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CAJUÍNA
TECHNICAL MANUAL

UNITED NATIONS
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BRASIL
ABC Agência Brasileira de Cooperação
MINISTÉRIO DAS RELAÇÕES EXTERIORES

Embrapa

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Preface

The present manual has been elaborated by the Brazilian Agricultural Research Corporation (EMBRAPA) within the framework of a bilateral technical cooperation project for the strenghtening of cashew production in Tanzania. The project was financed by the Brazilian Cooperation Agency (ABC). Its translation to Kiswahili was a joint initiative between United Nations Industrial Development Organization (UNIDO) and the Brazilian Embassy in Dar es Salaam.

1. PRESENTATION

Industrializing cashew apples, specifically for the purpose of producing juice, jams, preserves, jelly and whole or diced dehydrated fruits, is a handy alternative to add value to products and generate income to cashew farmers in Tanzania due to the fact that they can be preserved for months without undergoing any undesirable changes, thus maintaining their organoleptic properties, such as aroma, taste, texture and color, besides, what is mostly important, their nutritional values are kept at high levels.

This product can be preserved by simply combining four factors: concentration of sugar, heating and vacuum sealing packaging. The fourth factor, both extremely important and indispensable for every food processing unit regardless of its size, refers to precautions related to Good Manufacturing Practices.

This manual serves the purpose of catering for demands from small and medium-sized cashew farmers in Tanzania, related to producing *Cajuína*, in a simple way, as an economic alternative capable of adding value to raw materials. The manual takes into account application of technology processes compatible with the local situation of family-run agribusiness, as well as compliance with all food quality and safety requirements.

2. PRODUCT DEFINITION

Cajuína is a beverage produced from clarified juice, which is sterilized after packaged, sporting amber yellow color resulting from the caramelization of naturally occurring sugars found in the juice.

The product is generally bottled in glass. Adding sucrose or any other type of sugar, as well as preservatives or chemical additives, to the juice is not allowed.

Its label must inform the product name and all other requirements related to specific labeling regulations.
Characteristics and quality patterns for *cajuína* are the following ones:

Clarified Juice (*Cajuína*)	Maximum	Minimum
Relative Density at 20^{o}C	-	1,040
Soluble Solids (Degrees Brix)	-	10
Total Sugar Naturally Found in Cashews (g/100g)	15	7
Total Acidity (% of Citric Acid)	-	0.3
Brix/Acidity Ratio	-	33
Ascorbic Acid (mg/100g)	-	40
Ethyl Alcohol	0.5	-

3. STAGES IN THE PRODUCTION PROCESS

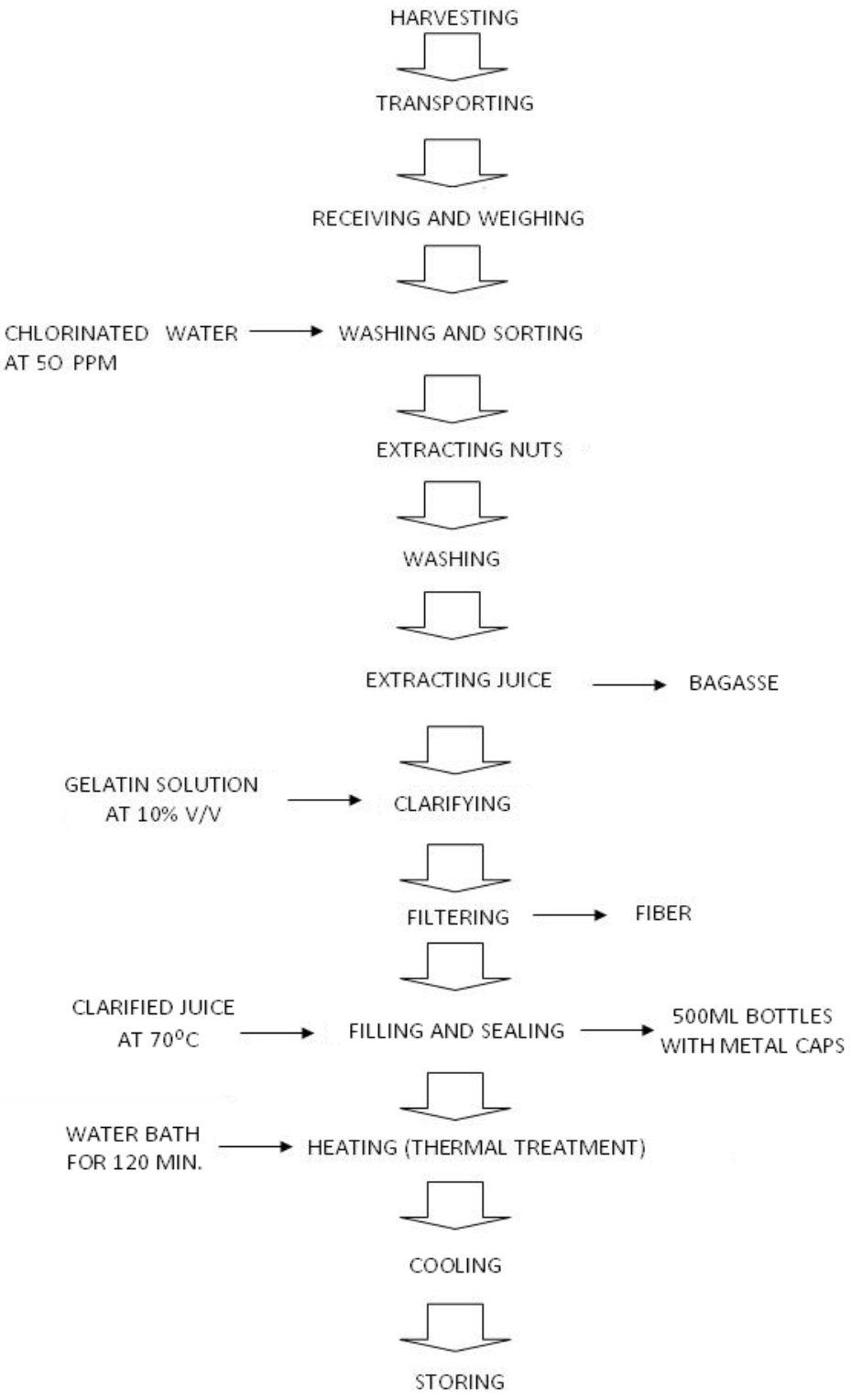

Figure 1 - Stages in the production process of cajuína.

3.1. HARVESTING

Indicators for the best harvesting time of cashew apples are color, firmness and composition. Nonetheless, in practice, harvesting takes place when apples are fully grown, in other words, at their maximum size, when they are still firm and sporting the typical color for their variety or clone.

