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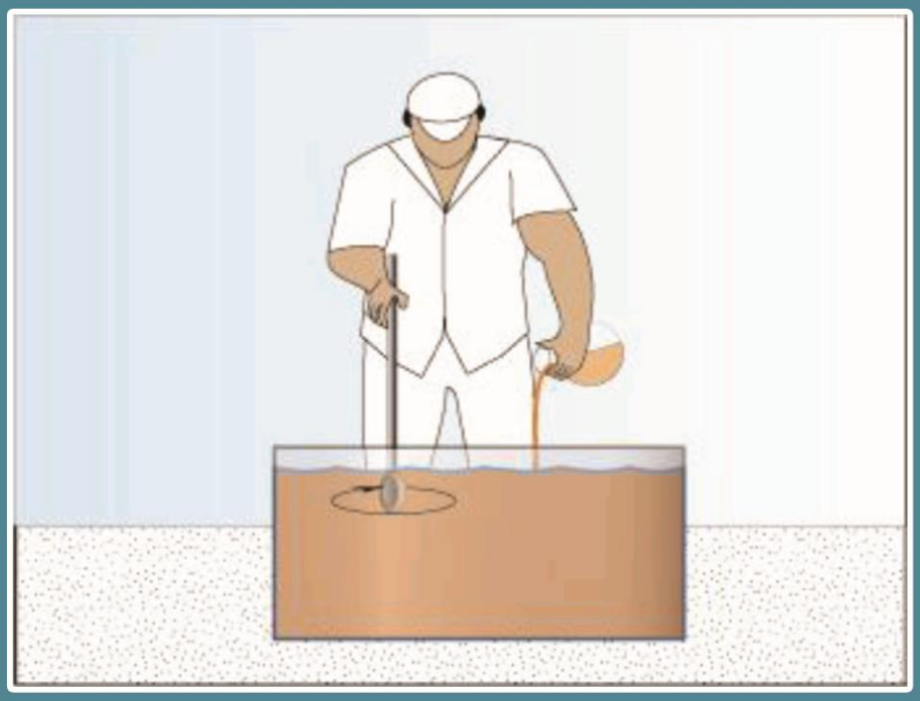
CASHEW JUICE
(Clarified)
TECHNICAL MANUAL



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ABC Agência Brasileira de Cooperação
MINISTÉRIO DAS RELAÇÕES EXTERIORES

Embrapa

JULY 2013

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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.

Using chemical additives to preserve cashew pulp is a widely applied method in Brazil, resulting in shelf life of around one year. Its use is recommended in the case of producing jams and dehydrated fruits.

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

2. PRODUCT DEFINITION

Clear cashew juice is a non-fermented, non-concentrated, non-diluted product with minimum total solids content from the edible part, obtained by crushing healthy and clean cashew apples (*Anacardium occidentale*, L.), to which chemical additives may be added. The end product is to be kept under cold storage conditions.

With regard to producing juice, cashews are received at the factory, weighed and analyzed according to their quality properties, which include percentage of fermented apples, damages caused by pests and diseases, cleanliness, soluble solids content (Degrees Brix), pH and acidity.

Following suit, apples are washed in chlorinated water (50 ppm), manually sorted along a belt conveyor so that inadequate fruits are removed, and finally sent to a processing section.

Clear cashew juice must have the following characteristics and composition:

Color: clear;

Taste: specific to the fruit, slightly acidic and astringent;
Aroma: specific to the fruit.

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

Product label must inform its name and all other requirements comprised in specific labeling regulation.

