

Reading Manual for Amaranthus Products Under PMFME Scheme



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CHAPTER 1

INTRODUCTION

Brief Overview

The most common leafy vegetable grown during summer and rainy seasons in India. Fits well in a crop rotation because of its very short duration nature and large yield of edible matter per unit area. Stem green to purple or with mixed shades of these two colours glabrous and succulent, leaf simple, alternate or opposite, exstipulate, entire obovate to lanceolate with acute tip green to purple or with shades of these two colors, purple coloration prominent in young leaves and fades away at maturity.



- Amaranthus Botanical Name- *Amaranthus tricolour L.* Family-Amaranthaceae Origin – India
- The fresh tender leaves and stem of amaranthus are delicious when cooked and highly nutritious
- Both green and red varieties are suitable for culinary preparations.
- Amaranthus is widely distributed in both tropical and sub tropical regions. Leaf amaranth is a warm season crop adapted to hot humid climatic conditions. It is grown throughout the year in tropics and in autumn, spring and summer seasons in temperate regions. Amaranthus comes up well in well drained loamy soil rich in organic matter.

- Suitable for preparing products like Squash (using leaves of Red variety), Pakoda(leaves and tender shoots of both varieties), Cutlet, Pickle(stem of both varieties) and Pakkavada (using leaves of both varieties).

Cultivars

Co-1(A. dubius)

This cultivar has been developed by selection from a local type at TNAU, Coimbatore, India in 1968. It is mainly grown for tender green as well as matured stems. It yields 2.150 kg of greens per 3 sq m area (7165 kg/ha) at 25th day after sowing leaves dark green with ridged appearance; stem dark green, round and succulent; inflorescence terminal and axillary, Takes 50 days for flowering and 90 days for seed maturity , plant height 150 cm , seed yield per plant is 13 g . Seeds are small and black, tolerant to pests and diseases.

Co. 2 (A. tricolor)

Selection from local type at TNAU, Coimbatore and released in the year 1976. Particularly suited for early harvest. It yields 3.230 kg of greens per 3 sq m area (10780 kg/ha) at 25th day after sowing . Early germination and vigorous growth make it more suitable for early harvest as tender greens. Takes 42 days for flowering and 80 days for seed maturity. Plants medium tall with 125 cm. Seed yield per plant is 48.4 g and 2.80 t/ha. Seeds bolder and black. Tolerant to pests and diseases.

Co. 3 (A. tristis)

Selection from local type at TNAU in 1981. This is the only type suitable for clipping of tender greens. Average yield of 30716 kg of greens per hectare. This cultivar lends itself for ten clippings commencing from 20 days after sowing and provides a continuous supply of luscious tender greens for a period of 3 months. As a seed crop, this cultivar flowers in 35-40 days after sowing and matures at 85-90 days.

Chhoti Chaulai (A. blitum)

Selection at IARI, New Delhi. Suitable for its leafy shoots. Plants erect with thin stem, slightly dwarf; leaves small, green in colour. Responds well to cutting. Flowers are borne in clusters in leafy axils. It is best suited for early summer and can be grown in rainy season also.

Badi Chaulai (A. tricolor)

Developed at IARI, New Delhi through selection. The economic product is leafy shoots. Stem thick, green; leaves large and green; responds to cutting and distinguishable by its much longer growing period. It is best suited for summer season.

Pusa Kirti (A. tricolor)

This cultivar developed at IARI, New Delhi is suitable for summer cultivation. The economic part is green and soft stem. The ratio of stem to leaf is 1: 4. The crop is ready in 30-35 days for first cutting which may continue up to 78-84 days.

Pusa Kiran

Developed through hybridization between *A. tricolor* x *A. tristis* at IARI, New Delhi. This cultivar is most suitable for rainy season. Leaves are soft, green and wide. The ratio of stem to leaf is 1:5. It provides first cutting in 21-25 days after sowing and continue up to 70-75 days.

Pusa Lal Chaulai (A. tricolor)

A high yielding, red pigmented cultivar developed at IARI, New Delhi is suitable for growing in both summer and rainy seasons. It has a stem-leaf ratio of 1 : 5. First cutting of leaves can be taken 33 and 24 days after sowing in summer and rainy seasons, respectively. It yields on an average 490 and 450 q/ha in summer and rainy seasons, respectively.

