

**PM Formalization of
Micro Food Processing Enterprises (PMFME) Scheme**

**HANDBOOK
OF
MOTH PRODUCTS**



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CHAPTER 1

1.1 INTRODUCTION



Scientific name: *Vigna aconitifolia*

Family: **Fabaceae**

Common name: **mat bean, moth bean, matki, Turkish gram or dew bean**

Origin: **India**

1.2 HISTORY OF MOTH BEAN

Moth bean is native to India , grown for food production and as a forage and cover crop. It is predominately grown in India, although it has been cultivated in the United States, Australia, Thailand and other parts of Asia. Since moth is a pulse thus it also a good source of vegetable protein.

1.3 GROWING CONDITIONS:

Moth is mostly growing in hot and dry region of northern and western India. It is considered as one of the drought resistance crop which can easily tolerate high temperature up to 45°C and slight salinity. Most suitable soil for the cultivation of moth is dry sandy soil. Optimum temperature range for the cultivation of moths ranges from 25-37°C. The annual rainfall required for moth is around 200-300mm while it has been found that it can also grown even at 50-60mm of rainfall annually.

1.4 CROP STATUS :

Cultivation of moth is done on approximately 9.26 lakh hectare of lands and the total production recorded as 2.77 lakh tones in India during 2012-17. Out of this Rajasthan is the largest producer of moths in India which is constitute 96.75% of area and 95% of total production followed by Gujarat (2.38% area and 3.6% production).

1.5 UTILIZATION

Moth bean can be consumed in number of ways such as sprouts, whole seeds, used for making papad, sandage, bhujia, badi etc.

CHAPTER 2

2.0 VARIETIES OF MOTHS BEAN

Moth bean have different varieties and there some specific varieties which grow specially in some state as per agro climatic zone:

2.1 Normal maturity group : Moth bean varieties fall under this category required more than 90 days to grow. These are Moth Guj.1 (MG -1), Jadra (IPCMO943), Jwala (IPCMO 912), IPCMO 880 (have 26% protein).

2.2 Medium maturity group : Moth bean varieties fall under this category required 70-90 days to grown and should have uniform rainfall throughout season. These are IPCMO 912, CZM.

2.3 Early maturity group : Moth bean varieties fall under this category required 60-65 days to grow. Important characteristics of this group is high yield, suitable for the late season, suitable for drought area, resistant to YMV.

2.4 State-wise recommended varieties:

State	Recommended varieties
Rajasthan	RMO-257, RMO-435, RMO 2004, RMO 225, RMO 40, FMM-96, Moth 880, Jwala, Czm 45,CZM 99, TMV
Gujarat	GMO 1, GMO 2, Maru Bahar, RMO-257
Maharashtra	CZM 45, CZM 99, RMO 435
Haryana	CZM 45, CZM 99

Source : Seednet GOI

CHAPTER 3**3.1 NUTRITIONAL COMPOSITION OF MOTH BEAN:**

Constituent	Content (per 100g dry seed)
Protein (g)	24.3
Carbohydrates (g)	68.0
Lipids (g)	3.9
Ash (g)	3.8
Calcium (mg)	133
Phosphorus (mg)	356
Magnesium (mg)	183
Potassium (mg)	-
Iron (mg)	11
Thiamine (mg)	0.50
Riboflavin (mg)	0.10
Niacin (mg)	1.7

Source : Ceming et al.

3.2 ESSENTIAL AMINO ACIDS COMPOSITION OF MOTH BEAN :

<i>Amino acid</i>	<i>Moth bean (g/16 g N)</i>	<i>FAO reference protein (g/16 g N)</i>
Lysine	5.6	5.5
Leucine	7.0	7.0
Isoleucine	5.1	4.0
Valine	3.3	5.0
Methionine	1.0	} 3.5
Cystine	0.5	
Phenylalanine	4.7	} 6.0
Tyrosine	-	
Threonine	-	4.0
Tryptophan	0.70	1.0

