Study on the effect of stepwise decreasing microwave power drying (SDMPD) of moth bean sprouts on its quality

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Abstract

Vigna aconitifolia (Jacq.), locally known as moth bean, is a drought-resistant pulse crop and grown in arid and semi-arid areas of India. Green pods and grains, in cooked or sprouted form, are a mostly consumable part of the plant as they are rich in protein. Sprouting increases the bioavailability of protein by 30%, but bacterial contamination is high in sprouts due to its high initial moisture content that creates a problem for its storage. Hence, to rectify the said problem, drying the sprouts up to storable moisture level can be the best solution. The microwave drying was investigated for drying of sprouted moth beans. The microwave drying of sprouted moth beans using single microwave power was not suitable for drying, as the burning of the product takes place before reaching desired moisture content while dried at a microwave power of 900, 720, 540, and 360 W. During the drying at a microwave power of 180 W, it took about an hour for drying. However, during this drying, by the time it reaches moisture content at around 57.89 kg per 100 kg dm, the product shows browning. Therefore, a new technique was employed for drying sprouted moth beans, that is, Stepwise Decreasing Microwave Power Drying (SDMPD). The sprouts were dried at each microwave power level, in decreasing order for a particular time at each respective microwave power, to reduce the browning effect thus protecting the product from burning. The sprouted moth beans were dried in 19 min using SDMPD. The rehydration ratio was found to be 1.96. The moisture content of resultant dried sprouted moth beans was found to be 4.95 kg per 100 kg dm with a minimum color change (Δe*) of 10.46, which was found to be reduced up to 6.84 after rehydration, indicating the improved color.

KEYWORDS
drying, microwave, moth bean, rehydration, sprouts

1 INTRODUCTION

Moth bean is famous with vernacular names, namely, Math, Kheri, Madike, Bhioni, Kunkuma, and Matki, in different languages in different regions of India, that represents its social awareness and importance. It is mostly known as drought hardy legume and grown in a dry and warm climate. Moth beans are a multipurpose crop and are a source of food, fodder, feed, and green manuring and used as pasture. Its green pods are consumed as vegetables. As moth bean is a pulse grain, it is an economical source for combating deficiency of protein.

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Moth bean is popular for a higher percentage of albumin and glutamine fractions of protein, lysine, and leucine amino acids (Bravo, Siddharaju, & Calixto, 1999). The snack items like papad, mangori, mogar, and bhujia-namkin are prepared from dry seeds of moth beans and are consumed daily. Multidimensional uses of moth beans help industries in growing a big way, exporting above said commercial edible products and creating employment through agro-based industries (Kumar, 2002). Chitra, Singh, and Rao (1996) revealed that consuming cereals with protein-rich legumes is considered to be one of the best ways to combat protein calorie-malnutrition in the world. Leguminous seeds are a good source of proteins and antioxidants. Phenolic compounds such as flavonoids, phenolic acids, and tannins are obtained from legumes. These natural phytochemicals and antioxidants from plants play an important role in the treatment and/or prevention of many diseases (Gupta, Shrivastava, Singh, & Bhagyawant, 2016).

Moth bean is mostly consumed by people in rural areas and the tribal belts of different states in India. Seeds are processed in dhal and/or are generally used in the sprouted form (Nimkar, Mandwe, & Dudhe, 2005). Sprouts are pre-digested food material. In the process of sprouting, stored inactive nutrients are converted into a sort of nutritional supplement by the seed’s enzymes which make sprout grow rapidly during the early days of its life. Sprouting results in the breakdown of protein into amino acids in presence of proteases enzymes, fatty acids are formed by the action of lipase enzyme from fats, and starches are converted into sugars in presence of amylases enzyme.

Negi, Boora, and Khetarpaul (2001) studied the effect of microwave cooking on the starch and protein digestibility of some newly released moth beans (Phaseolus aconitifolius Jacq.) cultivars. It was found that microwave cooking appreciably improved the bioavailability of starch and protein of unsoaked, soaked, and soaked-dehulled samples. However, most improvements in starch edibility (from 27.28 to 62.57 mg maltose released/g) were detected in soaked-dehulled and microwave cooked samples of Jwala variety, and equally, most improvements in protein edibility (from 72.29% to 87.56%) were detected in soaked-dehulled microwave cooked sample of RMO 225 variety.