Arka Suguna

A pure line selection from Taiwanese introduction (IIHR 13560) made at IIHR, Bangalore, ideal for multicut without becoming fibrous which also regenerates at a faster rate. The first cutting is ready in about 25 days after sowing and subsequent cuttings can be taken at 10-12 days interval (up to 90days). The cultivar is moderately resistant to white rust. Yield potential 270 q/ha.

Arka Arunima.

A multicut, purple cultivar with brown and dark purple leaves. Developed at IIHR, Bangalore. The first cutting becomes ready at 30 days after sowing. Leaves contain low antinutrient factors like oxalate and nitrates. It grows well in rainy and summer seasons and yields about 240 q/ha of greens.

Amont (A. cruentus)

It was developed in Montana, USA from line RRC-A362. Amont has a central main panicle with thick, erect to drooping, fingerlike branches. Days to maturity varied from 122 to 127.

CHAPTER 2

HARVESTING AND POST HARVESTING MANAGEMENT

The young amaranth seedlings grown for commercial purpose are often uprooted when they are 8–10cm tall (3–4 weeks after sowing). The first cutting can be made 3 weeks after sowing. Subsequent cuttings are made at 10–15 days interval depending upon the vegetative growth. As many cuts are made as possible until flowering begins, and suitable vegetative material is no longer available.

- Amaranthus grown for seed is not usually harvested for greens. Seed plants are cut when mature and seeds can be rubbed from the inflorescence and then removed by drying and threshing.
- These seeds may be separated from the chaff with fine screens and if necessary, by winnowing. Yield of gross products (total biomass) varies from 100–500q/ha depending on varieties.
- The leaves lose water rapidly during storage, particularly at higher temperature resulting in rapid wilting, decrease in chlorophyll, ascorbic acid and soluble protein content and an increase in amino acid content.
- It can be stored for 6 days at 24°–28°C temperature.

Major Components of Amaranthus in 100g

components	red variety	Green variety
Moisture (g)	85.5	91.6
Protein (g)	4.9	2.46
Carbohydrate (g)	10	4.02
Energy (kcal)	51	23
Fat (g)	0.5	0.33
Dietary fiber(g)	1	2.2
Calcium (mg)	368	215
Iron (mg)	2	2.32

Phosphorous(mg)	111	50
Sodium (mg)	42	20
Potassium(mg)	340	611
Vit B1 (mg)	0.08	0.03
Vit B2(mg)	0.3	0.16
Niacin B3 (mg)	1.2	0.66
Vit C (mg)	80	43.3
Vit A (IU)	5560	2917

Importance of Amaranthus

Amaranthus is commonly consumed in all over India. All the parts of the Amaranthus plants, viz leaves, tender shoots stems and seeds are edible and can be used for various types of preparations.

- The nutritional benefits offered by the leafy vegetable are extremely beneficial for not only our health but also for our skin and hair.
- It has been rediscovered as a promising food crop mainly due to its resistance to heat, drought, diseases and pests, and the high nutritional value of both seeds and leaves. They are rich in proteins and micronutrients such as iron, calcium, zinc, vitamin C, and vitamin A.
- It is high in several antioxidants, such as gallic acid, *p*-hydroxybenzoic acid and vanillic acid, which may help protect against disease.
- Amaranthus extracts have been used in ancient Indian, Nepalese, Chinese and Thai medicine to treat several conditions including urinary infections, gynecological conditions, diarrhea, pain, respiratory disorders, diabetes and also as diuretic.
- Antioxidants, molecules that reduce effect of free radicals; important for protection against cancer and degenerative disorders; are in abundance in *Amaranthus* spp.

Nutritional benefits of Amaranthus

- **Improves digestion:** The fiber content in red Amaranthus extremely beneficial to our digestive system which helps in regulating bowel movement by cleaning out the colon.
- **Aids in weight loss:** The protein content in red Amaranthus helps in reducing the insulin levels in your blood. The protein releases a hormone which acts as a hunger stopper, that is, It helps in lowering the constant hunger pangs
- **Treats anemia:** Red Amaranthus has a high content of iron, which is extremely beneficial for the development of blood flow in our system. Regular consumption of red Amaranthus can improve the hemoglobin level and purify our blood, resulting in the naturally improving our blood flow.
- **Improves immune system:** Being a high source of vitamins and nutrients, red Amaranthus plays a major role in improving your immune system. The amino acid, vitamin E, vitamin K, iron, magnesium, phosphorus, and potassium aids in boosting our immune system, and thus protect our body from disease-causing bacteria or viruses.
- **Reduce cholesterol:** Being a fibrous vegetable, red Amaranthus aids in lowering the levels of bad cholesterol in your body. The tocotrienols in the vitamin E reduce the bad cholesterol levels, thereby helping our body to maintain a balance in the cholesterol levels.
- **Improves heart health:** The phytosterols in Amaranthus plays a significant role in improving your cardiovascular health. It helps in reducing the high blood pressure levels and acts as an antidote against the development of any cardiovascular diseases.
- **Beneficial during pregnancy:** Vitamins and minerals are essential during pregnancy. An expecting mother must follow a diet with a higher source of vitamin and mineral, which can be found in Amaranthus, not only improve the health of the mother, but also the fetus
- **Improves eye health:** Being rich in vitamin A, Amaranthus is essential for the health of the eyes, as it can improve our vision as well as maintain it.