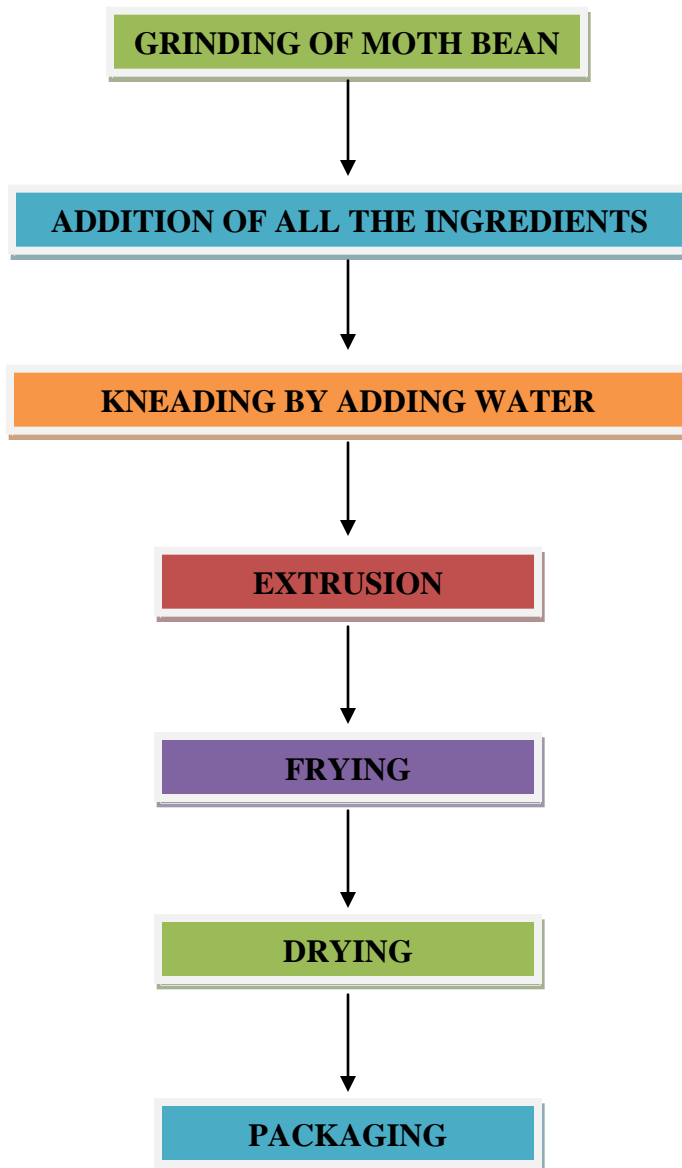
Compiled from: Palmer and Thompson (1975), Gopalan *et al.* (1982) and FAO/WHO (1973).

CHAPTER 4

As we have discussed earlier that moth bean consumed either directly or can be processed to make products from it such as papad, badi, bhujia etc.

4.1 MANUFACTURING OF BHUJIA FROM MOTH BEAN

Moth bean have been widely used in manufacturing of bhujia / Snacks due to its nutrition benefits as well as it also have good flavor. Manufacturing of bhujia from moth bean involves following steps:



4.1.1 Grinding of moth bean : Grinding of bean is mainly done with help of grinding machine and it should be smoothly grind so that texture of bhujia will be of good quality.

4.1.2 Addition of ingredients : Ingredients such as salt and spices are added in appropriate quantity. While adding these ingredients proper regulation of FSSAI must be followed.

4.1.3 Kneading : It is done for dough making, moth bean powder should be kneaded properly and during this process addition of water in to dough should be carefully monitored so that amount moisture should be present in appropriate quantity. Lesser use or more use of water affect the quality of dough.

4.1.4 Extrusion : After kneading, dough is passed through an equipment called as extruder. Extrusion is done to cut down the dough in a proper shape.