In this stage, when touched, apples easily detach from the tree. Moreover, due to cashew's being climacteric (ripening does not continue after harvested), apples need to be harvest when they are fully ripe, when they have their best taste and aroma (maximum sugar content, lowest acidity and astringency). Because of such, harvesters must walk the orchard every day, during production season, for the fact that ripe apples spontaneously detach from the tree, thus becoming useless for consumption.

Harvesting is to be done during hours when temperatures are milder.

For correct harvesting procedures, fruits are to be slightly turned from side do side so that they detach from the panicle branch. In case apples are a bit hard to be harvested, such fact evidences early ripening stages, unsuitable for harvesting. So as to avoid contaminating apples, harvesters must keep their nails clean.

Cashews are to be stored in layers inside harvesting plastic crates or containers (Figure 2). In case an excessively large amount of cashews is placed in a crate, fruits in upper layers may damage the ones in the bottom. Also true, the ones on top layers may be damaged by the crate immediately stacked on top of them, when crates are piled up.

For industrial purposes, fruits may be hand harvested, if plant size allows it, or if it is possible to use a long rod with a bag in one end. Nevertheless, using long rods without bags or shaking branches to harvest cashews is not advisable, because they may damage apples and make flowers and unripe fruits to fall, besides the fact that they do not always allow reaching ripe apples in the top of taller trees.

For the purpose of producing *cajuína*, cashew apples must be completely healthy and ripe, with soluble solids content preferably between 10.5 and 11.5, and must not be the sour type. Their color may be red or yellow, no requirements related to this regard. Fruits must neither be soiled in sand or soil matter, and nor be contaminated with microorganisms (mold and bacteria) when directly picked ripe off the ground.

Figure 2 - Harvesting cashew apples and storing them in adequate crates.

3.2. TRANSPORTING

Cashews are to be transported to the family-run agribusiness unit in adequate harvesting crates, which must not be so deep so as to avoid many layers inside, a fact that could result in smashed fruits, damaged texture and loss of juice. In general, such crates can hold up to 17.6 liters, in other words, 8kg to 9kg of fruits, measuring 0.5m x 0.22m x 0.16m.

Crates are to be carefully placed onto the vehicle and never thrown onto it. When stacking crates one must ensure ventilation between them and that the bottom of crates never touch fruits in other crates immediately bellow them.

The driver must be instructed to avoid speeding up and bumping, because it is precisely in this stage where most mechanical damages happen.

Exposing cashews to sunlight or high temperatures after harvesting causes them to lose water due to transpiration and increased respiration rate, resulting in reduced life cycle of products. As the result of such, apples lose luster, firmness and become sweeter. Crates must be stacked in the shade before they are transported and be taken as fast as possible to the family-run agribusiness unit (Figure 3). Mechanical damages are among the leading causes of post-harvest losses of cashew apples, and hence they are to be very carefully handled.

When cashews fall to the ground they may get useless for processing, the same situation may happen when inadequate harvesting crates are used, ones with rough surfaces and cutting edges, which may damage fruits. Any damage is an opening wound for decomposer microorganisms.

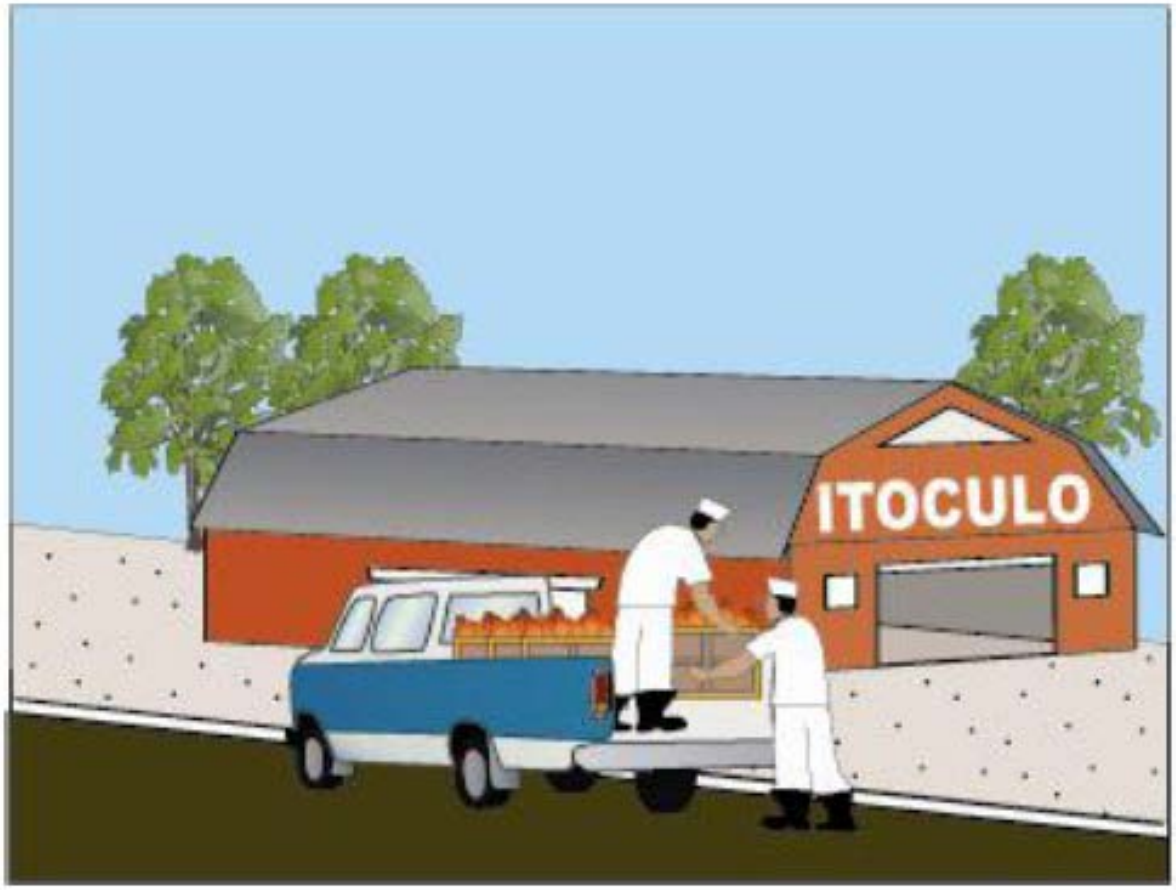

Figure 3 – Transporting cashews to the factory.

3.3. RECEIVING AND WEIGHING

Products are received in a place near the pre-washing zone, where they are weighed on a platform scale, with the purpose of providing means for payment and calculation of end product yields. The amount of raw material must be such to avoid interruptions in the production process.

Fruits must be stored in cool or well ventilated places. Crates or containers must be washed and dried before they are taken back to the field, because they may get dirty or carry mold, which speed up the deterioration process of fruits during transportation and storage.