3. STAGES IN THE PRODUCTION PROCESS

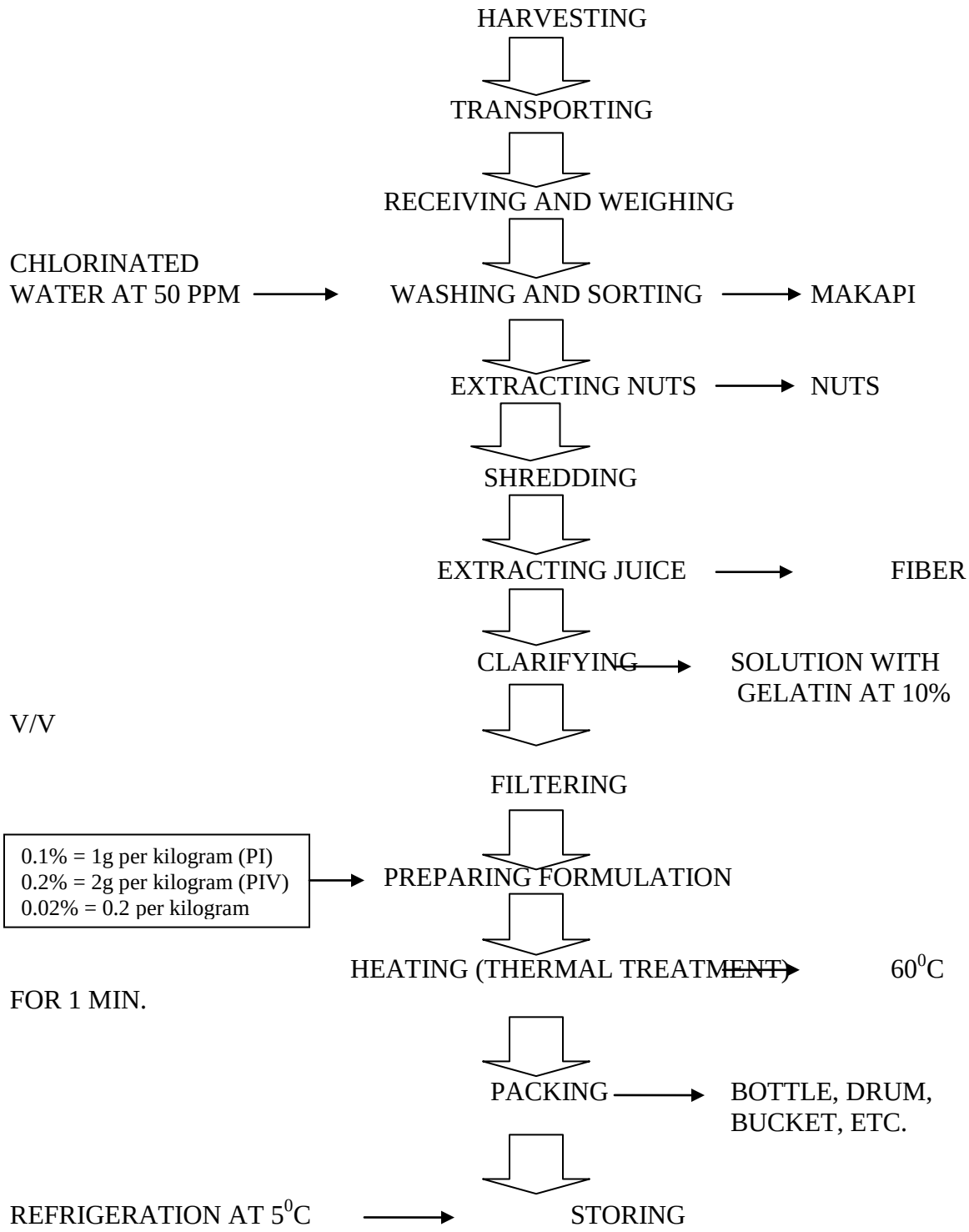

Figure 1 - Stages in processing Cashew Juice (Clarified).

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 juice, 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 be not 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 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.