4.1.5 Frying : Product obtained from extruder are fried deeply in oil.

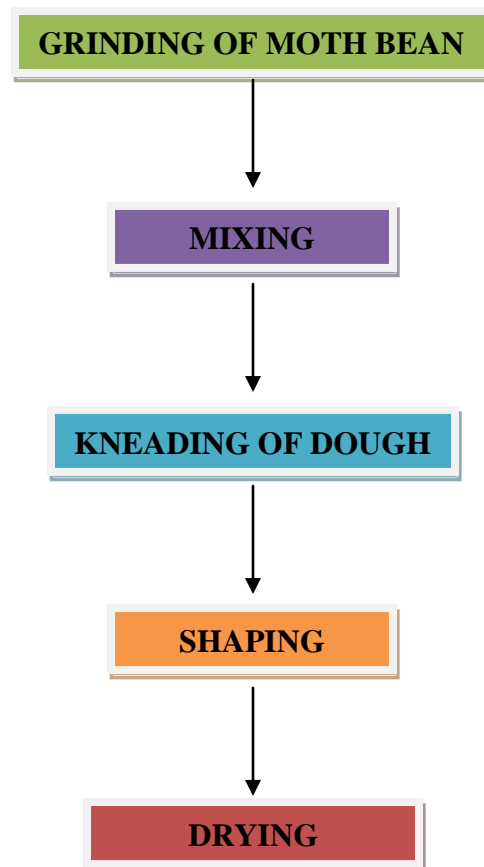
4.1.6 Drying : It is done to lower down temperature of fried product as well as drying process also remove some amount of oil at the same time.

4.1.7 Packaging : After drying, packaging is done for selling the products in market.



4.2 MANUFACTURING OF PAPAD FROM BEAN:

The process of papad manufacturing from moth bean is almost same as papad is made from other pulses. The given flow chart show the papad making steps from moth bean:



4.2.1 Cleaning of Moth bean : Moth bean are first cleaned for getting high amount and good quality of flour. For cleaning purpose mostly reciprocating air-screen cleaners and reel screen cleaners are used. Reciprocating air cleaner has two screen having different size of perforation which are used for separation of lighter materials like dust, leaves, husk etc. In reel screen cleaner there 2-4 cylindrical compartments, having different size of perforation screen which are fitted on a 5-7.5 mm diameter shaft. The cylindrical screen drum rotates at 5-35 rpm.

4.2.2 Drying : Drying of moth bean is necessary reduce the moisture content. The process of drying can be performed either through Sun or mechanically. Sun drying process usually take 1-6 days where moth bean by spread over the floor/roof in a 5 to 7.5 cm thick layer and followed by manual stirring. Mechanical drying is performed either batch type or continuous flow type at temperature ranges from 600 -1200°C.

4.2.3 De-hulling :De-hulling operation is performed for the removal of seed coat which also helps in reducing the anti-nutritional factors like tannins and insoluble fiber thus enhancing the quality of nutrition, digestibility of protein , texture, taste etc.

4.2.4 Grinding of moth bean : Grinding of bean is mainly done with help of grinding machine and it should be smoothly grind so that texture of papad will be of good quality.

4.2.5 Mixing : After grinding, powder obtained from grinder should be properly mixed along with all the required ingredients to make powder more uniform.

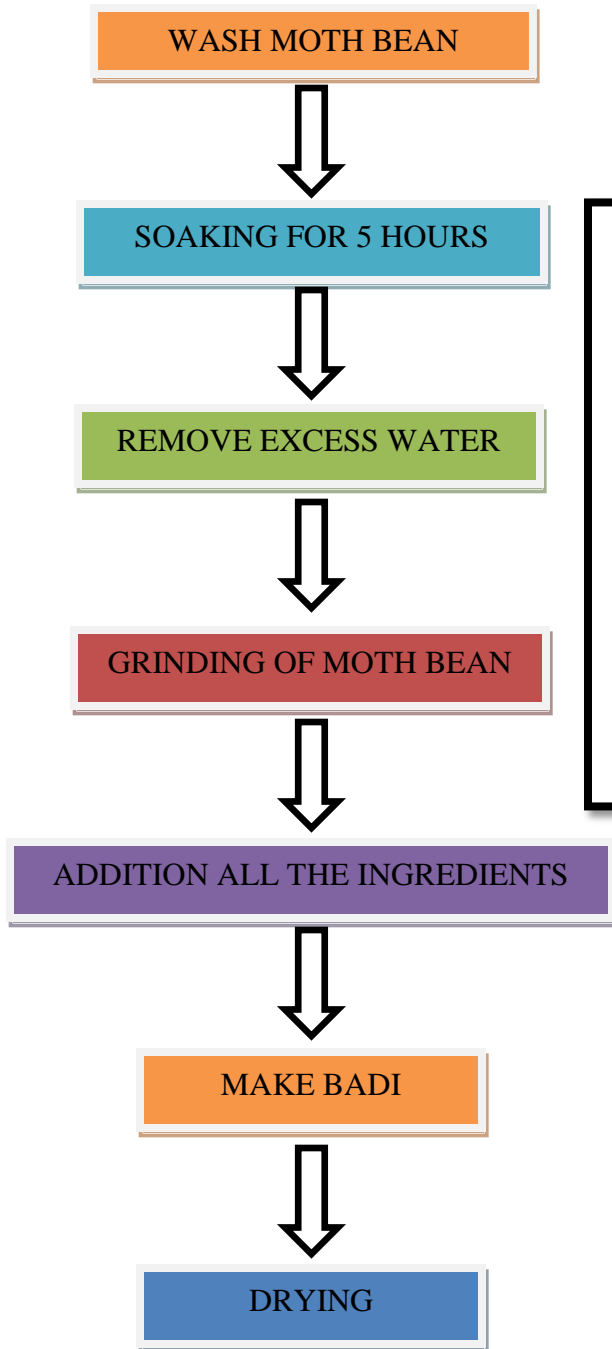
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4.2.7 Shaping : The papad press is machinery operated. The papad dough is made from moth bean flour, salt, carbonates, farinaceous material and water. The dough is made into sheet form by press machine into 1-mm thickness and cut into circular shape by machine. The pressed circular shaped papad is dried to 14-15% moisture level at room temperature using dryer machine.

