

## APPROPRIATE TECHNOLOGY FOR PRESERVATION OF FOOD IN UNSEALED COVERED CONTAINERS

S.R.H. RIZVI

PCSIR Laboratories, Karachi 39

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This technology is applied with simple handy kitchen appliances or modified appliances suitable for large scale handling. This technology is useful both for homes and for farm sites in remote areas particularly where there is a problem of disposal of surplus fruits and vegetables. The bulk storage may be done during glut season when surplus and low quality produce is wasted because of the lack of storage facilities and consumption in the market. However, this surplus could be saved from wastage through processing. The processing of materials is economical while most of the desirable qualities of fresh fruits are retained. The material thus stored through processing is available throughout the year for use in the food industry both at large and cottage scale as well as for consumer use.

Some of the fruits and vegetables on which we have successfully conducted experiments in which unsealed covered containers (plastic / glass) are used, include: (1) mango, (2) tomato, (3) citrus fruits, (4) apple, guava and plum, (5) chillies, (6) ginger, garlic and onion, carrot, cauliflowers, (7) beet root.

### MANGO

This fruit is grown all over Pakistan and many other countries. It is consumed both green and ripe. Green mature fruits are used for the preparation of vinegar and oil pickles, chutnies etc. The pulp of ripe fruit is used for the preparation of squashes, jam, nectar etc.

*Storage of Unripe Mango.* Unripe mango required for oil pickle making sliced with skin and stone, and the mango slices required for chutney and ginegar are without skin and stone.

Select sound fully mature fruits, wash them thoroughly by soaking and subsequently rinse in clean fresh water. Take entire fruit and chop into longitudinal slices with stone. Remove only the seed (Cotyledons). Alternatively peel off the skin and cut long slices of the white flesh. Discard stone and skin. These slices are stored in brine. Brine storage is highly technical and need curing

with increasing concentration of salt as explained below:

Initially 8–10% of common salt in proportion to the slices is added in a wide mouth glass/plastic containers. Further addition of salt is slow with interval of 2 to 3 days. When the slices are fully cured, the final salt concentration of 16–18% is achieved. At this stage the top is covered with a layer of salt and the lids of the containers are placed and are sealed with melted wax. After sealing, the containers are kept at a cool dry place.

The brin-cured mango can be stored for a long time and is readily available for the preparation of oil pickle, vinegar pickle, sweet mango chutney etc. At the time of use, the brine is drained off and the excess of salt from slices is leached out by washing in water.

The composition of different products depends on the taste of the people of that area.

*Storage of Ripe Mango Pulp.* Sound and fully ripe mangoes are selected. They are washed thoroughly in water by soaking and subsequently rinsed in clean fresh water. Pulp from mango is either extracted by hand or by pulping machine depending upon the amount of fruit and circumstances. The pump available is ready for preparation of squashes, jam and fruit nectar. The pump can also be stored as such in narrow mouth bottles with the help of potassium metabisulphite. Before adding the preservative, the pulp should be pasturised. The ratio of preservative to pulp is 3 oz metabisulphite to 100 lb pulp i.e. 1g/45g. The preservative is first dissolved in a small amount of water and then added to pulp and is thoroughly mixed. After addition of preservative, cover the lid and seal it with melted wax. Keep the juice in a cool dry place. The excess sulphur dioxide is removed by boiling the pump before use.

The pulp stored as above is available for the preparation of desired products. The preparation of squash has been discussed along with orange squash and for mango jam the procedure for apple and plum jam may be followed.

## CITRUS FRUITS

This group includes orange, mandarin, tangerine, lemon, lime, grape fruit, etc. The juice of all these fruits are used for the preparation of squash, cordial, jelly/marmalade etc.

*Extraction of Juice.* Wash oranges, lemon, lime etc. with hot water to remove dirt and excess of peel oil (peel is responsible for off flavour and bitterness in juice and squash), cut fruit in half and extract juice with hand juice extracting machine/electric juice extracting machine. Strain off the juice with strainer to remove small seeds and thick pulp. Again strain through a muslin cloth. Pasteurize the juice. This juice is ready for preparation of squash and for storage.

