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Studies on physico-chemical characteristics of bitter gourd powder

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Abstract
The present investigation was carried out to study the physical and chemical characteristics of bitter gourd and bitter gourd powder. Physical properties of bitter gourd are such as colour, shape, length, width and weight were determined. The colour of fresh bitter gourd was light green, shape was spindle, length 18.3 cm, width 4.56 cm and weight was 175.86 gm. Physical such as bulk density, true density, compressibility index, angle of repose were determined for prepared bitter gourd powder. It revealed that bulk density and tapped density of bitter gourd powder was 500kg m^{-3} and 666kg m^{-3} respectively. Angle of repose of bitter gourd powder was 35.5^0. Compressibility index and static coefficient of friction of bitter gourd powder was 24.92% and 0.83 respectively. Moisture content, protein, fat and carbohydrates were also evaluated. Further, chemical composition was reported and results showed that the moisture content 92.2%, fat 1.02%, protein 0.90%, ash 1.4% and crude fibre 2.08% in bitter gourd powder. The obtained study was found to be significant for the designers and processers in designing equipment for processing.

Keywords: Bitter gourd, bitter gourd powder, physico-chemical characteristics

Introduction
Momordica charantia (Cucurbitaceae) is a tropical plant with green leaves and yellow flowers. The bitter gourd fruit is grown for its edible purpose in African, Asian, and South American countries as well as in the Caribbean (Basch, *et al*., 2003) [2]. Depending on the variety, the immature fruit is white or green with a different size and shape. The immature fruit is a cheap vegetable available the whole year at local markets in southern and eastern Asia and tropical Africa.

Bitter gourd (*Momordica charantia* L.) belongs to the family of Cucurbitaceae and known as one of the bitterest fruits. It actually originated in India and eventually carried to China during the 14th century. It is tropical and subtropical climber. Bitter gourd received different names such as bitter gourd or bitter melon for its English name and Goya for its Japanese name. It is known with different common names in different Indian languages i.e. Hindi – Karela; Sanskrit – Karavelli; Marathi – Karli; Gujarati – Karelo; Bangali – Baramasiya; Kannada – Karali; Malayalam – Kaypa; Tamil – Pakar; Telugu – Kakara. Bitter gourd is one of the nature's most bountiful gifts and is one of the discarded vegetables by people, just because of its bitter taste as it contains a bitter compound called momordicin. Bitter gourd fruits consist of glycosides, saponins, alkaloids, reducing sugars, resins, phenolic constituents and free acids. (Thakur & Sharma, 2016) [12].

Bitter gourd contains bitter chemicals like charantin, vicine, glycosides and karavilosides along with polypeptide-p, plant insulin, which are hypoglycemic in action and improve blood sugar levels by increasing glucose uptake and glycogen synthesis in the liver, muscles and fat cells (Raman & Lau, 1996) [8]. Bitter melon contains another bioactive compound i.e. lectin that has insulin like activity due to its linking together 2 insulin receptors. This lectin lowers blood glucose concentrations by acting on peripheral tissues and, similar to insulin's effects in the brain, suppressing appetite (Harinantenaina *et al.*, 2006) [4].

Some studies have shown that at least three components (steroidal saponins, insulin like compounds and alkaloids) were found in bitter gourd plant parts that elicit hypoglycemic potential and/or other benefits for sufferers of diabetes mellitus. The hypoglycemic effect of these chemicals is more pronounced in fruit, where they are present in great abundance. Of the rich mixture of hypoglycemic compounds in bitter gourd fruit, charantin, vicine, and polypeptide-P are thought to provide the major diabetic medical benefits (Yoh *et al.*, 2003) [14]

It is rich in nutrients such as essential amino acids, vitamin A, carotenoids, folic acid, and vitamin C and the whole plant contains many bioactive compounds. Momordin-I is reported as having tumour protective effects; momordicines-I and II as having antimicrobial, acylglucosylsterols antimutagenic, and chitinase bacteriostatic effects (Nerurkar *et al.,* 2008) [6].
In the present study the physical and chemical characteristics of fresh bitter gourd and bitter gourd powder evaluated for the standardisation and preparation of value added products to achieve the desirable objectives.

Materials and Methods

Materials

Raw materials

Raw materials fresh bitter gourd was procured from the local 'Parbhani' market, Maharashtra.

Chemicals and glassware

Chemicals, reagents, glasswares and processing equipment required for analysis and processing were made available from Department of Food Chemistry and Nutrition, Department of Food Microbiology and Safety and Pilot plant, College of Food Technology, VNMKV, Parbhani.

Methods

Pre-treatment to bitter gourd

Fresh bitter gourds were washed using water to remove adhere material then cut by knife into 3mm thickness. Then 2% NaCl was sprinkled and kept that for 15 minutes. Then by using muslin cloth bitter gourd slices were squeezed to remove the excess water and reduce the bitterness.

Drying

The treated bitter gourd slice of 3mm were uniformly spread in a single layer on steel trays and dried at 60^0C for 6hrs by maintaining air velocity at 1.2 m/s in cabinet tray dryer Donal *et al*., 2016) [3].