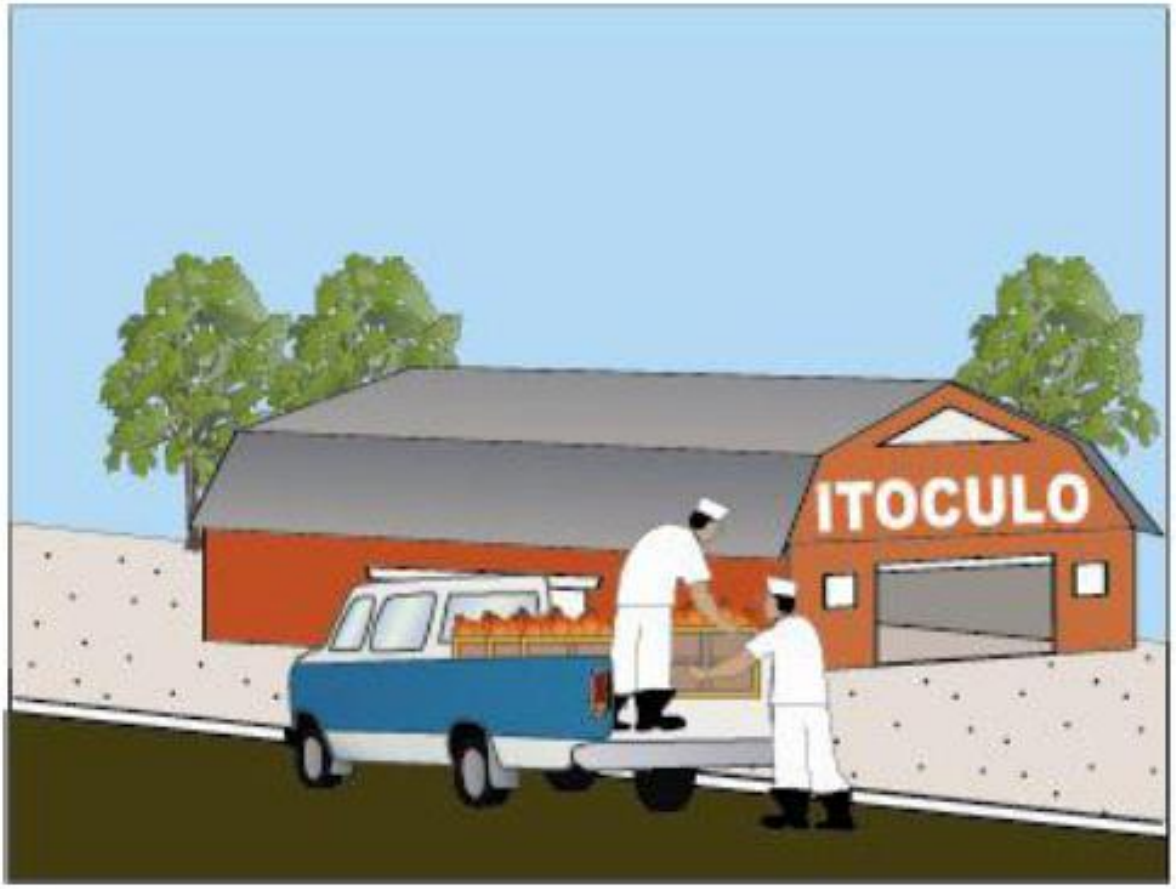

Figure 3 – Transporting cashews to the factory.

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

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).