- **Improves skin quality:** Rich in vitamin A, C and minerals Amaranthus can act as an antioxidant which improves skin and delay aging process. The red colored pigment in these leaves is known to fight free radicals which cause oxidative stress on your skin cells. These agents are also known to encourage new cell growth to reveal younger, fresher skin. It also offers a moisturizing effect on the skin to make it soft and supple.
- **Maintains Blood Pressure:** Amaranthus is quite low in calories and is high in Potassium. It also contains fewer sodium levels, making desirable for hypertension patients. Red spinach can help in regulating your blood pressure and lower the pressure on your heart.
- **For Thick Hair:** Being rich in calcium, iron, Vitamin C and A Amaranthus helps in providing the best health to the hair follicles and improves hair growth.
- **Anti-Cancer Properties:** Amaranthus is known for its Cancer warding properties. With high amounts of antioxidants and flavonoids, it is known to prevent many types of cancers. It can reduce the oxidative stress in the body, which give rise to tumor cells. These compounds can fight cancer cells and reduce tumor growth.

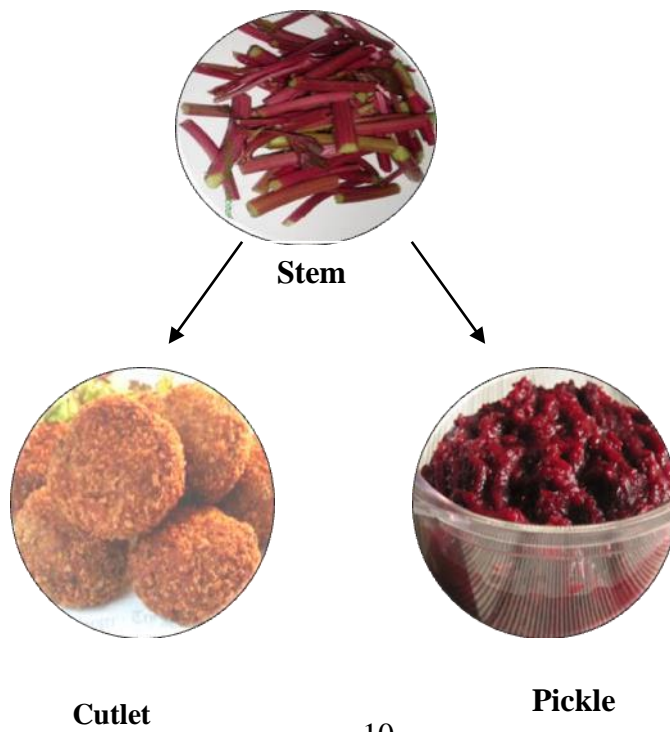
CHAPTER 3

PRODUCTS OF AMARANTHUS