*Storage of Juice.* Place measured amount of juice in a narrow mouth glass/plastic container. Add sulphur dioxide or potassium metabisulphite. (Add 3 oz metabisulphite per 100 lb juice, i.e. 3000 ppm metabisulphite). Cover the lid and seal it with melted wax. Store in a cool dry place.

*Preparation of Squash of Mango, Orange and Lemon.* Add 30 lb water to 100 lb sugar in a pan or kettle and heat. When the sugar is completely dissolved add 2 lb citric acid. Remove the pan from fire and strain the syrup through a double fold muslin cloth. Add 70 lb of orange/mango/lemon juice and mix thoroughly. Add 1 oz potassium metabisulphite per 100 lb squash. (Juice stored with sulphur dioxide or metabisulphite need no addition of preservative).

Put the squash in sterilized bottles. Seal by using sterilized corks and melted wax. Keep the bottle in a cool dark place.

*Preparation of Orange Jelly.* It is prepared as discussed in apple jelly, but pectin is added during the process.

*Lime Pickle.* Whole lime fruit can be preserved in brine by adding 8-10% salt in the initial stage and increasing slowly the salt concentration to 18% at the final stage. Fruit preserved will be available for the preparation of oil pickle and vinegar pickle.

## GUAVA, APPLE, PLUM, PEACH AND APRICOT

### *Extraction of Pulp and Juice*

*Guava.* Select sound fruit. Wash them thoroughly in cold water. Cut into slices of  $\frac{1}{2}$  to 1 cm thick. Add equal amount of water. Boil in an aluminium vessel for about  $\frac{1}{2}$  hr till the fruit is soft. Place the heated material on a muslin cloth and squeeze. Collect the juice and reject the residue. The juice contains all the soluble ingredients of

the fruit. This juice can be stored for a long time with the help of potassium metabisulphite at the rate of 3000 ppm or 3 oz per 100 lb juice. This juice can directly be used for the preparation of jellies as discussed below.

*Apple, Plum, Peach and Apricot.* Select sound fruits. Wash thoroughly in water. Peel apple. Blanch peach and apricot and remove skin. Cut into slices of  $\frac{1}{4}$  to 1 cm thick. Add equal amount of water and boil. Plums do not require peeling and slicing. Boil fruit with water in an aluminium vessel placed on direct fire or in a steam pan till the fruit is soft. Pass the heated material through an aluminium or stainless steel sieve of 2-3 mm mesh, the seeds and skin are removed and a homogenous pulp is obtained.

The pulp can directly be used for the preparation of jam, jellies etc or can be stored for further use with the help of 2 oz potassium metabisulphite per 100 lb pulp (2000 ppm).

*Preparation of Jellies and Jam.* In the preparation of jelly the decanted clear juice is taken and for the preparation of jam whole pulp including clear juice is used. Three important factors in the preparation of jam and jellies are: (1) sugar, (2) acid, and (3) pectin. When these are not properly proportioned several problems arise. Fruits which are rich in pectin and acid give excellent sets, however, those poor in these require their addition in such proportion so as to give a good set.

The juice extracted from apple, plum, peach, apricot, and guava, requires sugar. The quantity of sugar is directly dependent upon the pectin content of the pulp which is explained as under:

Take a teaspoonful of cool juice in a glass tumbler and add to it 2 teaspoonful of methylated spirit. Shake gently and allow it to stand for a while. Pour out the mixture on a plate and note the size of clotting: (a) number of small clots indicate that pectin is present in small quantity and sugar should be added less than  $\frac{1}{2}$  lb for every pound of juice extracted, (b) when two or three clots form, less than  $\frac{3}{4}$  lb sugar should be added to every pound of juice extracted. (c) If only one large clot forms, then the juice is rich in pectin and equal amount of sugar should be added.