Preparation of bitter gourd powder

Bitter gourd powder was prepared by grinding the dried slices of bitter gourd and pulverized continuously till the whole sample passed through 160 micron sieves. Obtained powder was weighed and packed in HDPE pouch (Ozgur *et al*. 2013) [7].

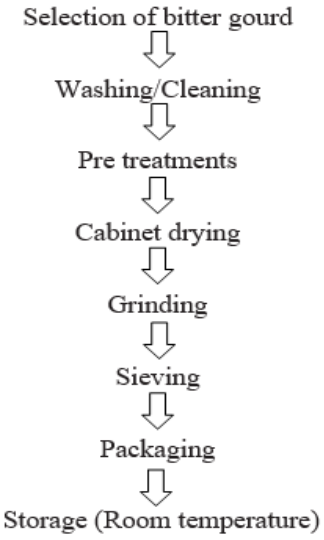

Fig 1: Preparation of bitter gourd powder

Different analysis

Physical properties of fresh bitter gourd

The physical quality parameters of fresh bitter gourd such as color, shape, length, width and weight were determined. Color and shape of fresh bitter gourd was determined by visually. Length and width of bitter gourd fruit was measured by using Vernier caliper having 0.001 mm accuracy (Wandhekar *et al*., 2021) [13]. Weight was measured using digital weighing balance.

Physical properties of bitter gourd powder

Physical properties such as angle of repose, bulk density, tap density, compressibility index and coefficient of static friction were determined for the bitter gourd powder as per the methods given by (Micha,1983) [5].

Proximate composition of bitter gourd powder

Bitter gourd powder samples was analysed for moisture, protein, fat, total ash, crude fibre and total carbohydrate contents according to their respective standard methods as described in (AOAC, 2000; Ranganna, 1986) [1, 9].

Mineral analysis of bitter gourd powder

5 grams of each sample was weighed in crucible and burn it on heating plate till the sample becomes fumeless. The obtained sample was placed in muffle furnace at 550°C for 5-6 hrs. The obtained ash samples were digested with concentrated Hydrochloric acid (HCL) on hot plate. The digested material was then filtered using Whatman No. 42 filter paper and the final volume made to 100ml with distilled water the obtained mineral solution was further used for analysis with respect to minerals calcium, magnesium, phosphorus, zinc, iron and copper content by using methods given by (Ranganna, 1986) [9].

Results and Discussion

Physical properties of Bitter gourd

The physical properties help in processing, milling and storage of food commodities. The different physical properties of bitter gourd were determined such as color, shape, length, width and weight. The obtained results are presented in the Table 1.

Table 1: Physical properties of bitter gourd

Parameters	Observations
Color	Light green
Shape	Spindle
Length (cm)	18.3±1.27
Width (cm)	4.56±0.25
Weight (g)	175.86±5.81

*Each value represents the average of ten determinations

The length, width and weight of bitter gourd fruit was 18.3cm, 4.56cm and175.86g respectively. The shape and color were observed visually, shape of bitter gourd fruit was found to be spindle and color was light green.

Physical properties of Bitter gourd powder

Physical properties such as angle of repose, bulk density, tap density, compressibility index and coefficient of static friction were evaluated. The results obtained are presented in the Table 2.

Table 2: Physical properties of Bitter gourd powder

Parameter	Observations
Angle of repose (º)	35.5±0.28
Bulk density (kg.m^{-3})	500±34.54
Tapped density (kg.m^{-3})	666±30
Compressibility index (%)	24.92±3.15
Static coefficient of friction	0.83±0.021

*Each value represents the average of ten determinations

Results obtained for physical properties of bitter gourd powder revealed that bulk density and tapped density of bitter gourd powder was 500kg m^{-3} and 666kg m^{-3} respectively. Angle of repose of bitter gourd powder was 35.5^0. Compressibility index and static coefficient of friction of bitter gourd powder was 24.92% and 0.83 respectively.

Proximate composition of bitter gourd and bitter gourd powder

The chemical composition of bitter gourd was carried out for the parameters such as moisture, ash, protein, fat and fibre. Obtained results are presented in Table 3.

Table 3: Proximate composition of bitter gourd

Parameters	Observations
Moisture (%)	92.2±0.1
Ash (%)	1.4±0.2
Protein (%)	0.90±0.01
Fat (%)	1.02±0.41
Carbohydrate (%)	2.4±0.12
Fibre (%)	2.08±0.03

*Each value represents the average of three determinations

The moisture content was very high in bitter gourd and it was 92.2%. The protein and fat content of moisture free bitter gourd powder was found to be 0.90 and 1.02% respectively. Ash content of bitter gourd powder was 1.4%. Fibre content was found to be in good amount 2.08%. Carbohydrate content was calculated by difference method and it was found that 2.4%. Obtained results for the chemical composition found to be significance with the (Satkar *et al*., 2013) [10].

