

RAW PISTACHIO PROCESSING IN IRAN

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Summary - With the 4-fold expansion of pistachio production in Iran in the past 25 years, traditional methods of processing have undergone enormous changes. Today most of the 200,000 ton Iranian crop is processed by modern processing lines developed, patented and manufactured in Iran. Local industry has benefited from the government policy of self-sufficiency and leading manufacturers like Momtazan Industrial Co. have started to look for overseas customers for complete processing lines including salting and roasting. Momtazan machinery and patents have dominated the Iranian processing plants in the past ten years, because of gentle handling of pistachios and the use of minimal amounts of water, and this has led to a safer product and cleaner environment. Usually most Iranian big farmers prefer to handle their own processing, so processing lines are planned around a capacity of 3 tons per hour, with major processors having 5 or 6 lines. This is partly necessary because processors have to handle three different varieties. In this article a brief but comprehensive description of the main machinery is given including hulling machine, air-leg for removing trash, machine for removing stick-tight, pre-drier, air-flow float tank, differential friction stick-tight separator, color sorter, needle machine for removing closed nuts, sizing, salting and roasting machinery. Also, the problems of hand picked harvesting are discussed and new ideas are sought for cracking this hard nut.

Key words: Pistachio, processing, machinery, MOMTAZAN, IRAN

INTRODUCTION

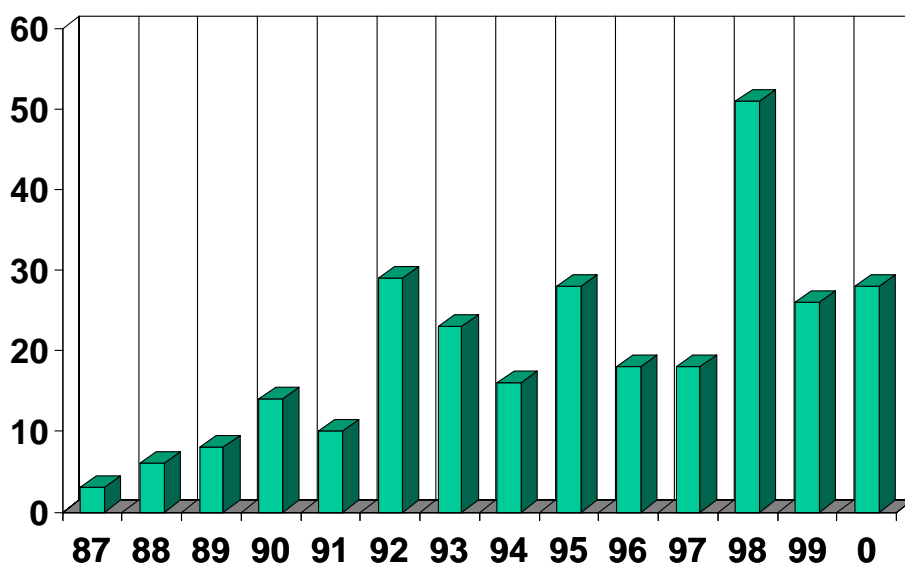
Iranians have started farming pistachios since a few thousands years ago. The first orchards were cultivated in Khorasan region. In the 6th century there are references to pistachio plantations in *Beihagh* (present day *Sabzevar*) and *Ton* city (present day *Ferdos*). Pistachio plantations eventually spread out to the Mediterranean coast and could be found in Turkey, Syria, Greece and North Africa. In the nineteen thirties, pistachio seeds were taken to the USA from Iran and planted in California. Until the beginning of this century pistachio was considered a luxury item, and it was not planted commercially. Farming pistachios as an independent crop, was started some 70 years ago in *Rafasanjan* a small city in *Kerman* province in southern Iran, it gradually spread to the whole province and other regions in the country. Today more than 200,000 tons of different varieties of pistachios could be produced in Iran annually.