*Cooking and Filling.* Put the strained juice in an aluminium vessel or steam pan and add requisite amount of sugar and citric acid, if required. Heat the mixture to boiling. Remove any scum that may appear. Stir to avoid charring. Cook to 221 F or 105 C. Pour hot jam or jelly into dry glass jars which has been previously sterilized in boiling water, leave for 4 to 6 hr for the jam or jelly

to set. Put a thin layer of melted wax in each jar to cover the jam/jelly surface. Seal the jars with lids and store in a cool, dry place.

### TOMATO

Apart from consumption of fresh tomatoes, the fruit is also consumed for the preparation of tomato juice, puree, ketchup, sauce etc. During its peak season it is very cheap. When the crop is very good, it has been noted that harvest becomes uneconomical and the farmers are compelled not to harvest, with the result that a huge produce is wasted. At the far site this surplus can be stored as pulp. This pulp can be used for the preparation of different tomato products.

*Preparation of Pulp.* Select sound and deep red mature tomatoes. Wash them thoroughly by soaking and subsequently rinse in clean and fresh water. Trim off all green portions and remove stalk, decayed portion and cracks. Crush the sorted trimmed tomatoes by hand with the aid of a wooden ladle or crushing is done through a crusher. Boil the crushed mass in an aluminium vessel or steam-jacketed pan for 5 min. Strain through a sieve of 1 mm mesh made of stainless steel or aluminium.

*Filling.* Fill in narrow mouth bottles while the pulp is still hot or lukewarm. Add 3 oz potassium metabisulphite per 100 lb pulp. Cover the lid and seal the lid with wax. Store in a cool place. Concentration of this single strength pulp is 6%.

*Tomato Puree.* Concentrate the juice obtained above to  $\frac{1}{2}$  -  $\frac{1}{3}$  its original volume. The concentrated pulp is known as tomato puree. It is prepared in a manner similar to tomato ketchup except sugar, salt, spices and vinegar are not added to it.

*Tomato Ketchup.* Concentrate tomato juice to 14° Brix then add sugar, salt, spices, vinegar etc., as are given below:

Pulp	-	5 lb
Sugar	-	12 oz
Salt	-	1¼ oz
Mixed spices (Chillies, nutmeg, mace, clove, peper, etc.)		½ oz
Onion	-	2 oz

When T.S.S. reaches 37, lower the flame and add 10 ml acetic acid and colour. Mix thoroughly. Fill the ketchup while hot in sterilized bottles and seal with cork and melted wax. Store in a cool place.

### CARROT, GARLIC, CAULIFLOWERS, CHILLIES, GINGER

Carrot, garlic, cauliflower, chillies, ginger etc., can be preserved in brine.

*Cauliflower.* Select good heads of cauliflowers. Cut into small pieces without damaging the flowers. Wash thoroughly in water. Weigh and place in a wide mouth containers. Add measured amount of water. Add common salt at the rate of 5% to the total weight to flower and water and cover with lid. Open next day and add some more salt. Increase the concentration of salt gradually. Final concentration should be 16%. Change the water and retain the concentration of 16% salt, cover the lid and store in a cool place.

*Carrot.* Wash thoroughly and cut longitudinally or transversely. Place in wide mouth containers and process it as for cauliflower to a concentration of 16%. When fully cured, place the lid and store in a cool place.

*Chillies.* Select chillies and remove stalks etc. Wash and process as carrot and store.

*Ginger.* Select ginger rhizome, wash and peel. Process like carrot, Shredded ginger can also be stored in brine.

*Garlic.* Peel small bulbs. Pass slowly through different stages of salt. Store in 18% brine.

*Onion.* Select small onions. Peel off skin and remove stem and tip, place in a wide mouth container and pass through the different stages of salt as in the case of carrot. Change the brine and store in a cool place.

All the above vegetable preserved in brine are available for cooking and for the preparation of pickles. Before use the excess salt should be leached out.

### BEETROOT

Select beetroot, remove green leaves and lateral roots. Boil in 2% salt water till the roots are cooked. Peel the skin and place them in 6% acetic acid solution with little sugar and salt. Store in a cool place.