Leaf based products



Stem based products



Amaranthus Products

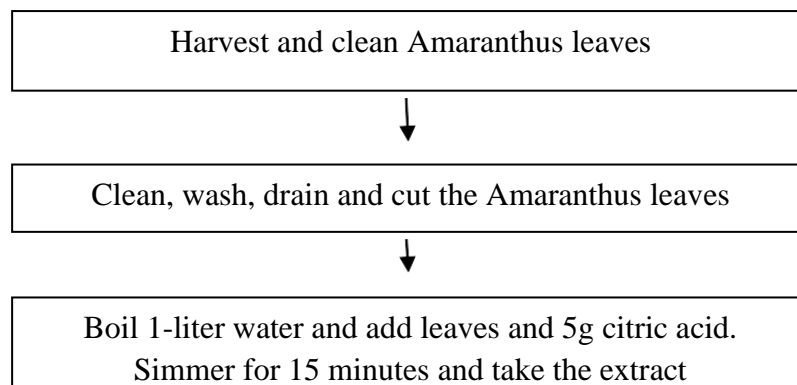
Amaranthus leaf squash recipe

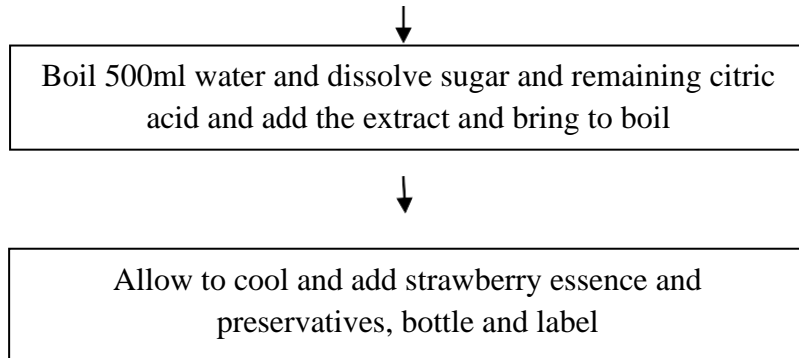
Ingredients

- Amaranthus leaves : 500 g ,
- Sugar: 1.75kg,
- Citric acid 15 g,
- water -1.5 litre
- Straw berry essence- 1 teaspoon,
- Sodium Benzoate- 1.5 g / litre.

Process

1. Clean, wash, drain and cut the Amaranthus leaves
2. Boil 1 litre water and add leaves and 5 g citric acid to this and simmer for 15 minutes.
3. Take the extract and keep it for cooling
4. Boil remaining 500 ml water and dissolve sugar and citric (10 g) and add Amaranthus extract, bring to boil (Temperature: 95-100 °C)
5. Allow to cool and add Straw berry essence- 1 teaspoon / litre, Sodium Benzoate- 1.5 g / litre
6. Bottle and label
7. Diluted to 5 times with cold water before use





Machineries Required



Leafy vegetable cutting machine



kettle/ sautiner



Automatic liquid filling machine



RO water unit

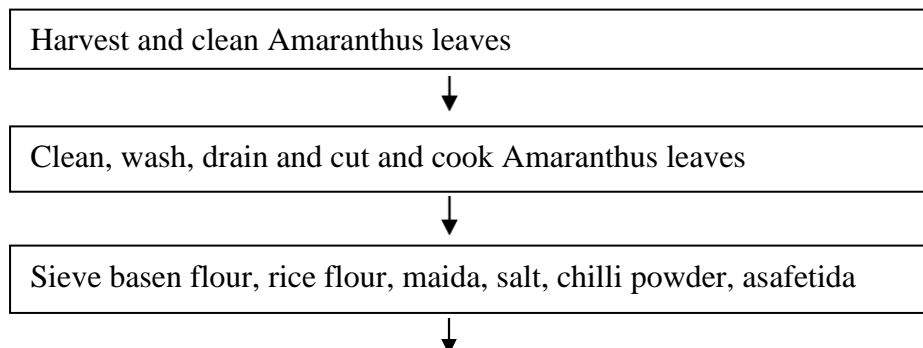
Amaranthus leaf Pakavada recipe

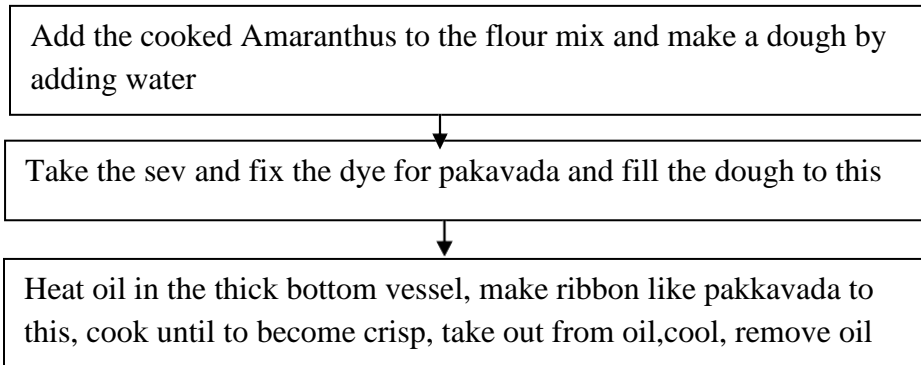
Ingredients

Amaranthus leaves- 250 g,
Basen flour-500 g
Rice flour-250 g,
maida-100 g,
Salt- 10 g,
Chilli powder-25 g,
Asafoetida powder- 5 g,
water-300 ml,
Vegetable oil-1liter.