DEVELOPMENT OF PISTACHIO PROCESSING MACHINERY IN IRAN

For hundreds of years pistachios were peeled (hulled) by hand. The workers handling this job worked so fast and skilfully that it was difficult to see the procedure even at close observation. About 25 years ago a machine was developed by an industrialist from *Kerman* to peel the pistachios. For quite sometime, the machine was enough to handle hulling which was considered the main task and the rest was done by hand. There were many efforts and quite a number of technical specialists tried to find a general solution for a complete line for processing pistachios. Among them, some 15 years ago, a company called *Momtazan Industrial Company* started manufacturing complete pistachio processing lines. This company developed 5 patented machines, these and other machines altogether form a continuous line. This company which started its activity in a small 20

square meter garage upon request of one of the enthusiastic pistachio growers today is manufacturing the processing machinery in a 30,000 square meter plot of land and about 8,500 square meters of factory space, employing some 130 people. Nowadays, Momtazan is proud of its record of machinery sales as indicated in the chart below.

Total hulling and processing lines provided by Momtazan



Total = 278

Overall pistachio processing in Iran can be divided into two parts:

PART I: Processing and hulling of raw pistachios from orchard

PART II: Processing of dried pistachios

PART I

Processing and hulling of raw pistachios from orchard

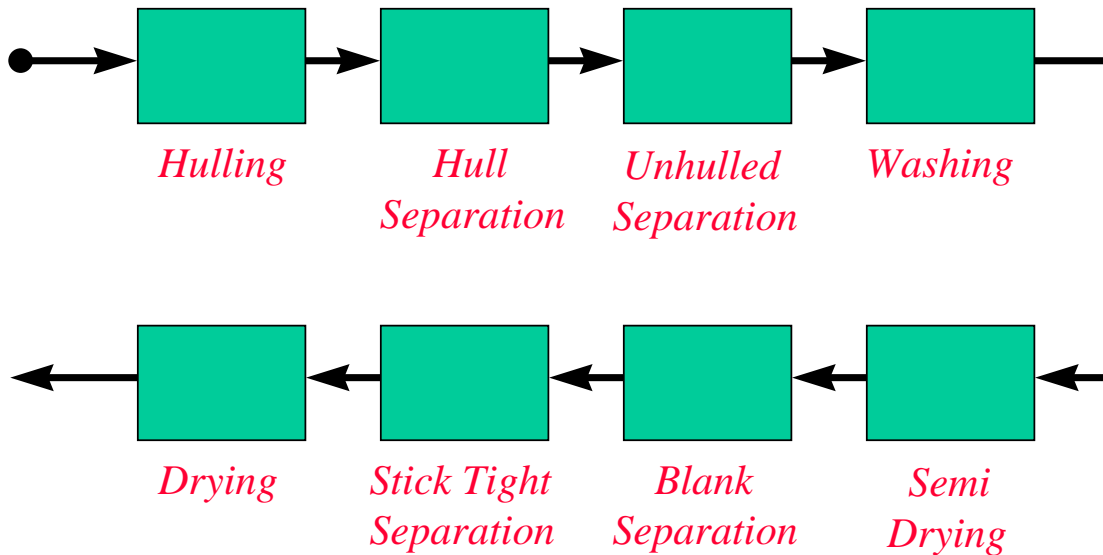
Because of traditional cultivation of trees, there is a gap of four to ten meters between rows and one to two meters between trees in each column, fresh pistachios have been harvested with bunches by laborers and charged into sacks. Then, sacks are collected and transferred to the processing plant by pickups, trucks or trailers for processing. In the plant separate activities are carried out automatically as shown in the following sequence.

Pistachio hulling and processing sequence is done in two methods.

- I dry processing**
- II Wet processing**

Dry pistachio hulling and processing line manufactured by Momtazan

In dry processing the procedure is as follow:



MOMTAZAN Dry Pistachio Hulling & Processing Sequence

As harvested pistachios are charged to the processing line, in dry processing they pass through the following steps:

- Hulling
- Separation of trash
- Separation of unpeeled pistachios
- Washing
- Pre-drying
- Separation of blank pistachios
- Separation of shell stick tight pistachios
- Drying

Hulling Machine

The most important machine in a hulling line is the peeler. Pistachios are peeled in Iran in a very simple, unsophisticated, reliable, stable and very economical manner. In this type of machine water is not used and this is a great advantage. Comparing this method with the peelers using water shows the advantages of dry hulling. In a wet peeler huge amounts of water is used, and quite a large pool is required for used water from each hulling line. Also a trash truck separator should be employed to separate the trashes. Another truck is needed to carry the trashes from the area and dispose of them. There are many environmental problems. However, in the dry peeling method (Iranian peeler), since there is absolutely no water involved in the peeling, hulls are conveyed into a truck by a conveyer belt continuously.