As a typical pattern of the studied cases, microwave power-assisted drying greatly reduced drying time compared to alternative techniques (Gursoy, Choudhary, Watson, & Gursoy, 2013; Shivhare, Raghavan, Bosisio, & Giroux, 1993; Vadiavambal & Jayas, 2007). In general, under microwave techniques, the drying rate will increase as microwave power and temperature increase (Chua & Chou, 2005; Ozkan, Akbudak, & Akbudak, 2007; Rajole & Pardeshi, 2019; Rayaguru & Routray, 2011). Also, there is a consensus about the improvement of the energy efficiency applying microwave technology for drying purposes. According to the facts mentioned above, microwave drying is highly recommended for drying seeds, fruits, and vegetables because it reduces the drying time and energy consumption, but for biological materials, it is strongly recommended to analyze the quality parameters of the final dried product. Therefore, to stabilize the practicability of the microwave technology in the drying process, options like drying time, energy potency, and quality should be thought-about at the same time. The larger parts of the studies are based on drying rate and quality criteria, but the energy consumption is only evaluated in a few studies (Jiang, Zhang, Liu, Mujumdar, & Liu, 2013; Ozkan et al., 2007; Sharma & Prasad, 2006).

Most assays reveal that microwave drying permits increased drying rates without affecting, even improving, the quality of the final product. Although the methodology utilized, and also the power level ought to be rigorously chosen to avoid harm within the samples, that is, the germination rate and also the quality of the ultimate product decrease with higher power level or a while of exposure to microwave radiation (Gursoy et al., 2013; Warchalewski & Gralik, 2011; Wesley, Lyons, Gariepy, & Gariepy, 1974). It ought to be pointed that the time needed for seeds, fruits, and vegetable drying depends not solely on the power or temperature utilized, however additionally on the initial wet content. Higher initial moisture content requires higher exposure time, which is an important question, especially for tropical or sub-tropical species.

However, most of the studies analyzed have been performed to investigate the effects of different microwave power levels on quality parameters. A fixed microwave power level has been applied during the entire process, but no temperature control has been included in the studies. The absence of temperature control involves the presence of hot spots, besides the drying going on; the decrease in mass of the product due to the loss of the initial moisture; and, therefore, the power density increases during the last stage of drying. It produces undesirably high values of temperature, which causes charring of the sample and, consequently, a decrease in seed viability and final product quality. According to Li et al. (2010a), to achieve an ideal drying effect over the entire microwave drying process, sample temperature must be controlled, and microwave power must be adjusted mainly in the final stage of the drying process.

There are only a few studies carried out on temperature control during the microwave drying process (Li, Raghavan, Wang, & Gariepy, 2009; Li, Raghavan, & Orsat, 2010; Li, Raghavan, & Wang, 2010; Nair, Gariepy, & Raghavan, 2011) improving drying effects in terms of time, energy efficiency, and product quality. The sample temperature in microwave drying is more difficult to control as compared to that in the case of hot air drying, in which product temperature never rises beyond air temperature. Therefore, the best temperature control is achieved with adjusted power by power–moisture content relationship and feedback temperature control (Li et al., 2010b). Consequently, a good temperature and power adjustment could avoid the need to use combined techniques which are more complex and expensive procedures.

Sprouts get contaminated by bacteria and other microbes due to their high moisture content. It can be stored up to 5 to 10 days with 95–100% RH at 0°C (DeEll, Vigneault, Favre, Rennie, & Khanizadeh, 2000). Therefore, there is a need to remove the moisture from it to reduce the water activities to preserve them. The removal of moisture through simultaneous heat and mass transfer can be performed by the dehydration process, which provides more shelf life and reduces weight and volume (Bakshi et al., 2013; Hota et al., 2017).
Keeping this factor in view, the present investigation was undertaken to study the drying behavior of sprouted moth beans using different levels of microwave power or combinations thereof and to study rehydration of dried sprouted moth beans.