3.4. WASHING AND SORTING

This stage aims at eliminating impurities brought from the field that may contaminate raw materials and result in problems related to equipment wearing out during the process. Washing also serves the purpose of reducing heat fruits have absorbed since they were harvested up to the moment they were received in the factory.

When cashews are brought from the field, they generally have high microbial load, due to their storage in crates, which are normally contaminated because of contact to the ground, handling, etc. Washing is aimed at reducing the microbial load on the surface of fruits and is done by sinking fruits in sodium hypochlorite solution, or bleach, from 15 to 20 minutes, in a concentration of 200 ppm (0.02%) of active chlorine (Table 1).

AMOUNT OF WATER **For 100 liters of water**	**SODIUM HYPOCHLORITE (with 8% of active chlorine)** **250ml**	**BLEACH (colorless and odorless)** **800ml**

Table 1 - Formulation of chlorinated water to wash cashews.

This concentration may be obtained by adding an average amount of 250ml of sodium hypochlorite (with 8% of active chlorine) or even 800ml of bleach (odorless) to 100 liters of water, in a tank lined with tiles or epoxy, or even made of stainless steel (Figure 4).

After washed, cashews are then placed on a sorting table, preferably made of stainless steel, from which workers remove rotten, unripe and imperfect fruits. Small imperfections and rotten spots must be removed using stainless steel knives.

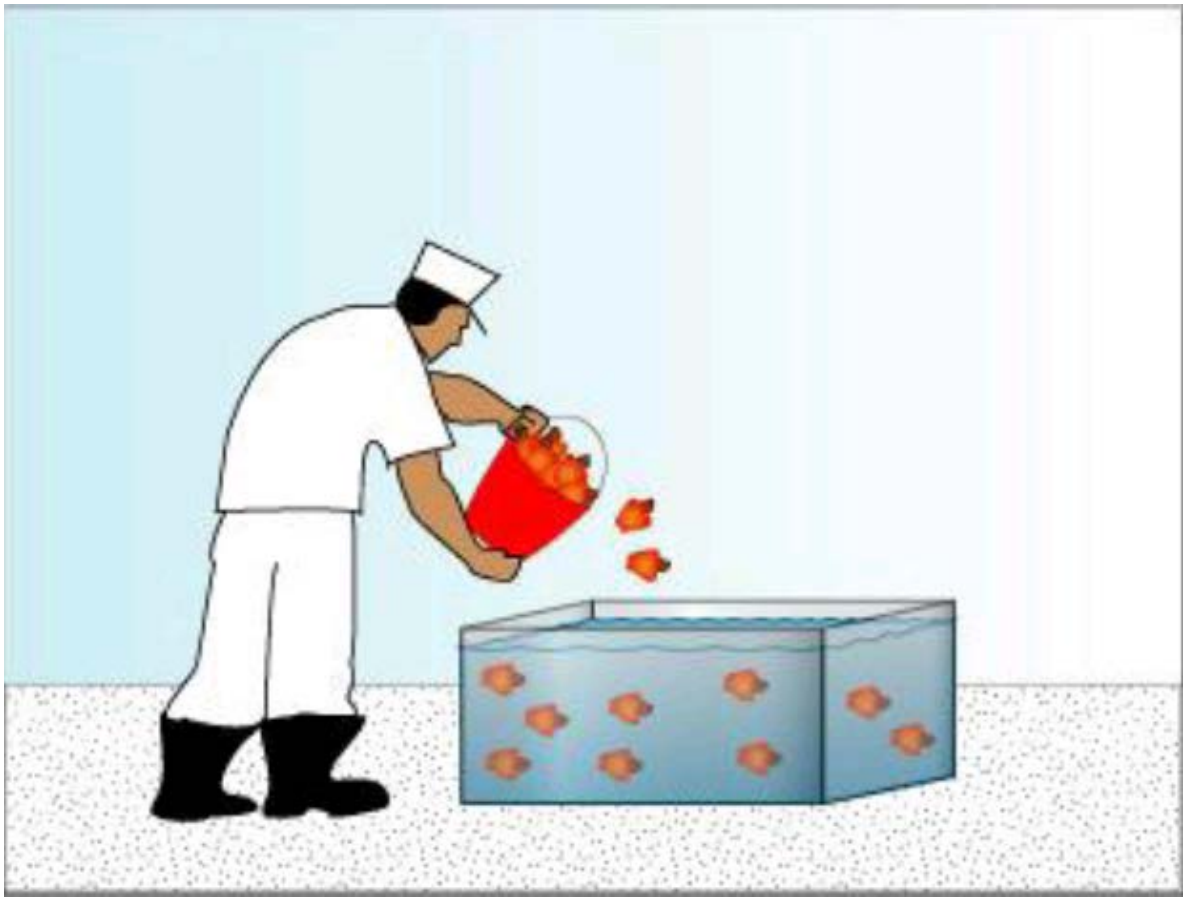

Figure 4 - Washing of cashews in chlorinated water.

3.5. EXTRACTING NUTS

This procedure can be done in two different ways. The first one refers to using a nylon string wrapped around the point where the nut is joined to the apple, which is then pulled up to the point the nut is cut loose without any tearing to the apple.

Another method is based on using a small manually-operated device to extract the nuts by means of a clear cut in the point where the nut is joined to the apple. If this operation is done by turning the nut around, tears in the apple will expose the flesh to microorganisms, resulting in decreased quality and loss of juice during washing and sanitization procedures.

Figure 5 shows the correct way of extracting nuts from cashew apples so as to avoid tearing or breaking the insertion point.

