a row for a commodity differ significantly($p<0.05$)

Storage studies

The newly developed instant soy paneer-green peas curry mix must have an extended storage life due to its dehydrated nature. For this purpose, a 50 g quantity of the developed product was packed in PP pouches and stored at room temperature to record storage study data. The product was evaluated based on the microbiological analysis and sensory changes during the storage period with each 4 months' interval.

Microbiological characteristics

The bacterial count (cfu/g), yeast and mold count (cfu/g) and coliform count (cfu/g) of the developed instant soy paneer-green peas curry mix product at storage periods of 0, 4, 8, and 12 months are presented (Table 6). After 24 and 48 hours of incubation, the estimated bacterial and mold counts were found to be considerably low. The reason may be associated with the lower moisture content of the developed product. However, the negligible microbial count could be due to contamination during sample handling affected by the packaging material or environmental air.

Table 6: Microbial storage studies of instant soy paneer-green peas curry mix

Microbial parameters	*0^{th} day*	*4 months*	*8 months*	*12 months*
TPC (cfu/g)	Nil	1.2×10^2	1.3×10^2	1.3×10^2
Yeast & Mold (cfu/g)	Nil	1.1×10^1	1.6×10^1	1.1×10^1
Total coliform (cfu/g)	Nil	Nil	Nil	Nil

Sensory changes

Sensory acceptability of a food product, which is perceived by touching and/or mouth feel, is an important aspect of consumer acceptability

[20]. The sensory evaluation was done using the hedonic scale in terms of appearance, aroma, taste, texture, and overall acceptance to know the acceptance rate of the developed product till the storage period from the initial day. A selected panel of 12 members was asked to evaluate and grade on a 1-9 point scale representing least acceptable to highly acceptable throughout the storage period of the sample. A sensory evaluation of the instant soy paneer-green peas curry is given in Table 7. The evaluation grade obtained indicates that all sensory parameters were well acceptable till the end of the storage period. However, for an instant type of product due to its dehydrated nature, a shelf life of 12 months at room temperature (25±1) is by all means considered good by the general expectations of dried food products while maintaining overall product quality.

Table 7: Sensory changes during storage period of instant soy paneer-green peas curry mix

Sensory parameters	*0^{th} day*	*4 months*	*8 months*	*12 months*
Appearance	7.55 ± 0.15^{a}	7.42 ± 0.11^{b}	7.35 ± 0.15^{c}	7.20 ± 0.18^{d}
Aroma	7.80 ± 0.10^{a}	7.75 ± 0.16^{b}	7.62 ± 0.10^{c}	7.55 ± 0.18^{d}
Taste	8.00 ± 0.17^{a}	7.90 ± 0.14^{b}	7.83 ± 0.07^{c}	7.70 ± 0.16^{d}
Texture	7.70 ± 0.12^{a}	7.70 ± 0.18^{a}	7.64 ± 0.13^{a}	7.57 ± 0.19^{a}
Overall acceptability	7.65 ± 0.09^{a}	7.65 ± 0.03^{a}	7.58 ± 0.12^{b}	7.50 ± 0.14^{c}

*Values with different superscripts in a row differ significantly($p<0.05$)

CONCLUSIONS

In the era of changing food habits and growing interest in milk product alternatives, soy paneer has been well-adopted for a few years as an alternative to milk paneer due to its high nutritional value. Soy paneer is a highly perishable product due to its high moisture content and cannot be stored for longer days; drying is the most suitable operation in order to increase the shelf life by reducing its moisture. Considering the sensitive nature of soy paneer to other thermal techniques, vacuum-assisted microwave drying, a novel drying technology, can be considered the most suitable thermal treatment for drying purposes. India occupies a premium position in the world for its versatile cuisine and a large number of different delicacies. The newly developed product instant soy paneer-green peas curry mix prepared by using vacuum assisted microwave drying technique fulfills all the requirements as discussed above. The product has taken less than 7 min as reconstitution time while retaining most nutrients and maintaining the sensory quality if compared to the fresh product. The vacuum-microwave drying technique highly affects the reconstitution characteristics of the dried product. The product is a rich source of protein, minerals, carbohydrates, and energy. Nonetheless, this novel approach of instant preparation of soy paneer-green peas curry mix is a quicker, healthier, and tastier option for new-aged consumers. The product had a shelf life of 12 months and perceives good sensory grade till the end of the storage period. Therefore, considering all the factors, it can be concluded that vacuum-assisted microwave dried instant soy paneer-green peas curry mix product can be considered a novel and recommendable development in terms of technological, nutritional, and organoleptic aspects.