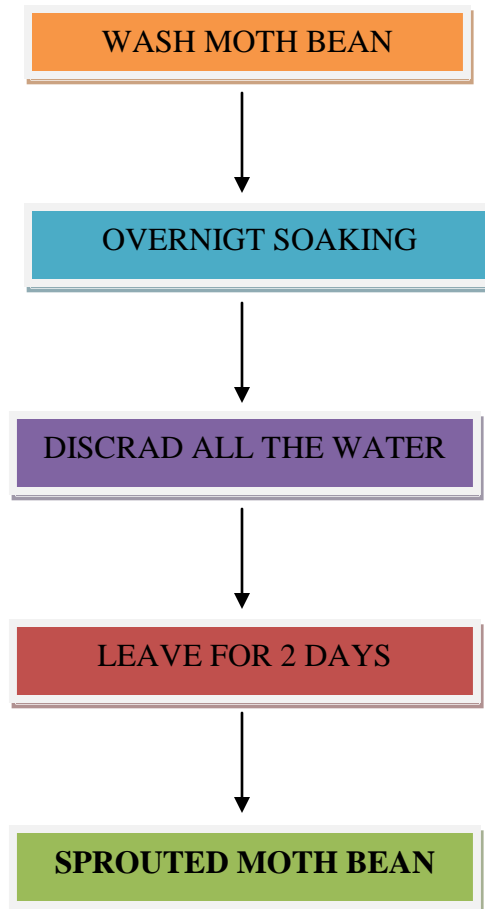
4.2.8 Packaging : The papad with a 14-15 % moisture label is packed in polythene sheets using a hand sealing machine and sent to the market after final packaging



4.3 MANUFACTURING OF MASALA BADI :



4.4 MOTH BEAN SPROUTS:



CHAPTER 5

5.0 EQUIPMENT FOR MOTH BEAN PROCESSING:

5.1 WEIGHING MACHINE :

For getting good quality of product, all the ingredients should be properly weighed with the help of digital weighing machine.



5.2 SIEVE :

It used for sieving flout of moth bean so that only fine powder can be utilized for manufacturing purpose. Without sieving coarse powder will be mixed up.



5.3 DOUGH MAKER :

Dough maker is used for dough preparation at a larger quantity and in lesser time. All the ingredients are mixed together uniformly with help of dough maker.



5.4 EXTRUDER MACHINE:

It is used for cutting the dough in to thick and small shape which will be appropriate for frying process.



5.5 SHEETING AND CUTTING MACHINE :

It used to roll the papad and cut in to proper shape.



5.6 FRYER :

Fryer is used for deep frying of bhujia.



5.7 PAPAD DRYING MACHINE:



CHAPTER 6

6.0 PACKAGING :

Packaging is an important part of food manufacturing process. It protect the food products from physical ,chemical, biological damages. Without packaging, food handling would be a messy, inefficient and costly exercise and modern consumer marketing would be virtually impossible. Thus food packaging lies at the very heart of the modern food industry.

Packaging Institute International defined packaging as the enclosure of products, items or packages in a wrapped pouch, bag, box, cup, tray, can, tube, bottle or other container form to perform one or more of the following functions: containment, protection, preservation, communication, utility and performance. If the device or container performed one or more of these functions, it was considered a package.