This type of machine is used for pistachios harvested with bunches as well. The machine design is very simple and for many years most of the small growers were able to use it in the villages and orchards far away from industrial zones. A new model of dry peeler that has been developed recently by *Momtazan Industrial Co.*, does the hulling much more delicately. It does not damage the pistachio kernel and avoids peeling unripe pistachios. This is more advantageous, as later on, the unripe pistachios could be separated easily.

Trash Removal

Most of the hulls, bunches and leaves are separated from the pistachios by the peeler and are conveyed out of the area. Some very small remaining pieces of hulls, bunches and leaves are separated at this stage. The amount of total trashes will not exceed more than one percent of total amount of hulls and bunches separated by the peeler itself. Trash removal is also a dry procedure. Trash separation is also used in the wet hulling lines, after pistachios are peeled by the wet peeler, but the dry thrash removing machine which is designed by *Momtazan* is more practical.

Separation of Unpeeled Pistachios

This machine is one of the most important machines which has been developed by *Momtazan Industrial Co.* By a very simple method unpeeled pistachios, which are unripe, are separated. For many years, unpeeled pistachios were picked out by laborers and this was really a very hard job and inefficient method. Development of this machine has led to a very clean and hygienic way of processing pistachios requiring much less labor.

Unpeeled pistachios are those pistachios with hulls sticking tight to the shells, because they are unripe. These pistachios, after separation, could be treated in either of the following methods:

1. Peel them with a wet grinding top peeler machine. This machine is positioned in a very suitable place in the new *Momtazan* hulling line. Unpeeled pistachios after being separated are immediately peeled by grinding method and after being peeled join back the originally peeled pistachios continuously without any further action.
2. Dry unpeeled pistachios as they are. As you probably are aware, the color of unripe pistachio kernels is greener than those of normal pistachios. Therefore dried unpeeled pistachios are later shelled, and the greener kernels are sold to the market at a higher price.

Washing

As pistachios are moved forward by a special stainless steel conveyor, water is sprayed at high pressure on top of the pistachios. This special conveyor removes the remaining trashes and loose hulls while they are being washed. Pistachios only take a shower and water consumption is minimal as nozzle sprayers are adjustable. As much as water is available, pistachios will be cleaned as well. The amount of water used, varies from zero up to three cubic meters per hour. Almost all the trash and dirt are separated by dry the air-leg and the peeler. Therefore, the water that is only used for washing pistachios, is clean and looks clear and could be sent back to the ground or used as irrigation water. This special conveyor has a slope and pistachios are forwarded while trashes removed easily.

Pre-Drying

At this stage we prefer to heat the pistachios as they move horizontally forward, for about 6 meters, for the following reasons:

- Some of the closed mouth pistachios that are about to open, would open up, because of the sudden heat shock they are subjected to.
- Normal split pistachios will open up more, looking more appealing.
- Other machinery, operating with dried pistachios from now on, work more efficiently.

Heat is generated by either gas or diesel oil burners. Heat is blown underneath the pistachios while they are moving forward. Heat direction is perpendicular to the direction of pistachio movement. A very nice, gentle and easy method is designed for forwarding pistachios through the heat bed. This mechanism is patented. The total contact surface of pre-drier with pistachios is made of stainless steel. Pistachios are turned many times as they are driven forward and receive heat. This will not damage the product and improves the quality of the pistachios due to the thin layer, and

allows pistachio mouths to be opened more. Actually the amount of kernel humidity will not decrease much. Only the water that has been absorbed in the washing process is removed at this stage.

Separation of Blank Pistachios

Blank pistachios are separated in two ways: By a water floating tank; By an air flow floating tank
The purpose of using floating tanks of any type is as follows:

- Separation of blank pistachios.
- Separation of small kernel contamination.
- Separation of blank or hollow pistachios with dried hulls on them.
- Separation of other trash.