Process

1. Clean, wash, drain and cut the Amaranthus leaves and boil to make it soft and mash.
2. Sieve basen flour, Rice flour, maida, salt, chilli powder, Asafoetida powder to get a uniform mixing.
3. Add the mashed Amaranthus to the flour mix and, make a dough by adding sufficient quantity water.
4. Take the sev and fix the dye for Pakkavada and fill the dough to this.
5. Take a thick bottom vessel, heat oil and, make ribbon like pakkavada to this, cook until it become crisp.
6. Take it out from oil allow to cool, remove excess oil and pack.





Machineries required



Leafy vegetable cutting machine



dough mixing machine



Automatic dye for sev and namkeen



automatic packing machine for namkeen

Amaranthus stem outlet recipe

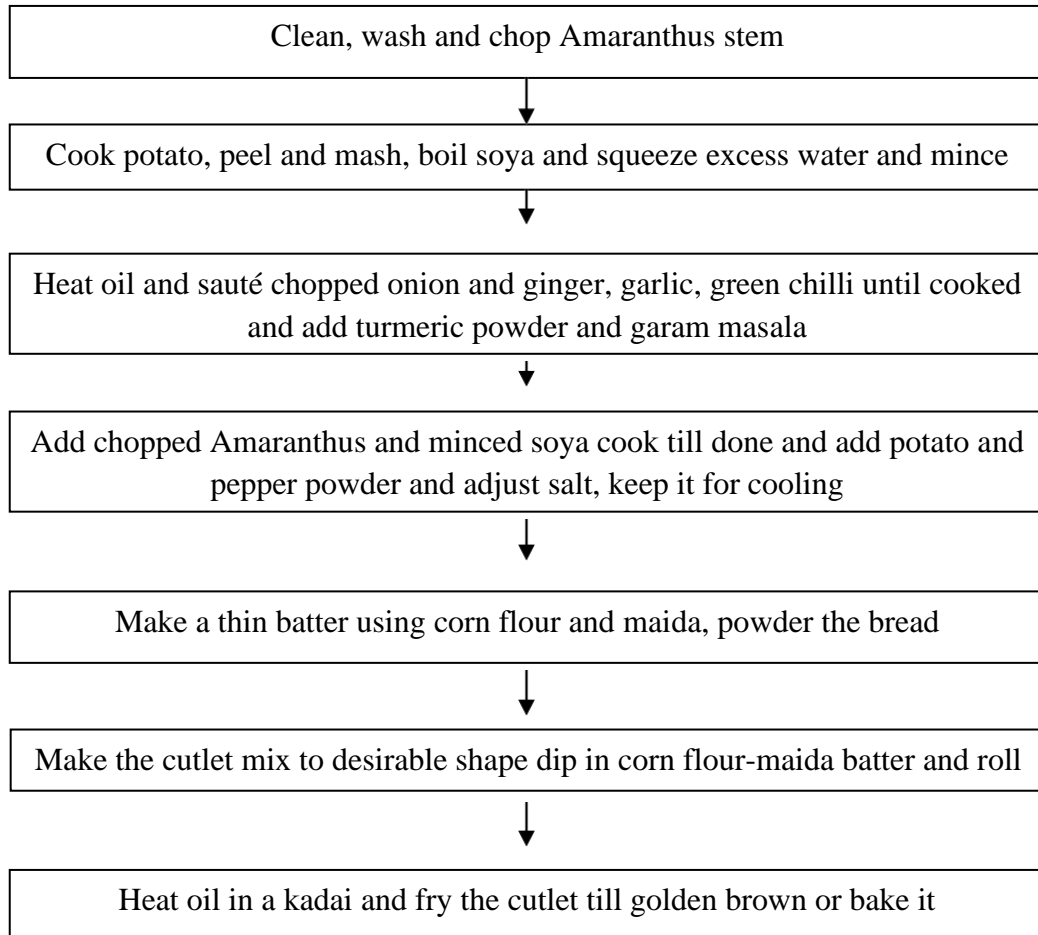
Ingredients

- Amaranthus stem : 500 g ,
- soya chunks-100g,
- Potato-500 g,
- Big onion-250 g,
- ginger, garlic, green chilly (niucely) chopped-25 g each,
- Garam masala-10 g,
- turmeric powder-one pinch,
- pepper powder-5 g,
- vegetable oil-1 liter,
- salt-to taste,
- cornflour-100 g,
- maida-150 g,
- bread-1 packet