6.1 NEED OF PACKAGING :

Packaging performs a series functions:

6.1.1 CONTAINMENT : The containment function of packaging makes a huge contribution to protecting the environment from the myriad of products that are moved from one place to another on numerous occasions each day in any modern society. Faulty packaging (or under-packaging) could result in major pollution of the environment.

6.1.2 PROTECTION : the primary function of the package: to protect its contents from outside environmental influences such as water, water vapor, gases, odors, microorganisms, dust, shocks, vibrations and compressive forces.

6.1.3 CONVENIENCE : Products designed to increase convenience include ready to cook or ready to eat foods which can be reheated in a very short time, preferably without removing the primary package. Thus, packaging helps in convenience of consumer. Convenient packages promote sales.

6.1.4 COMMUNICATION : Packaging contains a lot of information such name of its manufacturer, product name, terms and uses, date of manufacturing, best before. nutritional information thus helping the consumer to be more informed.

6.2 TYPES OF PACKAGING :

6.2.1 PRIMARY PACKAGING :

- Primary package are those package which directly came into contact with food products. It provides first or initial layer of protection to the food products.
- Examples - Metal cans, tea bag, paperboard cartons, glass bottles and plastic pouches.

6.2.2 SECONDARY PACKAGE :

- Secondary package are those package which surrounds or contains the primary package.
- It further used to group primary packages together.
- Act as carriers and many a times also used for the display of primary package.
- Examples are Corrugated case, Boxes.

6.2.3 TERTIARY PACKAGE :

- It contains number of secondary package together.
- Mainly used for bulk handling of food products.
- Example : stretch-wrapped pallet.

6.2.4 QUATERNARY PACKAGE :

- Quaternary package is mainly used for handling the tertiary packages.
- It generally includes a metal container which can be transferred to or from ships, trains.

6.3 PACKAGING OF MOTH PRODUCTS :

Packaging of moth bean and its products are mainly done to protect the food products from outside environment especially after the completion of process so that products can retain flavor, aroma, freshness for a longer period of time. Packaging is also done to increase their shelf life. Moth bean products can be packed in wide range material which includes LDPE, PET, glass, aluminum etc.

6.3.1 LDPE :

Low-density polyethylene is heat sealable, inert, odour free and shrinks when heated. It act as a barrier to moisture and has high gas permeability, sensitivity to oils and poor odour resistance. It is less expensive, therefore widely used. One of the great attributes of LDPE is its ability to be fusion welded to itself to give good, tough, liquid-tight seals.

5.3.2 PET :

PET can be made into film by blowing or casting. It can be blow moulded, injection moulded, foamed, extrusion coated on paperboard and extruded as sheet for thermoforming. Melting point of PET is higher than PP which is around 260°C and due to the manufacturing conditions does not shrink below 180°C. Thus PET is ideal for high-temperature applications. PET is also flexible to low temperature (-100°C). It also act as good barrier of oxygen and water vapour.

5.3.3 GLASS :

Now a day glass container has been also used for packaging. It has following advantages:

- act as strong barrier to moisture and gases.
- Prevent unwanted odors and microbial growth.
- do not react with food products.
- suitable for heat processing when hermetically sealed
- glass are re-useable and recyclable
- they are transparent to display the contents
- they are rigid, to allow stacking without container damage.

The disadvantages of glass include:

- glass have high weight which increases the transportation cost.

- very much fragile and low resistance to thermal shock as compare to other materials.
- potentially serious hazards from glass splinters or fragments .

6.3.4 ALUMINIUM:

Aluminium is used for packaging due its highly malleable properties: can be easily converted to thin sheets and folded, rolled or packed. Aluminium foil acts as a total barrier to light and oxygen odours and flavors, moistness, and germs, and so it is used broadly in food and pharmaceutical packaging, including long-life packs.

6.3.5 LAMINATE :

The laminates can be formed, filled, gas flushed and sealed on a single machine from reel stock. Gas flushing is achieved by saturating the powder with inert gas. The main advantages associated with laminates are lower material cost and lighter material weight. The disadvantages are that laminates do not have the mechanical strength and durability of rigid containers, and there can be difficulty in obtaining a satisfactory heat seal because of contamination of the heat seal area by powder during filling at high speed.