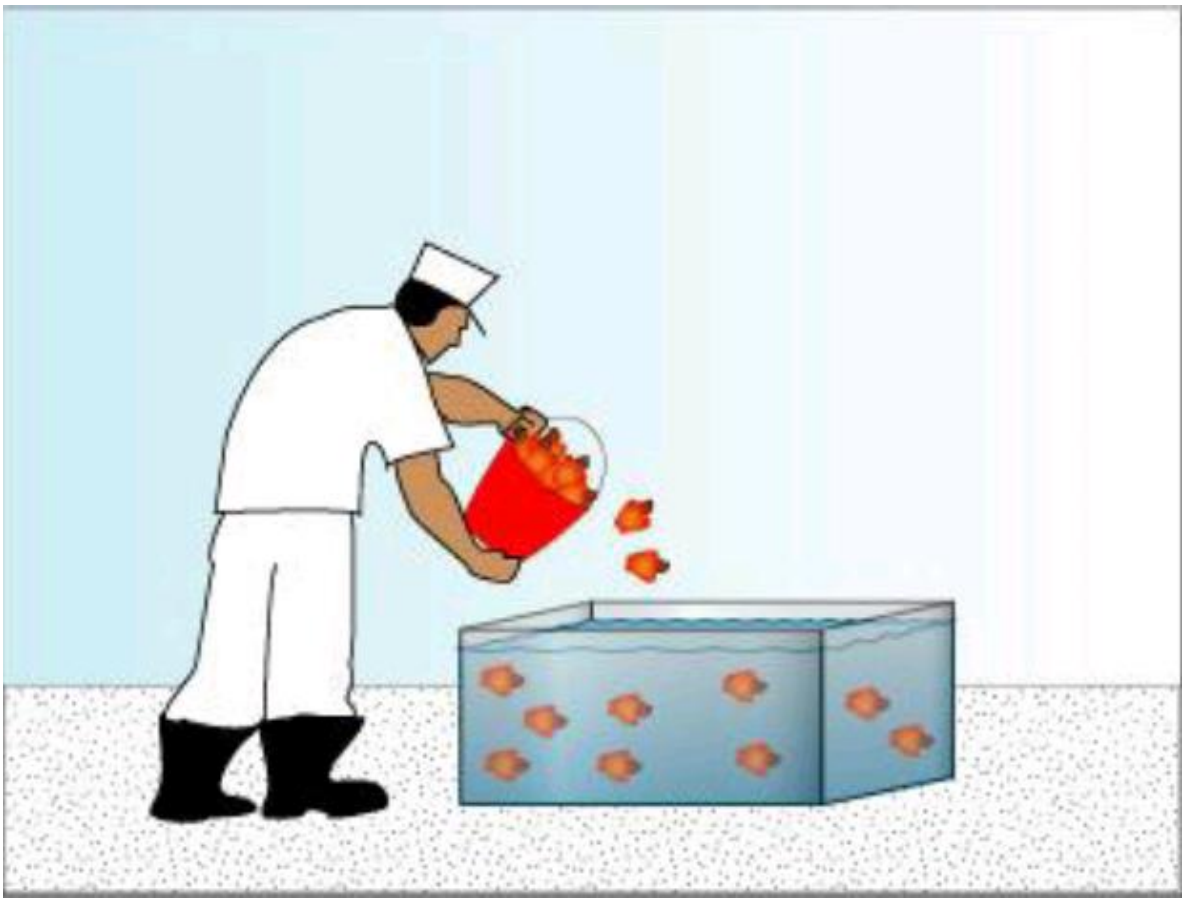

Figure 4 - Washing of cashews in chlorinated water.

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.