Mineral composition of Bitter gourd powder

Minerals are inorganic elements needed by the body as structural component and regulators of body processes. The results given with respect to various minerals such as calcium, potassium, magnesium, iron, and zinc were determined and accordingly results presented in Table 4.

Table 4: Mineral content in bitter gourd powder

Parameters	Values (mg/100g)
Calcium	23.76±0.35
Potassium	25.8±0.4
Magnesium	16.13±0.20
Iron	0.86±0.15
Zinc	0.26±0.15

*Each value represents the average of ten determinations

The concentration of these minerals was recorded to be calcium (23.76mg), potassium (25.8mg), magnesium (16.13mg), iron (0.86mg), and zinc (0.26mg) respectively. The concentration of calcium, potassium and magnesium were much higher than the other inorganic minerals. However, zinc was found very low in bitter gourd powder. Similar results for mineral composition of bitter gourd powder were reported by (Sorifa, 2018) [11].

Conclusion

From the present study it can be concluded that colour of fresh bitter gourd was light green, shape was spindle, length 18.3 cm, width 4.56 cm and weight was 175.86 gm. Physical characteristic such as bulk density, true density, compressibility index, angle of repose were determined for prepared bitter gourd powder. It revealed that bulk density and tapped density of bitter gourd powder was 500kg m^{-3} and 666kg m^{-3} respectively. Angle of repose of bitter gourd powder was 35.5^0. Compressibility index and static coefficient of friction of bitter gourd powder was 24.92% and 0.83 respectively Proximate composition revealed that fresh bitter gourd contains 92.2% moisture content. The fat and protein content of bitter gourd powder was found to be 1.02% and 0.90%. The crude fibre in bitter gourd was found to be 2.08%. Ash content of bitter gourd was found to be 1.4%. Mineral analysis of the bitter gourd powder was found to be good source of calcium 23.76 mg/100g, potassium 25.8 mg/100g and magnesium 16.13 mg/100g respectively. The data regarding iron, and zinc of bitter gourd was found to be 0.86 mg/100g and 0.26 mg/100g. Obtained results of physical properties of bitter gourd and bitter gourd powder finally concluded that these properties having the significance in machine designing and process operation.

References

1. AOAC. Official methods of analysis, 17th edition. Association of Official Analytical Chemists, Washington DC 2000.
2. Basch E, Gabardi S, Ulbricht C. Bitter melon (*Mormordica charantia*): a review of efficacy and safety. American Journal of Health-System Pharmacy, 2003;60(1):356-359.
3. Donal B, Satyabrata D, Dhua RS. Dehydration for better quality value added product of bitter gourd (*Momordica charantia* L.). Indian Journal of Pharmaceutical and Biological Research 2016;4(4):39-45.
4. Harinantenaina L, Tanaka M, Takaoka S, Oda M, Mogami O, Uchida M, *et al*. *Momordica charantia* constituents and antidiabetic screening of the isolated major compounds. Chemical and Pharmaceutical Bulletin 2006;54(1):1017-1021.
5. Micha P. Physical properties of Food Powders. Food Engineering 1983;1(1):1-9.
6. Nerurkar PV, Lee YK, Motosue M, Adeli K, Nerurkar VR. *Momordica charantia* (bitter melon) reduces plasma apolipoprotein B-100 and increases hepatic insulin receptor substrate and phosphoinositide-3 kinase interactions. British Journal of Nutrition, 2008;100(1):751-759.
7. Ozgur M, Akpinar-Bayizit A, Ozcan T, Yilmaz-Ersan L. Effect of dehydration on several physico-chemical properties and the antioxidant activity of leeks (*Allium porrum*L.), *Notulae Botanicae Horti Agrobotanici Cluj Napoca* 2013;39(1):144-151.
8. Raman A, Lau C. Anti-diabetic properties and phytochemistry of *Momordica charantia* L. Journal of Phytomedicine 1996;2(3):349-362.
9. Ranganna S. Handbook of Analysis and Quality Control for Fruit and vegetables Products, Second Edition, Tata McGraw Hill Publishing Limited, New Delhi 1986.
10. Satkar KP, Kulthe AA, Chalke PR. Preparation of bitter

gourd ready to serve beverage and effect of storage temperature on its keeping quality. The Bioscan 2013;8(2):115-117.
11. Sorifa AM. Nutritional compositions, health promoting phytochemicals and value added products of bitter gourd: a review. International Food Research Journal, 2018;25(5):1763-1772.
12. Thakur M, Sharma RK. Bitter gourd: health properties and value addition at farm scale. *Kisaan e- Patrika Marumegh*. 2016;1(2):17-21.
13. Wandhekar SS, Patil BM, Sadawarte SK, Sawate AR, Swami AM. Physico-chemical evaluation of selected ingredients for preparation of instant Appe mix. The Pharma Innovation 2021;10(5):1474-1478.
14. Yoh GY, Eisenber DM, Kaptchuk TJ, Phillips RS. Systematic review of herbs and dietary supplements for glycemic control in diabetes. Diabetes Care. 2003;26(1):1277-1294.