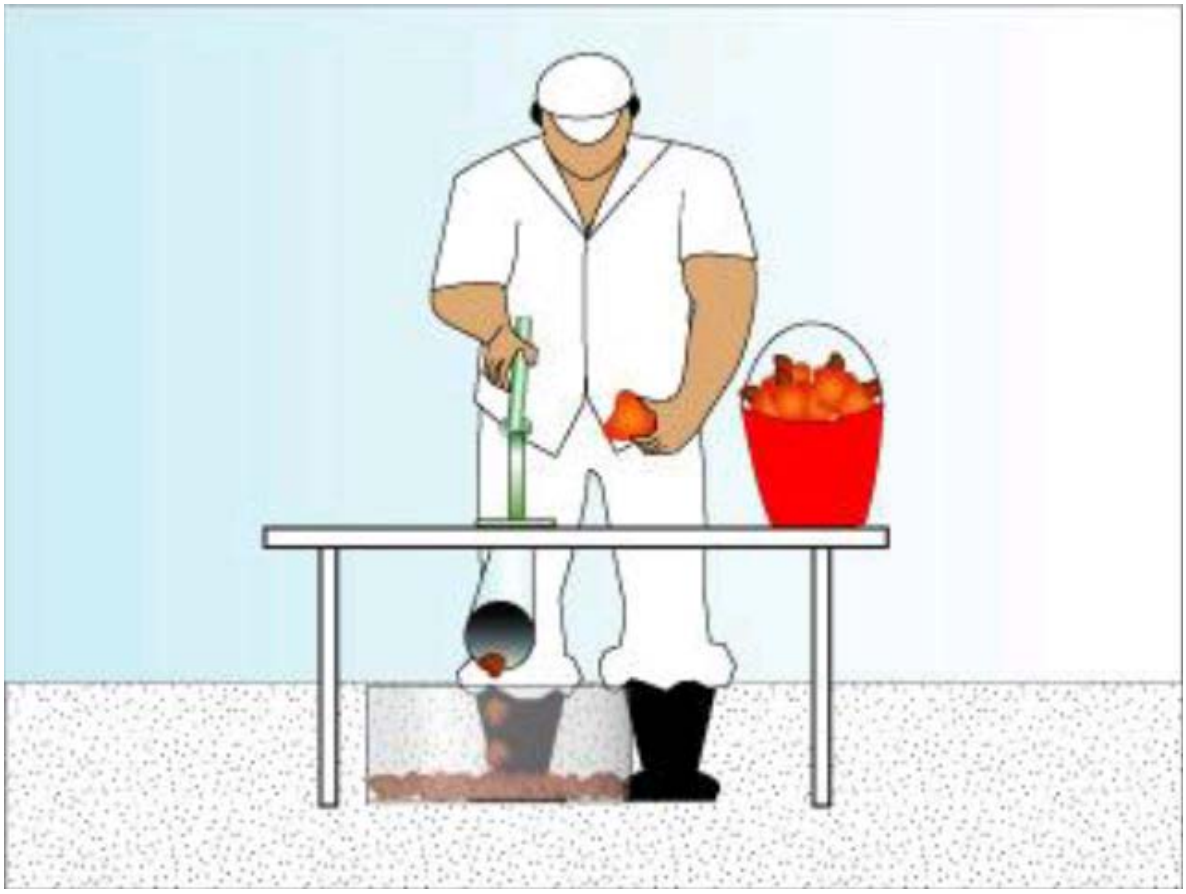

Figure 5 – Extraction of nuts from cashew apples.

3.6. EXTRACTING JUICE OR CRUSHING

Another point to be taken into account in what concerns the quality of clear juice is the type of crushing applied to extract juice. A thorough crushing, in which fibers are torn will produce more astringent juice, thus resulting in a product with different taste as compared to the one obtained through light crushing. Nonetheless, crushing must be done in a rationalized way, aiming at producing good yields and satisfactory juice quality, free of excessive amounts of tannins.

Extracting juice for the purpose of producing *cajuína* normally requires presses. Such presses may be continuous or non-continuous.

Non-continuous presses are those equipped with a device which is gradually tightened by means of a helical axis (screw type) or mechanical or hydraulic pressure used to crush batches of products. Such presses do not release large amounts of tannins from peels, but they are slower and less productive.

Continuous presses (Figure 6) are equipped with a screw that spins and crushes the apples,

thus being more efficient and productive. However an inconvenience to them is the fact that they work at lower pressures, hence resulting in lower yields, so as to avoid excessive release of tannins due to the abrasive force caused when apples come in contact with the sides of the screw.

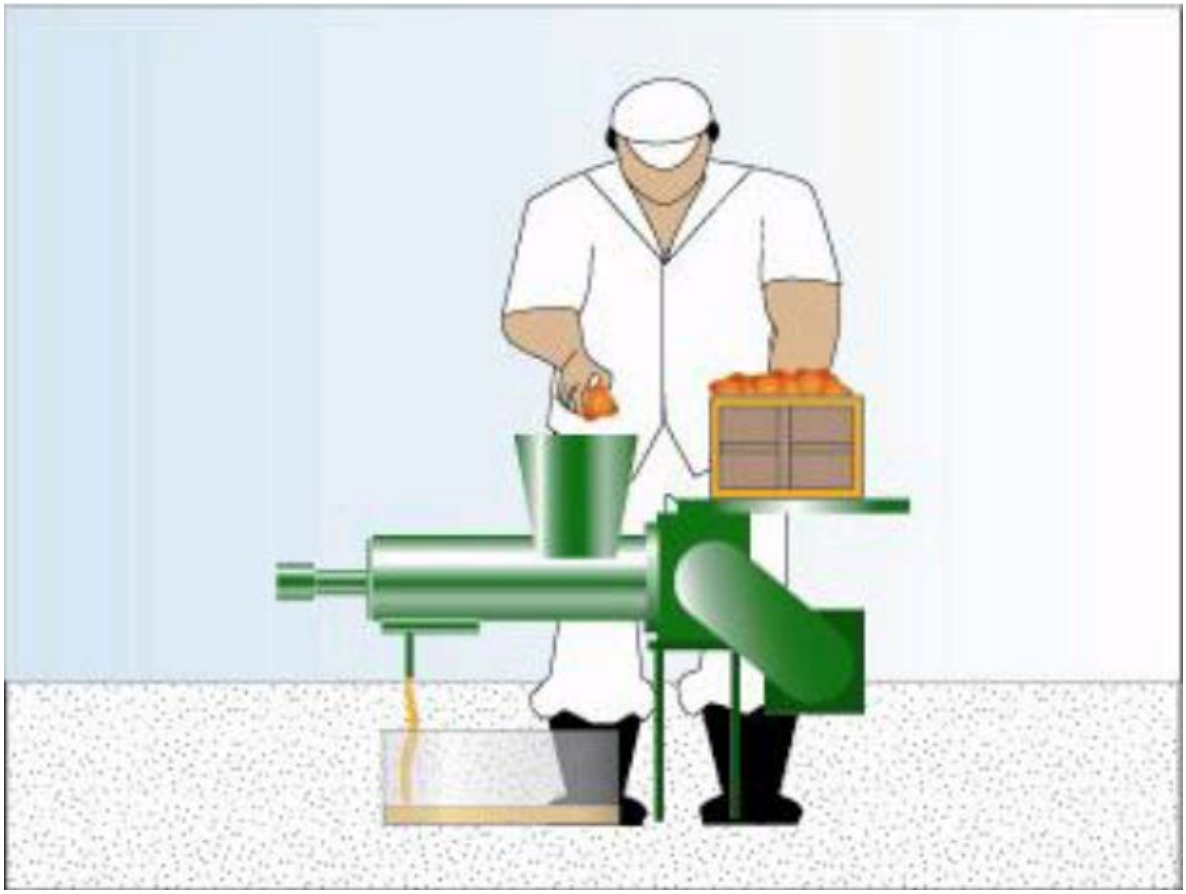

Figure 6 - Extraction of cashew juice.