2 | MATERIAL AND METHOD

2.1 | Preparation of sample

The moth beans of cultivar N88 were used for purpose of experimentation. The dried moth beans were chosen for obtaining sprouts and further experiment on microwave drying thereof. The moth beans were cleaned, graded, and washed for removing dirt and other impurities. The experiment was carried out in 16 perforated containers (7 x 10 cm) of SS material placed in one plastic tray (30 x 36 cm; Ledaskar, Deshmukh, & Pardeshi, 2018). The samples were soaked in potable water (1:10 w/v ratio) for 3, 6, and 9 h. The excess water was drained, and the samples were kept for sprouting at 27°C temperature for sprouting in a plastic tray for 24 h (Dattatray, Monica, Surendra Babu, & Jaganmohan, 2019; Singh, Jain, & Sharma, 2015). The rinsing at an interval of 6 h in clean water during sprouting was followed as suggested by Pardeshi and Tayade (2013) as in the case of sprouting of soybean. A similar process for the sprouting of fenugreek (Shirke, Pardeshi, Jadhav, Pagar, & Pujari, 2020) and wheat (Ledaskar et al., 2018) was followed for better resultant sprouts. Samples of about 10 g were taken out at every 2 h interval and analyzed for sprouting percentage. The sprouting percentage was calculated as shown in Equation 1. Based on the sprouting percentage, the process conditions of the sprouting were determined and used for further study.

\[
\text{Sprouting percentage (\%)} = \frac{\text{The total number of seeds sprouted}}{\text{Total number of seed soaked}} \times 100.
\]

2.2 | Determination of moisture content

Using the hot air oven drying method, the initial moisture content of the sample was determined. The weight of samples was measured using the electronic weighing balance (least count 0.001 g). Hot Air Oven was set at 105°C, and the sample was kept for 24 h (AOAC, 2000). The moisture content (M) was calculated using Equation 2.

\[
M = \frac{W_a - W_b}{W_b} \times 100,
\]

where \(M\) = moisture content, kg/100 kg dry matter (dm); \(W_a\) = initial weight of sample, g; and \(W_b\) = final weight of the sample (dm, dry matter), g.

2.3 | Determination of moisture ratio

The MR of the sample was calculated using Equation 3 (Chakraverty, 1988).

\[
MR = \frac{M - M_e}{M_0 - M_e},
\]

where \(MR\) = moisture ratio; \(M\) = moisture content of sample, kg/100 kg dm; \(M_e\) = equilibrium moisture content of sample kg/100 kg dm; and \(M_0\) = initial moisture content of the sample, kg/100 kg dm.

The drying rate (kg/100 kg dm per min) of the sample during the drying period was determined by Equation 4 (Chakraverty, 1988).

\[
\text{Drying Rate (} \frac{D_t}{t} \text{)} = \frac{\Delta W}{\Delta t} \times 100,
\]

where \(\Delta W\) = weight loss in given interval, kg/100 kg dm, and \(\Delta t\) = difference in time reading for given interval, min.

2.4 | Experiment setup and procedure

The freshly sprouted moth beans were washed, and surface water was removed. A 50 g sample with 0.20 g/cm² spread density was loaded on a rotating plate in a microwave oven for further experimentation of drying study undertaken during this work. The experiment was carried out in two steps. The first step includes the continuous microwave drying of sprouted moth beans at five different microwave power fields, that is, 900, 720, 540, 360, and 180 W using a microwave oven (IFB 30SC4, 900 W rated power). The weight reduction was noted at 1 min interval of time. The samples were weighed using an electronic weighing balance with an accuracy of 0.001 g. In the first set of experiments, the drying was done at a particular microwave power field for different time intervals (1, 2, ..., min), and moisture content after each drying time was determined. This experiment was done to determine the occurrence of the burning of a product being dried using particular microwave power. Kenghe, Yewale, and Kanawade (2016) studied the effect of different drying techniques on dehydration of sprouted moth beans. The samples were dried approximately to an equilibrium moisture content of 11.62 kg per 100 kg dm to 5.68 kg per 100 kg dm depending on the nature of drying. Accordingly, the prefixed weight of the sample was taken for each experiment and dried until the moisture content of the sample reached below 10.00 kg per 100 kg of dm. The color values were noted, and deviation in color from a fresh sample (ΔE) was estimated, as discussed in Section 2.4. In the second experiment, the drying was done with a stepwise reduction of microwave power for a fixed time (Table 1). In the second step, stepwise decremental microwave power drying of sprouted moth beans was carried out. Sprouted moth beans were dried at a particular interval of time at decreasing microwave power field from 900 to...
180 W as per the detailed combinations of experiments given in Table 1.

2.5  |  Color analysis

The color (L, a, and b values) was measured using Chromameter (CR-400). Hunter L, a, and b color scales were used for measurement of color values and are based on the Opponent-Color Theory. The assumption of Opponent-Color Theory is the receptors in the human eye perceive color as the following pairs of opposites (Hunter and Harold, 1987).