For many years traditionally floating tanks were used to separate hallow pistachios, using water as media to float hallow pistachios. Even today still in some processing plants, that have enough water available, they are using water floating tanks. After many years of investigation and research, *Momtazan* developed a new dry floating tank and changed the media using air instead of water. This type of special air flow floating tank called "Dry pool" later on and patented in the name of the Momtazan owner. There are some advantages of Dry Pool with respect to the floating tank.

The dry pool is a very useful machine in the whole processing line. It separates hallow pistachios, semi-hallows and dried hull pistachios, as well as very small pistachios.

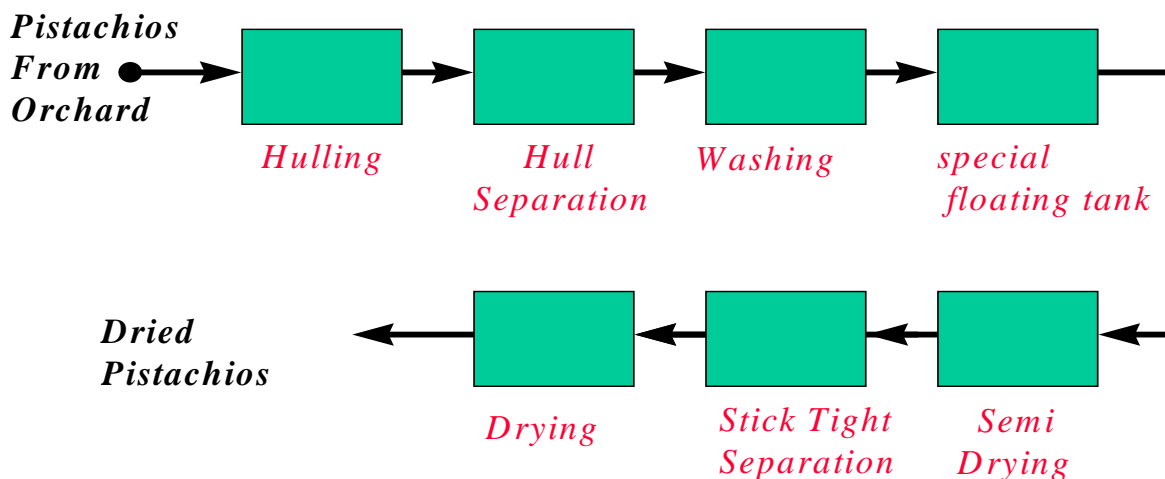
Separation of Stick-Tight Pistachios

This machine is designed for separation of those pistachios with a small portion of shell remaining on them. Most of these types of pistachios have closed mouths. The following are the reasons for separation:

- We do not like any pistachios with hulls to pass through the dryer, because this will affect neighboring pistachios and would change the color.
- Separating stick tight pistachios in this stage will decrease labor costs.

*Wet pistachio hulling and processing line manufactured by **Momtazan***

For separation of blank and lighter pistachios in wet hulling and processing method a new developed floating tank instead of air flow floating tank is used. The sequence is attached.



MOMTAZAN wet Pistachio Hulling & Processing Sequence

Separation of Blank pistachio by Momtazan Floating Tank.

If there is sufficient amount of water, the Momtazan floating tank is recommended. Momtazan floating tank is a very unique floating tank. In this special floating tank the accuracy of separation is optimum. As it indicates in Pistachio by its nature there are some air bubbles which is hidden somewhere between the kernel and shell. This causes a big problem in existing floating tanks. Because of this air bubbles the good, large and wide opened pistachios will float among blanks on the surface of the water. Momtazan developed a new floating tank which will release this air bubbles and let this good pistachios merge into the water and join the other good ones.

The location of this floating tank in wet processing line is changed. The best place is after washing machine and before pre-dryer. Most of the unpeeled pistachios which are blank, damaged by birds and insects or how some are lighter than the others are separated here. Therefore there will be no need to further processing of this kind of pistachios.