These presses are known as expellers and must be completely made of stainless steel, despite the fact that brands available on the market do have small parts made of brass.

Carbon steel (“iron”) cannot be used to make such presses, because free iron particles in this material react with tannins resulting in black bluish juice.

Yields of juice produced from apples may range between 60 and 80%, however it is recommended to consider yields around 70% for best juice production.

For the crushing of apples in expeller presses, it is advisable to filter juice immediately after coming from the press so as to eliminate larger fibrous residues before the next step.

3.7. CLARIFYING JUICE

The clearness of the juice to produce *cajuína* is a determining factor to the end product quality. Hence, such juice must be exposed to clarifying agents that can effectively produce flocculation in the suspension when they come in contact with tannins.

Fortunately, tannins play an indispensable role in the production of *cajuína* since they cause flocculation of the pulp in the juice when a clarifying agent is added (commercially available gelatin).

When tannins, a naturally occurring compound found in the apple itself, and gelatin, an animal protein intentionally added, come into contact they cause destabilization in the juice, which leads to flocculation and separation of the pulp, resulting in a colorless supernatant part and another yellowish decanted part. Such destabilization takes place due to the interaction of electric charges and electrostatic forces between tannins and the protein found in the gelatin added.

Commercially available, food grade, gelatin is currently the most efficient product for such procedure. It must be added in the form of watery solution with 10% concentration, that is, the ratio of 100g of gelatin to 900ml of water heated to the approximate temperature of 50 to 60^{o}C. Heating enables gelatin to dissolve in the water, since proteins do not dissolve in cold water.

Such gelatin is obtained from the purification of collagen, which is a protein industrially extracted from cow skin according to strict requirements of good manufacturing practices. This product is refined and marketed in the form of grainy powder, light yellow in color, tasteless and odorless. It is different form gelatin found in grocery stores and supermarkets which is a colored or whitish powder.

Preparing the gelatin solution is to be done side by side with juice extraction. If not possible, it must be done after extracting the juice. That is so because gelatin in 10% solution, at 30^{o}C, is hard and more difficult to be used to clarify cashew juice.

Using very hot water to dissolve gelatin may result in denaturation or destruction of the protein chain in the gelatin, reducing its efficiency in the clarification process. Never should one add grainy gelatin straight into the juice, because it won’t be effective as a clarifying agent in such form.

Another important point to take into account is that the amount of gelatin for the juice is not determined by strict rules or according to a given percentage of solution per volume of juice. It is so because of the physical and chemical characteristics of each juice and is

related to the amount of tannins present in it, which varies, as mentioned before, according to each variety of cashew and based on other factors.

In order to add the gelatin required for cashew juice to flocculate, a fairly vigorous stirring is needed (Figure 7), however one must avoid frothing. Then the gelatin container is tilted little by little, pouring a thread of the solution into the juice, which is to be constantly stirred until well-shaped floccules are formed and separated from the supernatant part (clarified juice).

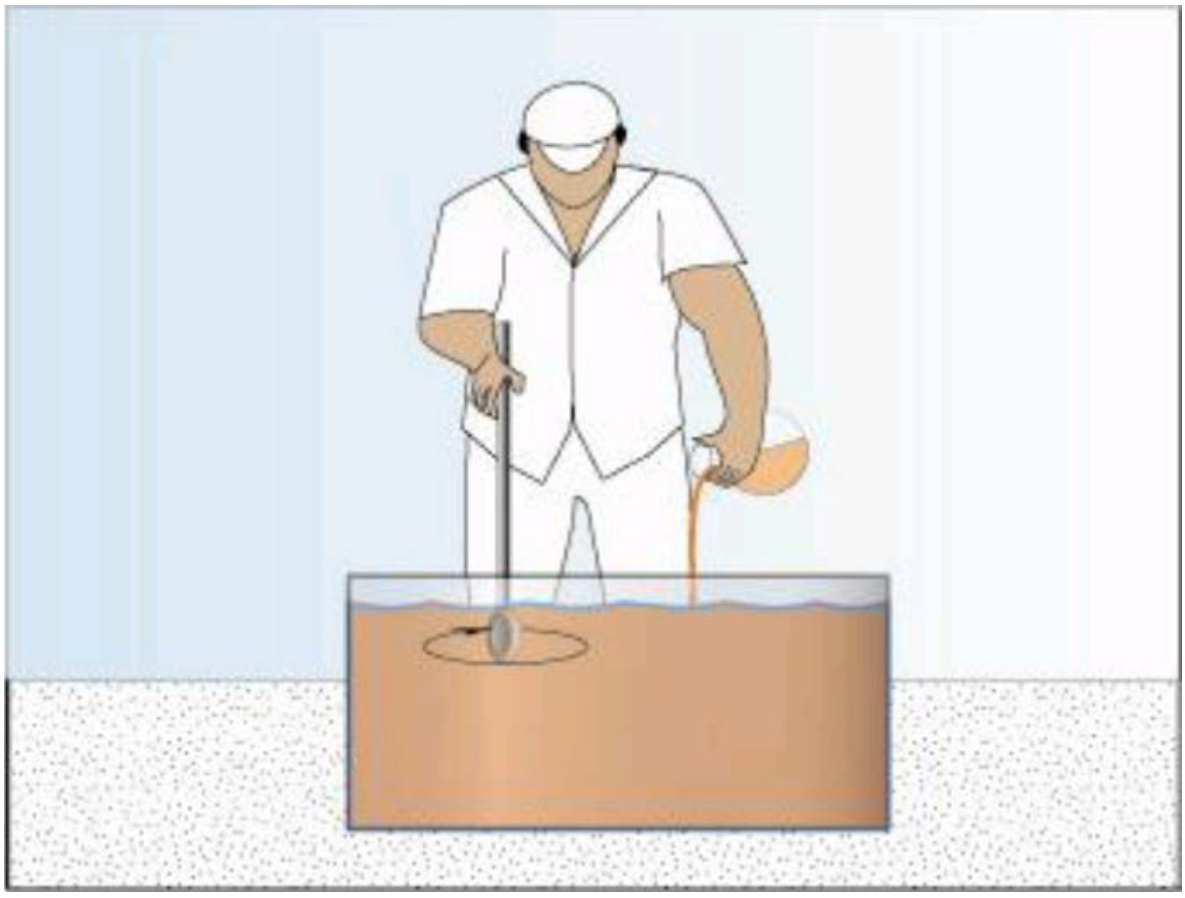

Figure 7- Clarification of cashew juice.

For small scale production, it is advisable to use a ladle capable of holding one liter. This ladle must be sunk into the juice where the gelatin solution is being poured into and stirred with movements from the bottom upward, creating a continuous flow of juice from the bottom up inside the container. In doing so, gelatin will be evenly distributed in the juice, which will favor flocculation and interfere in the speed of the reaction, as well as impacting on the size of floccules formed.