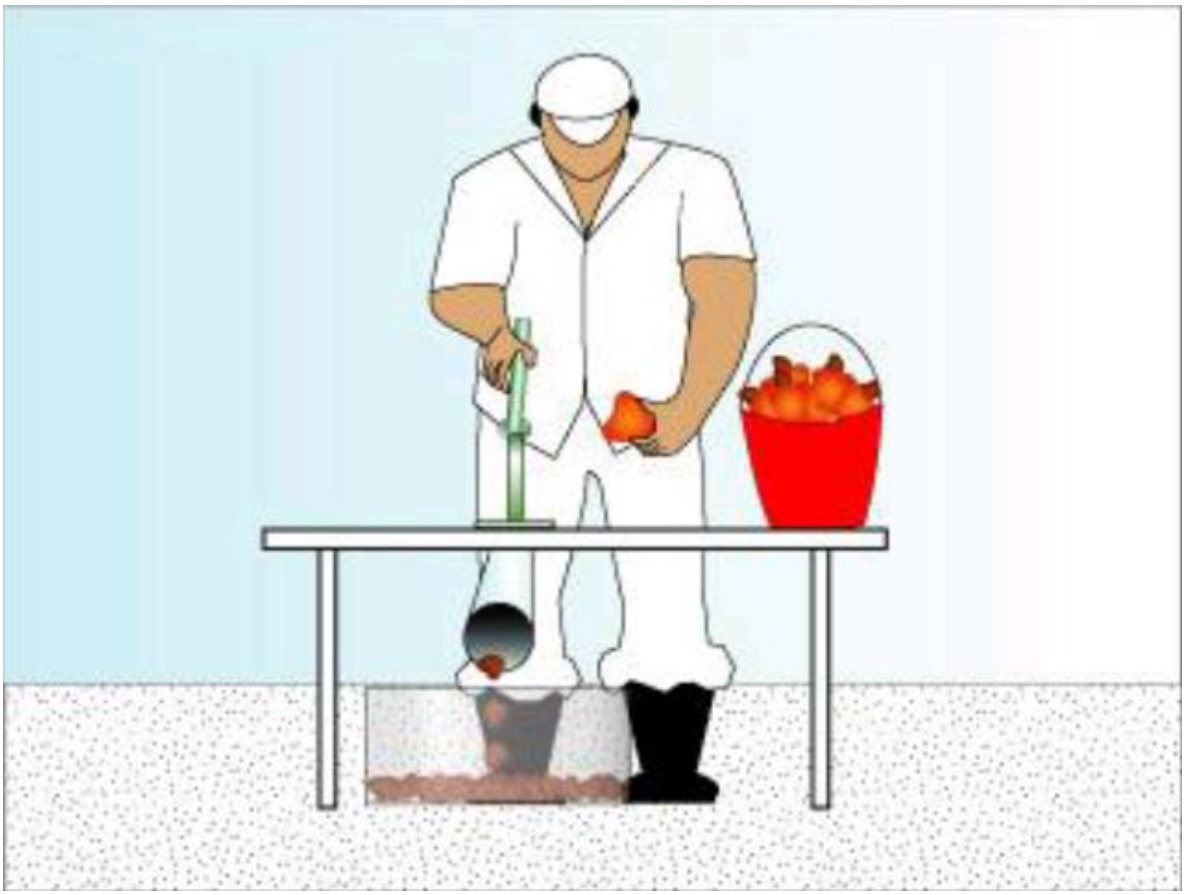

Figure 5 – Extraction of nuts from cashew apples.

3.6. SORTING

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. In order to have a quality end product, a thorough sorting of raw materials must be carried out by skilled workers, capable of removing uneven fruits. It is best to use fruits in adequate ripening stage, free of contamination, rotten spots, physical damages, torn surface and smashed parts. It is important to have good lighting in the place this procedure is carried out.

3.7. SHREDDING

After selected, cashews are then shredded, aiming at increasing yields. For such purpose, apples are put in a shredder which tears fruits without ripping their fibers. This operation is recommended for famers who do not have a continuous press. The juice extracted must be put into clean containers, made either of plastic, glass, aluminum or stainless steel, never made of iron. In the beginning of the process, apples are torn in a shredder. Afterward they are taken to a unit equipped with a horizontal pulper with stainless steel mesh and a 0.5-milimiter opening, so that fibers are removed from the pulp.

3.8. 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 in expeller presses (Figure 6) is a common method in most factories processing cashews and results in excellent yields. 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 a mechanical or hydraulic press used to crush batches of products. Such presses do not release large amounts of tannins from peels, but they are slower and less productive.