6.4 SOME RECENT DEVELOPMENT IN PACKAGING :

6.4.1 ASEPTIC PACKAGING

Aseptic packaging is the filling of sterile containers with a commercially sterile product under aseptic conditions, and then sealing the containers so that reinfection is prevented; that is, so that they are hermetically sealed. Application of aseptic packaging involves: packaging of pre-sterilized and sterile product and packaging of a non-sterile product to avoid infection by microorganisms.

The major reasons for the use of aseptic packaging are : to take advantage of high temperature-short time (HTST) sterilization processes, to enable containers to be used that are unsuitable for in-package sterilization and to extend the shelf life of products at normal temperatures.

6.4.2. ACTIVE AND INTELLIGENT PACKAGING

Active packaging is defined as packaging in which subsidiary constituents have been deliberately included in or on either the packaging material or the package headspace to enhance the performance of the package system.

Intelligent packaging is defined as packaging that contains an external or internal indicator to provide information about the history of the package and/or the quality of the food. Sachets and pads are the most widely used forms of active packaging and the various functions which they perform are discussed in the following:

- Oxygen absorber
- Carbon dioxide absorber or emitter
- Ethylene absorber
- Ethanol emitter
- Moisture absorber

6.4.3 MODIFIED ATMOSPHERE PACKAGING

MAP can be defined as packaging of food items where atmosphere inside the packet has been modified to increase the shelf life of food products. It involves active modification or passive modification. In active modification air is displaced with a controlled, desired mixture of gases, and the process is called as gas flushing. Passive modification occurs due to respiration and the metabolism of microorganisms associated with the food. The package structure normally incorporates a polymeric film, and so the permeation of gases through the film also influences the composition of the atmosphere that develops.

6.5 LABELING

Labeling performs the communication function of packaging, informing the consumer about nutritional content, net weight, product use and so on. Labeling acts as a silent salesman through distinctive branding, as well as facilitating identification at check-outs through the Universal Product Code (UPC).

There various types of labeling which are as follows:

6.5.1 GLUED-ON LABELS : These are the simplest type and consist of sheet material (typically paper), which has been printed and cut to size. They are attached to the package with adhesive, which is applied either at the time of application, or at the time of manufacture, in which case the adhesive is activated with moisture immediately prior to application.

6.5.2 SELF-ADHESIVE (PRESSURE-SENSITIVE) LABELS : These can be made from paper, plastic or aluminum foil laminated to paper or plastic, and can be produced to adhere to a wide range of materials.

6.5.3 IN-MOLD LABELS : It offers better resistance to heat, moisture and chemical than those labels made from paper. There are also recycling advantages with film labels. IML materials must be able to withstand the container manufacturing process. The heat generated during blow molding presents a challenge to most inks because pigments can change.

6.5.4 SLEEVE LABELS : A wide range of containers can be sleeve labeled including glass bottles, plastic bottles and metal cans. Sleeve labels shrink into or stretch around contours, penetrate variable geometries and conform to irregular features.

6.5.5 HOLOGRAPHIC LABELS : Holographic labels that incorporate a hologram have large application in food packaging for both marketing and security reasons, specifically in the areas of anticounterfeiting (authentication) and brand protection. Surface relief and volume are the most common type of hologram. Surface relief holograms exhibit a characteristic rainbow-colored pattern or image. Volume, or reflection, holograms have a very different appearance to surface relief holograms and are generally used for authentication.

CHAPTER 7

7.0 STORAGE OF MOTH BEAN AND ITS PRODUCTS

The proper storage of moth bean and its products with utmost care is very important otherwise it will become stale and rancid much faster which may further alter the aroma and flavor and can also harm the health of consumer. Food products are mainly vulnerable to light , air, heat, odour, and moisture. Thus the proper storage requires following :

7.1 Dark Place : Processed food products should be always stored in a dark room to avoid it from sunlight or UV light, so that quality such as aroma and flavor should be maintained till final consumption.

7.2 Airtight : To avoid food products from absorbing moisture and unpleasant odour from air.

7.3 Hypothermia: Exposure of food products to heat will ruin its quality thus avoid keeping food products in sunlight or near heat .

7.4 Away from strong odour . Some food products have tendency to absorb any odour quickly thus processed food products must be stored separately.