An object’s color is completely described using the following three values.

\[
\Delta a = \Delta a_{\text{fresh}} - a',
\]

\[
\Delta b = \Delta b_{\text{fresh}} - b',
\]

\[
\Delta L = \Delta L_{\text{fresh}} - L',
\]

\[
\Delta E = \sqrt{\Delta L^2 + \Delta a^2 + \Delta b^2},
\]

where \(\Delta E\) is the change in color of dried sample concerning fresh sample of sprouted moth beans, \(L\) indicates the level of light or dark, \(a\) indicates value of redness or greenness, and \(b\) indicates the value of yellowness or blueness.

2.6  |  Rehydration ratio

The whole dried sample was taken for rehydration. The weighed 10 g (\(W_1\)) of dried sample was kept in 10 times w/v of hot water at 93°C (Ogwal & Davis, 2006), and the rehydrated sample was drained and weighed after removal of surface moisture. The said final weight was noted as \(W_2\). The time of rehydration was fixed as 10 min based on observations noted in Table 3 and Figure 7. The rehydration ratio (RR) was determined using Equation 9.

\[
RR = \frac{W_2}{W_1},
\]

where \(W_1\) = initial weight of dried moth beans sample, g, and \(W_2\) = final weight of rehydrated moth beans, g.

3  |  RESULTS AND DISCUSSION

3.1  |  Effect of soaking time on sprouting percentage

Moth beans were sprouted as discussed in Section 2.1. Figure 1 indicates the effect of different soaking times on the sprouting rate of moth beans. It indicates that the sample soaked for 6 h (97% sprouting) and 9 h (97.5% sprouting) showed the highest sprouting percentage in 20 h of sprouting whereas the sample soaked for 3 h showed 88% of sprouting in 22 h. Thus, it could be inferred that the increase in soaking time from 3 to 6 h has a desirable effect on sprouting percentage whereas the sprouting showed little increase for soaking more than 6 h. An increase in the sprouting rate could be the effect of sufficient hydration of moth bean during the soaking time of 6 and 9 h, as during hydration, the metabolic activity of resting seeds increases, which leads to complex metabolic changes resulting in the onset of sprouting process (Kavita & Deepika, 2017). Insufficient imbibition of water during 3 h soaking resulted in the less sprouting rate of the sample. Sufficient soaking time followed by maximum sprouting will help to enhance the nutritional quality of moth beans as it helps to reduce the anti-nutritional factors. These results are per the study conducted by Chitra et al. (1996), who observed a 60% reduction in phytic acid content in chickpea and pigeon pea and over 40% reduction in green gram on germination.

3.2  |  Effect of microwave power level on drying of sprouted moth beans

3.2.1  |  Variation in moisture content with drying time

The drying of sprouted moth beans was carried out as discussed in Section 2.4. Figure 2 shows the drying curves for the sprouted moth beans. From Figure 2, it could be observed that an effective factor in reducing the time required for drying was microwave power. The time required for drying decreases from 95 to 5 min with the increase of microwave power from 180 to 900 W. The drying of samples at 900 W requires 94.74% less time as compared to that at 180 W. The final and targeted moisture content of the entire samples was ranging from 0 to 10.00 kg per 100 kg of dm for all the samples investigated. It was seen that moisture content decreased at faster rates during the initial stage and considerably slowed down later, as shown in Figure 2. It was clear that the moisture removal rate increased with the increasing levels of microwave power used for drying purposes. The rate of moisture removal was higher at higher microwave power as well as higher in the initial stages of drying and reduced gradually with an increase in drying time (Sedani, 2019). This was due to the very high initial moisture concentration in the sample. In a microwave oven, the moisture removal rate (Patil, Pardeshi, & Shinde, 2015) was higher with
minimum drying time as compared to that using other drying methods like sun drying, solar drying, and hot air drying (Patil, 2015). Equilibrium moisture content was treated to be zero kg per 100 kg dm (Maskan, 2000) as removal of moisture continues with time and, subsequently, the product may get burnt (Soysal, 2004). This may be because during microwave heating, the moisture from a product is removed even up to the bone dry state and the further heating leads to loss of dry matter making it difficult to attain a state of equilibrium (Sedani, 2019). Badguraj, Karpe, and Kalbande (2019) found that the Sun drying and solar tunnel drying took, respectively, 13.5 and 16.5 h for drying of sprouted moth bean. The average drying rate was found to be 0.01519 and 0.0074 kg per 100 kg bone dry mass per min corresponding to an average moisture content of 0.4160 and 0.4236 kg per 100 kg dm, for solar tunnel dryer and open sun drying, respectively. Ullah and Kang (2017) reported that the moisture content of the product was decreased with the higher temperature of the dryer. Microwave drying required less drying time in achieving the required moisture content as compared to other drying methods.