ACKNOWLEDGMENTS

The authors wish to acknowledge the Defence Research and Development Organization, Ministry of Defence, Government of India, for providing required facilities for conducting the study.

Conflict of interest

The authors declare that there is no conflict of interest regarding work reported in this paper.

REFERENCES

1. Rekha, C. R., &Vijayalakshmi, G. (2013). Influence of processing parameters on the quality of soycurd (tofu). *Journal of Food Science and Technology,* 50(1), 176-180.
2. Maurya, S. B., Shukla, S. S., &Gour, L. (2018). Studies on physical and hunter colour of gamma irradiated tofu (soy paneer). *International Journal of Current Microbiology and Applied Sciences,* 7, 2008-2018.
3. Malik, T., Saxena, M., &Sonu, K. S. (2018). Development of a ready to cook curry. *International Journal of Innovative Science and Research Technology,* 3(3), 354-357.

4. Ozcan-Sinir, G., Ozkan-Karabacak, A., Tamer, C. E., &Copur, O. U. (2018). The effect of hot air, vacuum and microwave drying on drying characteristics, rehydration capacity, color, total phenolic content and antioxidant capacity of Kumquat (Citrus japonica). *Food Science and Technology,* 39, 475-484.
5. Chauhan, O. P., Bhawya, D., Kumar, M., Roopa, N., & Raju, P. S. (2015). Effect of variable microwave power and vacuum levels during dehydration on the quality attributes of potato cubes. *American Journal of Advanced Food Science and Technology,* 3, 53-66.
6. Bal, A., Chauhan, O. P., Pandey, A. K., Semwal, A. D., Mishra, A., Almujaydil, M. S., & Mahmoud, E. A. (2022). Development of instant paneer type product from groundnut using microwave dehydration. *Food Science and Nutrition,* 10(5), 1520-1526.
7. AOAC (2000) Official Methods of Analysis. 17th Edition, The Association of Official Analytical Chemists, Gaithersburg, MD, USA.
8. Merrill, A.L. & Watt, B.K. (1973) Energy Value of Foods: Basis and Derivation. Agriculture Handbook No. 74, ARS United States Department of Agriculture, Washington DC.
9. Ranganna, S. (2001) Hand Book of Analysis and Quality Control for Fruits and Vegetable Products. 7th Edition, Tata McGraw Hill Book Co., New Delhi.
10. AOAC (2005) Official Methods of Analysis. 18th Edition, AOAC International, Rockville.
11. Lawless, H.T. and Heymann, H. (1998) Sensory Evaluation of Food: Principles and Practices. Chapman and Hall, New York.
12. Ojha, A., Kulkarni, D. N., Sharma, A., & Joshi, S. (2014). Effect of concentration of coagulant and soaking time on retention of major isoflavones and quality of soy-paneer. *Asian Journal of Dairy and Food Research,* 251-254.
13. Malik, T., & Kajla, P. (2020). Comparative nutritional and microbiological quality of ready to cook mixed vegetable curry. *Journal of Food Science and Technology,* 57(6), 2099-2106.
14. Feng, H., & Tang, J. (1998). Microwave finish drying of diced apples in a spouted bed. *Journal of Food Science,* 63(4), 679-683.
15. Lewicki, P. P. (1998). Some remarks on rehydration of dried foods. *Journal of Food Engineering,* 36(1), 81-87.
16. Mahendran, T., & Prasannath, K. (2010). Influence of pre-treatments on quality of dehydrated ripe banana (*Musa acuminata* cv. Embul). *Journal of Food and Agriculture,* 1(2), 11-16.
17. Jiang, N., Liu, C., Li, D., Zhang, Z., Liu, C., Wang, D. I., & Zhang, M. (2017). Evaluation of freeze drying combined with microwave vacuum drying for functional okra snacks: Antioxidant properties, sensory quality, and energy consumption. *LWT-Food Science and Technology,* 82, 216-226.
18. Hodge, J. E. (1953). Dehydrated foods, chemistry of browning reactions in model systems. *Journal of Agricultural and Food Chemistry,* 1(15), 928-943.
19. Bal, A., Chauhan, O. P., Xavier, J. R., &Semwal, A. D. Use of Vacuum-assisted Microwave Drying for Development of Instant Soy Paneer. *Journal of Food and Agriculture Research,* 1(2), 142-156.
20. Obatolu, V. A. (2008). Effect of different coagulants on yield and quality of tofu from soymilk. *European Food Research and Technology,* 226(3), 467-472.