Process

- Clean, wash and chop Amaranthus stem, cook potato, peel and mash, boil soya to make it soft and squeeze excess water and mince.
- Heat 150 ml oil in a thick bottom vessel and saute chopped onion and ginger, garlic, green chilly until cooked, add turmeric powder and garam masala.
- Add the chopped Amaranthus to this, saute and add, minced soya, cook it well and finally add mashed potato and pepper powder adjust salt to taste. Keep aside for cooling.
- Make a thin batter using corn flour and Maida by adding water
- Powder the bread nicely.

- Shape the cutlet mix to desirable form, dip in corn flour-maida batter and roll in bread powder
- Heat oil in a Kadai and fry the cutlet till golden brown.



Machineries required



Cutting and chopping machine for vegetables



Automatic cutlet or burger patti making machine



Frying unit

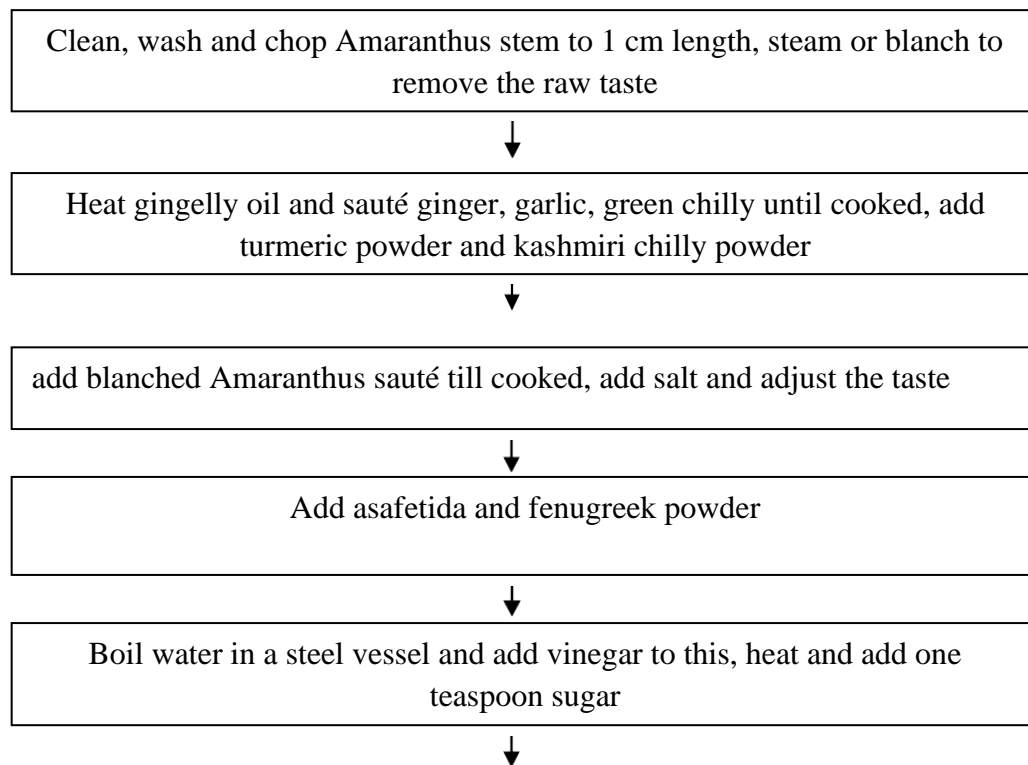
Amaranthus stem

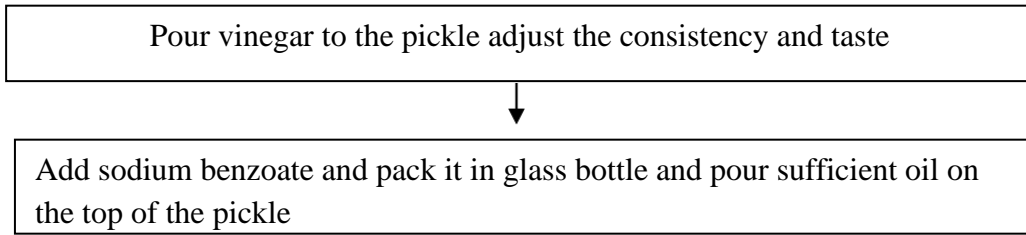
Ingredients

- Amaranthus stem : 1 kg ,
- ginger, garlic, green chilly (nicely) chopped-50 g each ,
- Gingelly oil- 300g,
- Asafoetida powder -20 g,
- Fenugreek powder-10 g,
- Kashmiri chilli powder- 50g,
- turmeric powder- 2 g,
- Salt-50g,
- Vinegar-300 ml,
- Sodium benzoate-2g,
- boiled water-200ml