3.2.2 Variation in drying rate with average moisture content

The drying rate indicates the extent of the removal of moisture periodically from the sprouted moth beans. The drying rate is proportional to the absorbed microwave power in all phases of the process. Figure 3 shows the drying rate of sprouted moth beans concerning different microwave powers. It could be concluded from Figure 3 that the total drying took place in the falling rate period at higher power whereas at 180 W, the drying was carried out in a constant rate period up to moisture level of 90 kg per 100 kg dm followed by
gradually falling rate period. Shinde, Pawar, and Khodke (2016) reported that the moisture movement during the drying process occurs through capillary movement toward the outside surface even though the rate of drying wasn't constant. The highest drying rates were observed during drying at 900, 720, and 540 W power levels, and the lowest drying rate was observed during drying at 180 and 360 W microwave power levels. When moisture content decreases, the rate of drying also decreases. This was because of decreased dielectric loss constant and decreased absorption of microwave energy of relatively dried sprouted moth beans. Higher energy is needed for breaking away bound water, whereas little energy is required for the removal of free water. However, there was a continuous rise in product temperature because the energy absorbed by the product was higher than that required to vaporize water. This results in burnt spots occurring at the last stage of drying. Increasing the microwave power from 180 to 900 W results in an increase in the drying rate. Similar results were obtained in microwave drying of carrot (Wang & Xi, 2005), dill leaves (Sedani & Pardeshi, 2018) and Mint leaves (Özbek & Dadali, 2007; Sedani & Pardeshi, 2019).
3.3  Effect of drying time and microwave power on the burning of sprouts

The product starts to burn before it reaches to final moisture content at high microwave power (Rajole & Pardeshi, 2019) as discussed earlier. However, as evidenced in Figure 4, the burning consequence in form of some small black or brown dots was observed at 80% of total drying time at 900 W, 75% of total drying time at 720 W, 80% of total drying time at 540 W, and 95.23% of total drying time at 360 W. Although there was no burning spot observed during drying at 180 W, the browning starts from 57.89% of total drying time, which is not desirable. Table 2 shows microwave power, drying time, and moisture content of the sample when the occurrence of burning during microwave drying of sprouted moth beans at different levels of microwave power. The moisture loss throughout microwave heating is a crucial issue while planning microwave processes for grain or different foods. Uneven heating, like edge heating, will increase moisture loss (Ni & Datta, 1999). The drying is directly related to the product’s moisture content (Pardeshi, Arora, & Borker, 2009). As the microwave power increases, heat generation inside the product increases, and if not controlled or cut down a particular time, the product will start losing its volatiles and lead to a burning effect. The drying rate is proportional to the absorbed microwave power in all phases of the process (Gaukel, Siebert, & Erle, 2016).
To mitigate the problem of burning sprouted moth beans during the microwave drying process, a new method was investigated for drying sprouted moth beans. Using graphs in Figure 4, the drying time, where the product starts burning, was noted, and a new experiment was designed for drying sprouted moth beans using different microwave powers. The new experiment was formulated and conducted by subjecting the sprouted moth beans to the identified slot of drying time at a varied and decreasing level of microwave powers as 2 min at 900 W, next 2 min at 720 W, next 3 min at 540 W, next 4 min at 360 W, and rest 8 min at 180 W, respectively. Time was determined with the help of Figure 4. The so formulated drying process collectively required 19 min to reach the desired moisture content. The dehydration ratio (Kaur, Kaur, Oberoi, Gill, & Sogi, 2008) was found to be about 2.40 from the observations recorded as an initial weight to the final weight of dried materials.

### 3.4 | Effect of stepwise decreasing microwave power drying (SDMPD) of sprouted moth beans

Figure 5 revealed the reduction of moisture content at different and decreasing levels of microwave power. The final moisture content attained was 9.69 kg per 100 kg dm at the end of said drying. The corresponding variation of rate of drying concerning average moisture content is shown in Figure 6. The continuously decreasing drying rates are observed with decreasing moisture content at all levels of microwave power used for drying. The required drying of 19 min under this present study was very less as compared to that required as 720 min under drying of sprouted moth beans at 50°C (Singh et al., 2015), 600 min for drying at 60°C, 780 min under the Sun, and 2,100 min under shade drying of sprouted moth beans (Kenghe et al., 2016).