7.5 Away from moisture.

CHAPTER 8

8.1 FSSAI REGULATION FOR BHUJIA

SL.NO	ADDITIVES	MAXIMUM LEVEL
A	Antioxidants	
1.	Tocopherol	GMP
2	Lecithin	GMP
3	Butylated hydroxy anisole (BHA)	200ppm
4	Tertiary butyl hydro quinone (TBHQ)	200ppm
B	Emulsifier/ Stabiliser	
1	Methyl cellulose	0.5%
2	Carboxymethyl cellulose	0.5%

8.2 FSSAI REGULATION FOR PAPAD

According to the FSSAI standards, Papad means the Pulses based Product made by grounded Pulses flour. The FSSAI standard for papad are :

Moisture	Not more than 14.0 per cent by weight
Foreign matter -Extraneous Matter	Not more than 1 per cent. by weight of which not more than 0.25 per cent. by weight shall be mineral matter and not more than 0.10 per cent by weight shall be impurities of animal origin
Other edible grains	Not more than 4 per cent by weight.
Damaged grains	Not more than 5 per cent by weight
Weevilled grains	Not more than 6 per cent by count.
Uric acid	Not more than 100 mg per kg
Aflatoxin	Not more than 30 micrograms per kilogram
It is also Provided that the total of foreign matter, other edible grains and damaged grains shall not exceed 9 per cent by weight.	

8.3 SANITARY AND HYGIENIC REQUIREMENTS FOR FOOD MANUFACTURER/PROCESSOR/HANDLER

The place where food is manufactured, processed or handled shall comply with the following requirements:

1. The premises shall be located in a sanitary place and free from filthy surroundings and shall maintain overall hygienic environment. All new units shall set up away from environmentally polluted areas.
2. The premises to conduct food business for manufacturing should have adequate space for manufacturing and storage to maintain overall hygienic environment.
3. The premises shall be clean, adequately lighted and ventilated and sufficient free space for movement.
4. Floors, Ceilings and walls must be maintained in a sound condition. They should be smooth and easy to clean with no flaking paint or plaster.
5. The floor and skirted walls shall be washed as per requirement with an effective disinfectant the premises shall be kept free from all insects. No spraying shall be done during the conduct of business, but instead fly swats/ flaps should be used to kill spray flies getting into the premises. Windows, doors and other openings shall be fitted with net or screen, as appropriate to make the premise insect free The water used in the manufacturing shall be potable and if required chemical and bacteriological examination of the water shall be done at regular intervals at any recognized laboratory.
6. Continuous supply of potable water shall be ensured in the premises. In case of intermittent water supply, adequate storage arrangement for water used in food or washing shall be made.
7. Equipment and machinery when employed shall be of such design which will permit easy cleaning. Arrangements for cleaning of containers, tables, working parts of machinery, etc. shall be provided.

8. No vessel, container or other equipment, the use of which is likely to cause metallic contamination injurious to health shall be employed in the preparation, packing or storage of food. (Copper or brass vessels shall have proper lining).
9. All Equipments shall be kept clean, washed, dried and stacked at the close of business to ensure freedom from growth of mould/ fungi and infestation.
10. All Equipments shall be placed well away from the walls to allow proper inspection.
11. There should be efficient drainage system and there shall be adequate provisions for disposal of refuse.
12. The workers working in processing and preparation shall use clean aprons, hand gloves, and head wears.
13. Persons suffering from infectious diseases shall not be permitted to work. Any cuts or wounds shall remain covered at all time and the person should not be allowed to come in direct contact with food.
14. All food handlers shall keep their finger nails trimmed, clean and wash their hands with soap, or detergent and water before commencing work and every time after using toilet. Scratching of body parts, hair shall be avoided during food handling processes.
15. All food handlers should avoid wearing, false nails or other items or loose jewellery that might fall into food and also avoid touching their face or hair.
16. Eating, chewing, smoking, spitting and nose blowing shall be prohibited within the premises especially while handling food.
17. All articles that are stored or are intended for sale shall be fit for consumption and have proper cover to avoid contamination.
18. The vehicles used to transport foods must be maintained in good repair and kept clean.
19. Foods while in transport in packaged form or in containers shall maintain the required temperature.
20. Insecticides / disinfectants shall be kept and stored separately and away from food manufacturing / storing/ handling areas.