Process

- Clean, wash and chop Amaranthus stem to 1 cm length steam or blanch to remove the raw taste.
- Heat 300 ml gingelly oil in a thick bottom vessel and saute ginger, garlic, green chilly until cooked, adds turmeric powder and Kashmiri chilli powder.
- Add blanched Amaranthus to this, saute till cooked by stirring, add salt and adjust the taste.
- Add asafoetida and fenugreek powder.
- Boil 200 ml water in a steel vessel and add vinegar heat and add one teaspoon sugar to this.
- Pour the vinegar to the pickle adjust the consistency and taste. Change the pickle to a steel vessel add sodium benzoate when cooling.
- Pack it in glass bottle and pour sufficient oil on the top of the pickle.





Machineries required



Cutting and chopping machine



Automatic pickle blending machine



Automatic pickle packing machine

CHAPTER 4

REGISTRATIONS AND LICENCES REQUIRED

- FSSAI License
- SSI Registration
- Legal Meteorology License
- Bar Code Registration
- Pollution Control Board License for unit having a motor capacity above 9.5 H p
- GST Registration

FSSAI labelling requirements

- Name, trade name or description
- Name of ingredients used in the product in descending order of their composition by weight or volume
- Name and complete address of manufacturer/packer, importer, country of origin of the imported food (if the food article is manufactured outside India, but packed in India)
- Nutritional Information
- Information Relating to Food Additives, Colors and Flavors
- Instructions for Use
- Veg or Non-Veg Symbol
- Net weight, number or volume of contents
- Distinctive batch, lot or code number
- Month and year of manufacture and packaging

- Month and year by which the product is best consumed
- Maximum retail price

FSSAI for Amaranthus products

Every food business operator involved in the manufacture, processing, storage and distribution and sale of food products must compulsorily obtain FSSAI Registration or License.

It is a 14-digit registration of a license number which is printed on all the food packages. The 14-digit registration number gives details about the assembling state, producer's permit.

FSSAI license & registration

Registration: For turnover less than 12 lakh.

State License: For turnover between 12 Lakh to 20 crores.

Central License: For turnover above 20 crore.