Moments after adding the gelatin solution to the juice, its color changes to whitish, cloudy or milky. This milky color remains until the time the first floccules are formed. After adding a bit more of the gelatin solution, larger floccules will be formed, making the juice look like milk coagulated after lemon drops were added to it.

In case the whitish color remains, this may be the result of a clarification process poorly carried out. It may be caused by not reaching the clarification point or going past it. If clarification point was gone past, it is advisable to add a bit more whole juice and stir it gently so that it comes in contact with the gelatin, which may have being added in exceeding amounts. In case gelatin was not enough to clarify the juice, it is recommended to continue the process until the desired result is obtained.

In order to have a perfect control of this process, which is paramount to produce *cajuína*, one must do the pitcher test, a very efficient procedure. It is a preliminary check of gelatin amounts to be used before the process itself is done, thus minimizing mistakes mentioned before.

The pitcher test is a preliminary assay, in which portions of juice being processed are tested. Samples from the juice are put in glass containers, preferably cone-shaped with the opening facing up, into which different amounts of gelatin solution are added so that the approximate amount to be used is found.

It is necessary to carry out a correlation analysis of the amount of gelatin solution used for a given amount of juice. It is recommended that the volumes for these test containers are proportional to that of the tank or production container. For example: if a clarification tank holds 100 liters, test containers should hold one liter, therefore being proportional, which makes it easier to calculate the correlation between the amount with best results in the pitcher test and the amount to be added in the production tank.

Despite of using the test, small variations may occur and it is normal, because the pitcher test is a simulation of larger scale production, aiming at minimizing mistakes and waste of materials.

Figure 8 illustrates the pitcher test used in industrial and semi-industrial production. Materials used comprise laboratory glass flasks, with holding capacity of one liter, and a 10-mililiter graduated pipette. In this test, stirring procedures are to be similar to those used in the industrial process, as well as juice and gelatin solution temperatures.

Each container needs to have holding capacity of one liter of cashew juice and must be graduated so that one can read the level in which the separation takes place moments after the test has been started.

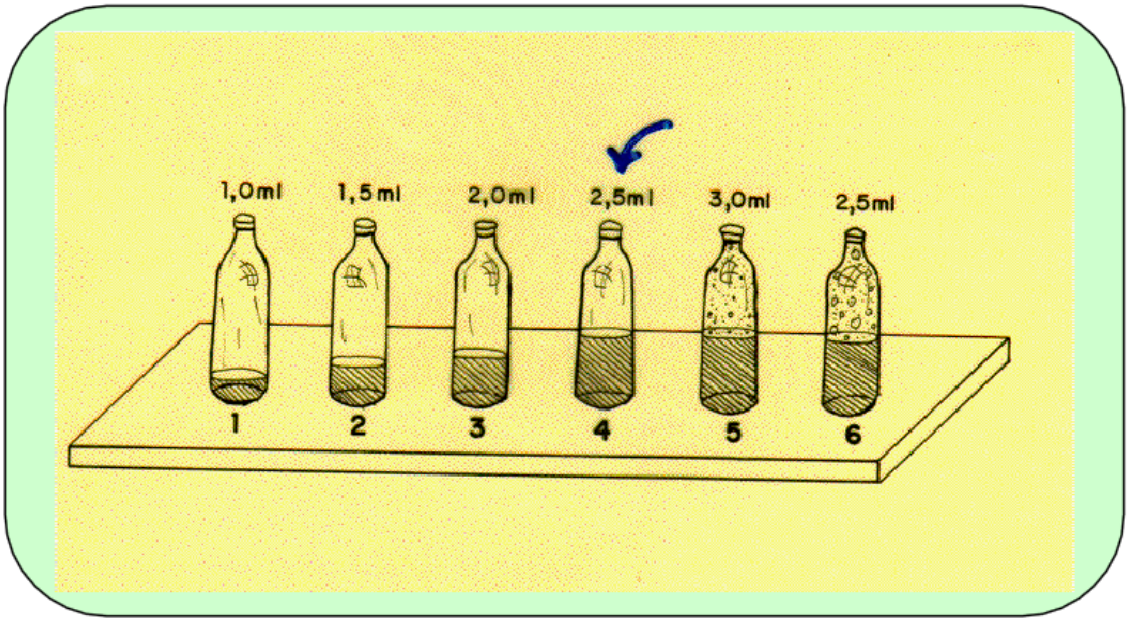

Figure 8 - Testing gelatin and clarified juice.

In the example above, bottle 4, that is, the one that received an amount of 2.5ml of gelatin solution had the best clarification, because it produced the largest amount of precipitated materials and the best juice clearness. One can observe that in spite of increasing gelatin amounts in bottles 5 and 6, the amount of precipitated materials remained the same and the supernatant part tended to be increasingly cloudier.

It is important to mention that such figures are only illustrative and that real results can only be obtained by observing the process in cashew juice. The material used in the pitcher test must be the same one used for the overall production process, and must be discarded as the test is completed.

Another important aspect with regard to clarification refers to using gelatin authorized for use in food products, that is, food grade, and certified by health surveillance institutions. The use of “glue”, which resulted in the term “gluing” *cajuína*, is an unscrupulous procedure, since “glue”, they way it was used in the past and even sometimes today, is a protein product that flocculates cashew juice and is made from leather pieces and residues from fish processing with high amounts of impurities and sometimes rich in heavy metals, such as chrome, which cause severe damages to health. By no means one should make use of such products as input or raw material in the production of food and beverage.

3.8. FILTERING CASHEW JUICE

Filtering cashew juice after clarification is to be carried out in a careful way, because it will impact on the end product quality and yields. For this purpose, cotton or felt fabric pieces are installed in three or four filters placed one on top of the other, made of an iron or wooden frame, with gutters to collect the clear juice filtered. The juice collected must be re-filtered until clear and glossy juice is obtained.

This is a slow, though efficient, process. It is possible to obtain a good amount of clarified juice, more than 80% of the whole juice amount. In this case, the fabric used as filtration medium is molded by sewing and then placed on supporting rings made of fabric to serve as stretching structures on a frame to make the shape of a rudimentary filter, though efficient for the purpose of handmade production of *cajuína* at commercial scale.

After this step is completed, one obtains clear, clarified, colorless, transparent juice, resembling white wine in color. It is also know as “glue water” in some producing regions.

3.9. FILLING AND SEALING

Clarified cashew juice is normally bottled in 500 ml bottles which are filled by hand or by means of semi-automatic fillers, and then are closed with screw or metal caps in a table top capper.

Cashew juice must be bottled still hot (70 to 80^{o}C). This procedure does not break the bottles, because they are fairly resistant to filling temperatures.