### 3.5 | Effect of stepwise decreasing microwave power drying of sprouted moth beans on the color deviation of the sample

The parameter L, a, and b are used to calculate Δe*. The change in color, that is, Δe*, as per Equation 8, of the dried product, as compared to fresh sprouted moth beans sample was found to be 10.46. The change in color, that is, Δe* of rehydrated samples concerning fresh sprouts, was accounted to be 6.84, thus showing improved color after rehydration. Jokic et al. (2009) studied the influence of drying on color and rehydration characteristic of wild asparagus, during the convective drying process, and noted that the Δe after rehydration was lesser than dried sample. The Δe of sample dried at 40°C, 50°C, 60°C, and 70°C was 4.98, 10.42, 11.01, and 13.91, respectively, and of rehydrated sample dried at 40°C, 50°C, 60°C, and 70°C were 3.77, 12.84, 7.59, and 9.78, respectively, thus showing improved color after rehydration.

| Time  | Weight   |
|-------|----------|
| 0 min | 10.000   |
| 1 min | 15.666   |
| 2 min | 16.937   |
| 3 min | 17.364   |
| 4 min | 17.964   |
| 5 min | 18.430   |
| 6 min | 18.958   |
| 7 min | 19.127   |
| 8 min | 19.550   |
| 9 min | 19.735   |
| 10 min| 19.952   |
| 11 min| 19.955   |
| 12 min| 19.956   |
| 13 min| 19.957   |
| 14 min| 19.958   |
| 15 min| 19.959   |

### 3.6 | Effect of stepwise decreasing microwave power drying of sprouted moth beans on rehydration

The RR at a pre-estimated rehydration time of 10 min was calculated as per Equation 9. Table 3 represents the data showing weight during rehydration. As per observation from Figure 7, the weight gain by moth beans was stagnated after 10 min of rehydration; therefore, the time of the process of rehydration was fixed as 10 min after adding the weighted sample (W1) in 10 times w/v of hot water (93°C; Ogwal & Davis, 2006). The RR was found to be 1.96 against the dehydration ratio of 2.40, thus 81.67% regaining of moisture as possible. The high regain of moisture during rehydration may be due to the undisturbed matrix of food material as a result of the faster drying process. A similar RR as 1.94 was observed by Ogwal and Davis (2006) for beans by rehydration in the water at 93°C for 30 min. At a higher rehydration temperature, a lower rehydration time was observed by Vazquez, Ulloa, Ulloa, and Ramirez (2015). The rapid initial water uptake by legumes has been attributed to the filling of capillaries on the surface of the seed coats and at the hilum (Ulloa et al., 2013). The decline in rehydration rates at later stages is related to the combined effects of increased extraction rates of soluble materials and lower water absorption, presumably because of the water filling the free capillaries and intercellular spaces. Subsequently, the amounts of water absorbed with further rehydration were minimal until equilibrium was attained, which signaled the maximum water capacity of the instant whole bean. Similar rehydration patterns have been reported in many foodstuffs (Ghafoor, Misra, Mahadevan, & Tiwari, 2014; Vega-Galvez, Notte-Cuello, Lemus-Mondaca, Zura, & Miranda, 2009; Yildirim, Oner, & Bayram, 2010).
4 | CONCLUSION

The stepwise decreasing microwave powder drying (SDMPD) of sprouted moth beans could dry the material in 19 min and helped prevent the product from burning. The RR was found to be 1.96 as compared to the dehydration ratio of 2.40, ensuring a low change in color, that is, to the extent of 10.46, which was reduced to 6.84 after rehydration, showing improved color and approaching toward that of a fresh one. This method can be used for drying sprouted moth beans to preserve them for further usage, as and when required.

CONFLICT OF INTEREST
The authors have no conflict of interest.

ETHICS STATEMENT
The experiment is conducted as per requisite statistical design and conducted scientifically, and the results obtained are first-hand observations.

AUTHOR CONTRIBUTIONS
S. R. Sedani conducted the actual experiment. I. L. Pardeshi looked after the idea, data analysis, and other related issues. A. R. Dorkar has physically helped in the conductance of experiments.

DATA AVAILABILITY STATEMENT
The data that support the findings of the study are available from the corresponding author upon reasonable request.

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