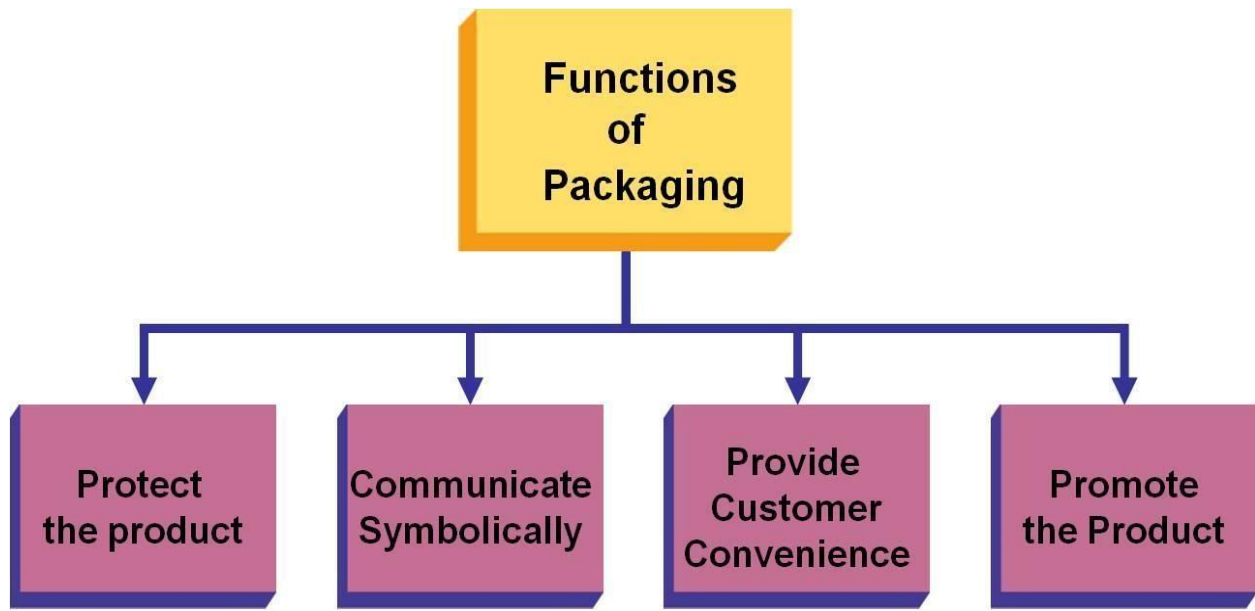
CHAPTER 5

PACKAGING OF AMARANTHUS PRODUCT

- Amaranthus based value added products like leaf squash, Pakkavada and stem-based Cutlet and Pickle need to be packed safely and hygienically without losing its nutritional properties.
- Amaranthus squash has been made using the extract of the leaves and sweetened with sugar and enough citric acid, artificial flavor and class -II preservatives.
- Amaranthus Pakkawada has been prepared using cooked and mashed leaves with basen flour, rice flour, Maida, chilly powder, asafoetida and salt into a dough and then fried the ribbon like Pakkawada in hot oil.
- Amaranthus Cutlet is a highly nutritious snack item prepared using the stem of Amranthus and other ingredients like soya chunks, onion, potato, green ginger , garlic and spices.
- Amaranthus pickle is prepared using the stem of the Amaranthus and other ingredients like ginger, garlic, chilly powder, Asafoetida, Gingelly oil and vinegar



Role of packaging



Other Physical Protections of Packaging's

- Offer Protection against environmental conditions- moisture barrier
- Offer protection against microorganisms- oxygen barrier
- Strength properties to withstand mechanical hazard during transportation and storage
- Have a good printability.
- Moisture absorption from humid atmospheres promotes microbial growth in turn leads to loss of structure, texture, and consistency of the product.
- Beyond a certain level of moisture content, microbial infection and biochemical degradation sets in.

Consumer Packages

- The options available to the traders/exporters in the selection of a consumer pack for domestic and export market are quite wide.

- The selection/choice of the packaging material/system depends upon a number of factors.
- Shelf-life period(the degree of protection required by the product against moisture pick-up, aroma retention and discoloration.
- Climatic conditions during storage, transportation, and distribution.
- Type/sector of market.
- Consumer preferences.
- Printability and aesthetic appeal.

Suitable container for Amaranthus squash

- Three most popular packaging for juices, smoothies, and fruit-based beverages are Glass, PET and Cart .
- The most important parameter to check while evaluating package performance of different packaging materials is their ability to protect product quality. Other factors that take into consideration are recyclability and shelf life.
- Three very important properties which packaging should have if it is to aptly maintain product quality are as follows:
 - Aroma barrier
 - Gas barrier
 - Light barrier

Nearly all juices, smoothies, and fruit-based drinks are extremely sensitive to oxidation, which can lead to loss of vitamins and unwanted changes in color and taste. The gas barrier attribute of a container plays a major role in determining oxidation rate and consequently quality degradation. The other important attribute is oxygen exposure, which includes oxygen in head space, permeation through closure or spout, and how permeable the walls of the container.

CHAPTER 6

SANITARY AND HYGIENIC REQUIREMENTS FOR FOOD MANUFACTURER/ PROCESSOR/HANDLER

- 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.
- The premises to conduct food business for manufacturing should have adequate space for manufacturing and storage to maintain overall hygienic environment.
- The premises shall be clean, adequately lighted and ventilated and sufficient free space for movement.
- Floors, Ceilings and walls must be maintained in a sound condition.
- The floor and skirted walls shall be washed as per requirement with an effective disinfectant the premises shall be kept free from all insects. 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.
- 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.
- 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.
- No vessel, container or other equipment, the use of which is likely to cause metallic contamination injurious to health shall be employed in the process.
- All equipment's shall be kept clean, washed, dried and stacked at the close of business to ensure free from growth of mould/ fungi and infestation.

- There should be efficient drainage system and there shall be adequate provisions for disposal of refuse.
- The workers working in processing and preparation shall use clean aprons, hand gloves, and head wears. 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.
- All food handlers shall keep their fingernails 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.
- 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.