Filling bottles with hot clarified juice serves the purpose of creating vacuum inside, that is, an empty space inside the bottles where there will be no air when the juice cools down inside the closed bottles. This fact results from the state the hot liquid is in, that is, expanded. When it cools down, its volume reduces inside the container, hence creating a void called vacuum, and that helps preserving the end product.

After filled, bottles are to be closed with metal caps when they are still hot (Figure 9) in a specific capper, commercially available at specialized stores.

Figure 9 – Bottle filling and sealing

Plastic caps are also used to seal bottles with thread finishes, and this operation is done by hand.

So as to evaluate the bottle closing efficiency it is necessary to hold firmly the cap between the index finger and the thumb and then spin it to see if it easily unscrews. Some times the metal cap may spin, but great effort is required to do so. Therefore, one can consider its closing procedure to be good. Another evaluation refers to more technical inspection of rimming angles of caps by means of pass or fail calibration check.

3.10. THERMAL TREATMENT

Bottles are to be heated in water bath with the purpose of sterilizing the product according to marketing requirements, which, consequently, such procedure causes sugars to caramelize, resulting in the typical amber yellow color of *cajuína*.

While still hot, bottles are put in water bath for one to two hours after water has reached boiling point (Figure 10).

Figure 10 – Thermal treatment of cajuína

Bottles are put in baskets and then in water bath in tanks equipped with steam piping or containers made of carbon steel placed on burners, for one to two hours. It is important not to make very tall piles of bottles and to be sure that all bottles are immersed in water during the entire duration of the process in order to prevent them from breaking.

Another important point to be stressed with regard to this step is that when a basket with bottle holders is not available for the water bath, in other words, bottles are placed loosely inside the container, it is advisable to put a layer of cotton waste in the bottom to prevent bottles from breaking due to friction against the bottom of the container when boiling starts.

This procedure is of critical importance for the *cajuína* production process, because it is precisely where there are major losses of bottles due to thermal shock. Nonetheless, if the general rules are followed to avoid thermal shock in breakable materials, damages are minimized.

However, it is recommended not to place bottles filled with cold juice in hot water and never to place bottles with hot juice in cold water, because breakage will be inevitable resulting in damages and accidents.

Thermal treatment of *cajuína* serves two purposes: producing the typical color and flavor to the product and also killing microbes found in the cashew juice, resulting in a product free of harmful and decomposer microorganisms.

3.11. COOLING

Bottles containing *cajuína* are still hot and in water bath. In this very moment if removed they will break or crack due to thermal shock.

Gradual and slow cooling of bottles is necessary to have them removed from hot water. Therefore it is convenient to start putting running water at ambient temperature into the tank and simultaneously removing the same amount of hot water, without emptying the tank.

When the water in the bath reaches temperatures around 45-50^{o}C, which is recommended because one can stand keeping the hand in the water for a longer period of time, bottles can be removed without the risk of breaking or bursting. They are to be put in a place to dry and then labeled and stored in an appropriate room.

3.12. STORING

After dried, bottles are to be labeled according to the type of product. Labeling is done by hand: glue is put on labels and then they are placed on the bottles. Finally, they are stored in corrugated cardboard boxes. Storage conditions are: a dry and well ventilated place at room temperature.

4. RELATED PROBLEMS AND DEFECTS

If *cajuína* is stored for consumption during offseason periods, defects may occur, which are caused by a number of factors related to the apple itself, as well as others related to technology used, as mentioned in the following.

Cloudiness (Turbidity)

This problem may be caused during different processing steps, mostly because of very high levels of contamination and inefficient thermal treatment to eliminate microorganisms found in the juice, mainly yeasts.

Poor sanitization of bottles may also cause this problem for filth and microorganisms may have been left inside them, proliferating in the juice.

- **High contamination levels of juice or bottles is caused by the producer neglecting hygiene practices and will only be eliminated if good manufacturing practices for food products are adopted, based on thorough quality control during all production steps.**

There is also a third cause to cloudiness, which is an excessive amount of gelatin during the clarification step. In this case, such juice may be diluted in juice not yet clarified and then filtered once more.

Sedimentation after long periods of storage

When this problem happens, it indicates incorrect clarification, precisely with poor filtration. Sediments found in many *cajuínas* are the result of late reaction of between gelatin and tannins. This generally happens when the juice is bottled cold and during the water bath this precipitate is formed, decreasing the end product quality.

To avoid such problem, it is advisable to add small amounts of gelatin and that the exact moment of flocculation is determined, mainly during the end of clarification. After flocculation, good filtration will retain larger insoluble particles found in the juice.

Another important recommendation is to avoid removing the layer which will be retained in the filtering fabric during juice filtration, because this would help producing a clearer clarified juice.

Lack of typical color

The typical color of *cajuína* is amber or transparent brown. This color is produced during the caramelization process at high temperatures and long cooking period of sugars found in the juice.

When *cajuína* is ”undercooked”, a very gentle caramelization process takes place, resulting in lower darkening rate. The problem of “pale” *cajuínas* will be solved by gradually increasing cooking time until the desired color is achieved. This factor is directly related to the amounts of sugar naturally occurring in the juice, that is, the higher the sugar content, the more intense the caramelization process and the lower the thermal treatment duration, and vice-versa.

C*ajuína* with no cashew flavor

This problem may be related to frauds, caused by adding water to juice before it is made into *cajuína*. Nevertheless, sometimes it may result from lower levels of sugar in the juice. Therefore, it is advisable not to produce *cajuína* from such raw materials and to assess the reasons why the cashew tree is bearing low quality fruits.

5. PROCESS CONTROL OF *CAJUÍNA*

Quality must be understood as a consequence of an effective control of raw materials, inputs and ingredients; control of processes and staff; and validation of these steps by inspecting the end product and determining its life shelf, which is to be informed on the label.

It is the agribusiness unit responsibility to determine the expiry date for their product, which is 6 months for *cajuína*. It is important to stress that no information printed on the label or advertised can be deceiving and highlight properties inherent to the product as advantages.

Hazard Analysis and Control of Critical Points based on Good Manufacturing Practices is a new quality control methodology, a more dynamic one, that allows more effective control of products, from raw materials used to the end product made (including utensils, equipment and staff), thus minimizing losses, avoiding re-processing and granting more safety to the end product quality.

In using this methodology, it is possible to easily and quickly find problems, thus preventing hazards to the health and economic losses of consumers.

Besides measurements such as pH, acidity, soluble solids, characterization of imperfections and foreign materials found through visual analysis, it is also necessary to monitor the implementation of each step in the process. Monitoring must analyze factors such as the adequate ripening stage of fruits, efficiency during transportation, receiving, sorting, crushing, and storage of the end product. Sometimes even at shelves in grocery stores. This means that it is necessary to verify if the way each step is done is satisfactory.