On the other hand the advantages of this type of floating tank with respect to dry pool in the line are as follow:

- Low electric required power
- Lower noise
- Not much adjustment

Dryers

The humidity of the pre-dried output pistachios of the Momtazan hulling line is about 35 percent. The purpose of using the drier is to dry pistachios up to about 5 percent moisture content. The investigation showed that in order to keep the quality of pistachios, they require about ten hours of drying with temperatures of about 40-50 degrees Celsius.

As one ton of dried pistachios (equivalent of the product of processing three tons of fresh pistachios) is the output capacity of the line, for continuous operation we need dryers with a reservoir capacity of at least 10 tons. This would let pistachios be dried slowly with high quality, while maintaining a flow rate of one ton per hour. In order to bring down the humidity of pistachios to 5 percent, the time we need is about 10 hours. We prefer to have two dryers with a capacity of 5 tons

instead of one dryer with a capacity of ten tons, because of a better chance for mixing. These kinds of dryers perform best when they work continuously. Output pistachios of these dryers are charged to small silos for better cooling and better homogenizing. Later on dried and cooled pistachios could be transferred to the stores for further processing.

In some countries like America where pistachios belong to very few growers, or processing plants are huge, they store pistachios with about 12% humidity in very large silos with capacities of 500-700 tons. With such big capacity silos humidity could be brought down slowly to 5 % while they are remaining there for long periods of time.

In Iran the situation is much different, pistachio growers are quite too many and they prefer to hull their product by themselves. Therefore using big silos is not economical. This is another reason we use two dryers instead of one. Output pistachios of these dryers mostly are charged to small silos for better cooling and better homogenizing. Later on dried and cooled pistachios could be transferred to the stores for further processing.

Technical Specifications of a Typical Processing Line

The line is designed in such a manner that no labor is required. All machines start automatically and are protected in a very safe manner. Some technical specifications are as follow:

Capacity:	3000kg/h fresh pistachios
Power consumption:	35 kW including dryers
Fuel consumption:	15 l/h diesel oil
Water consumption:	up to 1500 l/h
Total length:	30 m
Width:	2.5 m, with dryers about 8 m
Weight:	At highest 6 m

PART II

Processing Dried Pistachio

Machinery for processing dried pistachios depends on the needs and requests of the customer. Growers who finished processing of their raw pistachios look for markets to sell their product. Most of them process their pistachios by themselves, some of them selling their product to the bigger companies such as R.P.P.C (*Rafsanjan* Pistachio Producers Co-operative), some of them store and keep their product to sell at higher prices later on. The biggest ones export their pistachio themselves. Anyway, the following processing steps are taken to sell their crop at higher prices.

- Cleaning up pistachios either by air-leg or by gravity separator .In this stage some foreign particles such as shells, trashes, blanks, blanks with stick-tight are separated.
- For final quality control, there are picking tables to collect and pick up some unwanted pistachios. Separating yellow marked pistachios will decrease *afatoxin* contamination. Recently Momtazan is developing a color sorter to separate these pistachios in more convenient ways. Final destination and customers' requirements are very important and designate the level of separation and quality.
- Separation of split and non split pistachios.
- Sizing.
- Packing of raw pistachio. In this stage pistachios will be packed in about 50 to 70kg Gunny bags for transportation by containers.

Most of the Iranian pistachio is exported to other countries in raw in gunny bags for further salting and packing according to customers' requirements. Salting and packing business in Iran is still at its infancy. The reason is, that in the domestic market families prefer to salt pistachios according to their own method and their own taste. The reason for exporting raw pistachio is the policy and customs tariffs of importing countries.

Momtazan designed and manufactured a very efficient roaster with a capacity of 1000 kg/h as a continuous roaster. Several of this type of roasters are manufactured and installed in various places. More detailed information about this roaster is presented by our Mr.Dadgar in separate paper.

Conclusion

Development of pistachio processing machinery in Iran has taken a very long way and is still moving forward at a fast pace. In the beginning, there were sporadic attempts at manufacturing simple machines for hulling pistachios. But it remained for a man with roots in the pistachio rich *Zarand* province of *Kerman*, Iran, and bunches cultured in Sacramento, California to transform those isolated attempts into systematic development of complete pistachio processing plants of today. This progress rolls on and the next major task probably would be the picking which is still carried out by hand.