After crushing or extracting juice, one must avoid aerating the product because air degrades substances such as the ascorbic acid (vitamin C) and alters color, aroma and flavor.

Waste collection, storage and disposal

Storage containers for the collection of waste must serve this single purpose, and be preferably made of stiff washable plastic with cover and a polystyrene bag inside for the garbage.

These bags must be collected at least once a day and taken in the end of each day to a disposal area outside the premises, from which they will be removed by public or hired companies. Waste storage facilities must be washed, sanitized and closed to avoid proliferation of pests.

6. GOOD MANUFACTURING PRACTICES - GMPs

Good Manufacturing Practices (GMPs) are basic requirements to make products not harmful to consumers. GMPs comprise construction projects for buildings and facilities, hygiene and sanitization plans and even storage conditions and distribution. Companies producing fruits abide by Good Manufacturing Practices regulated in specific laws.

Every production unit must have a Good Manufacturing Practices manual available, a document with the company's letterhead, containing all the information about procedures of Good Manufacturing Practices adopted in the factory. Major measures related to Good Manufacturing Practices are listed bellow:

Facilities

- Production unit must be located in a place free of smoke and dust;
- The building must be solid, providing enough space for all production stages and constructed in such a way to avoid contamination of end product by raw materials;
- Floor and walls must be washable and drains are necessary to avoid water from lodging;
- Windows must have insect screens installed;
- Production unit must be well lit and ventilated;
- Light bulbs must be protected against breakage and explosion;
- Bathrooms must not be directly communicable with the production area.

Personal Hygiene

- Workers must always wash hands before entering the production area and begin processing activities, after handling contaminated materials, and immediately after using bathrooms;
- The place to wash hands must have: running water, soap, paper towel, and pedal-activated plastic garbage can;
- Nails must be always clipped and never polished;
- Hair must be always protected under caps;
- It is not allowed to wear rings, bracelets, earrings, necklaces, watches, wedding rings, and others, because such jewelry may contaminate food;
- It is recommended to avoid anti-hygienic practices in the production area: smoking, sneezing, coughing, spitting, and others;
- Every worker involved in production activities suffering from any kind of food-borne disease or any infectious disease must be compulsorily sent away from the production area;
- When workers have open wounds or cuts they must be instructed not to handle food, unless the injury is protected under waterproof material, therefore not posing a risk to contaminate food;

- Uniforms must be made of light colored fabric and be clean at all times.

Pest Management

- Facilities must be closed in such a way not to allow the entrance of pests such as flies, birds, rodents and others;
- Garbage must never build up, so as to avoid pests; it must be taken out at least once a day or whenever necessary and its container must be cleaned after every disposal;
- Every cashew producing unit must have in place an efficient and continuous pest management plan. The processing unit and its vicinities must be regularly inspected, aiming at reducing the risk of contamination to the lowest levels possible;
- Extermination measures comprise treatment with authorized chemicals and/or biological substances, as well as physical barriers, which are to be applied under the guidance of skilled professionals, that is, companies or institutions accredited for such purpose, deeply knowledgeable of the risks those substances pose to health;
- Before using any chemical, one must be cautious enough to cover all equipment and utensils to avoid contamination. After the necessary time for its effect, facilities are to be completely cleaned before production is resumed, so as to eliminate any residues;
- In the event of hiring an outsourced company, it must have an operating license issued by the relevant institution and provide an expert with educational background and/or experience in the field to be in charge of overseeing services hired.

Water Quality

- Water that comes in contact with food must be suitable for human consumption;
- Water tanks, cisterns and other water storage containers must be covered, free of cracks and cleaned every six months, at least.

Cross contamination

- It is not allowed to let pets into the production area;
- It is necessary to correctly sanitize equipment, utensils and molds used in the cashew processing unit;
- Chemicals and cleaning products must be stored away from packaging materials and ingredients used in the production process;
- Ingredients and packaging materials must be stored under conditions that prevent them from getting damaged or contaminated. Products must be kept on pallets and away from walls so as to allow appropriate cleaning of storage facilities. Stock turnover must be ensured, with compliance to the principle of First One In, First One Out.

7. EQUIPMENT AND UTENSILS

Equipment and utensils necessary to make clarified cashew juice:

- Brick tanks lined with tiles or epoxy paint, according to the production capacity, for the washing and sorting of apples; vented plastic crates for immersion and handling of raw materials in water during washing;
- Press for juice extraction, the expeller type or even the hydraulic type. Expeller presses result in more yields, in terms of making the fullest use possible of juice (around 70% of the juice). However they must be used in such a way to allow medium pressure, leaving some juice in the bagasse to minimize problems related to high contents of tannin. Such presses are made of AISI-304 stainless steel with structure made of carbon steel, equipped with electric motor and speed reducer;
- Piston presses (hydraulic or screw) result in lower levels of tannins; however juice yields are around 50%. Comparing prices, expellers may be more expensive, but are continuously operated, whereas piston presses crush batches, are non-continuous and have lower productivity;
- Homogenization tank to receive juice from the press made of AISI-304 stainless steel and structure made of carbon steel. Tank holding capacity must be suitable to press capacity;
- Sanitary pump to transfer fruit pulp or juice;
- Cylindrical clarification tank or one with conical bottom and in size suitable for easy decantation of juice treated with gelatin, which will be later filtered. Most suitable sizes vary according to the capacity of the plant to be installed. However, its height must be two times greater or more than the diameter size. It must also be equipped with an outflow valve in the lower part of the cone;
- Equipment to filter clarified juice of easy maintenance requirements and efficient enough to remove all suspended material in the juice. One type, best adapted to small scale production, is built in several sections aiming at holding larger particles in the first meshes and smaller ones as they make it through the meshes up to the point where filtration is efficiently achieved. Synthetic and natural fabrics and fibers, such as felt, cotton may be used together, the latter used in the first sections. For larger production, it is advisable to use filter press, with cellulose filtering plates. This equipment must be completely made of stainless steel and easily disassembled;
- Tank to treat juice after filtration. This tank must have the same holding capacity of the clarification tank, but not the same size, on the contrary, it must be shallower so as to allow better handling during pre-heating of the juice. This tank must have a heating system comprised by a burner (industrial stove type), so that juice can be prepared inside. One or more quick closing valves to fill bottles must be installed. The ideal height depends on the unit layout and one must preferably make use of

floor unevenness between tanks so as to reduce the use of pumps. A cover is necessary to avoid losing juice due to evaporation during the cooking process;

- Capper, hand operated or semi-automatic to close bottles. This equipment can be easily built and there is no need to be made of stainless steel. Holding capacity is variable and it is not very expensive to be purchased;
- Water bath tank comprised of a tank with heating system and installation of cold water feeding for cooling after the thermal process is done. This tank must have at least two vented baskets for bottles to be placed inside it.

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