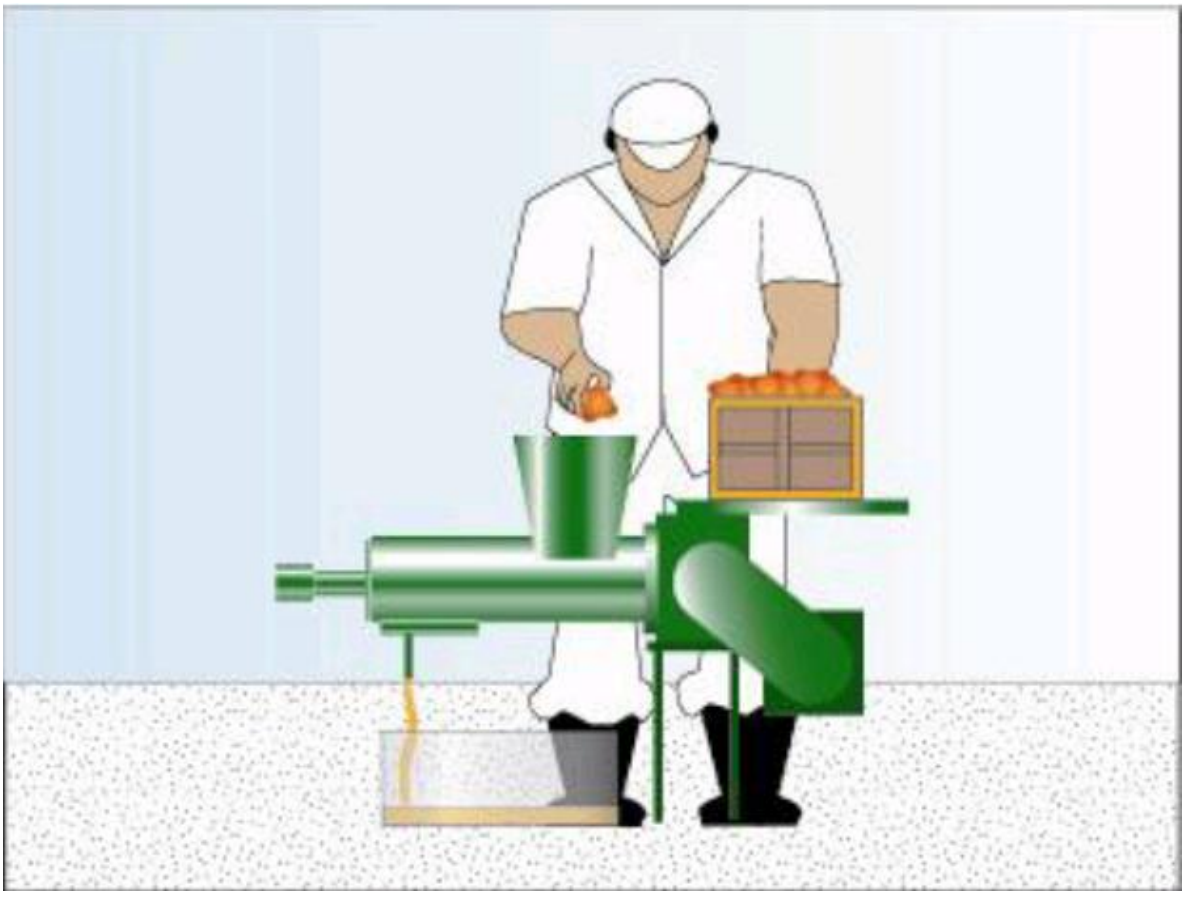

Figure 6 - Extraction of cashew juice.

Juice production may range from 60 to 80%, although the recommended percentage to obtain better quality juice is around 70%.

When crushing apples in expeller press, it is advisable to filter juice immediately after it is produced so that bigger fibers are removed before the next stage in the process.

3.9. CLARIFYING JUICE

The clearness of the juice to be clarified 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.

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.

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

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.

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).

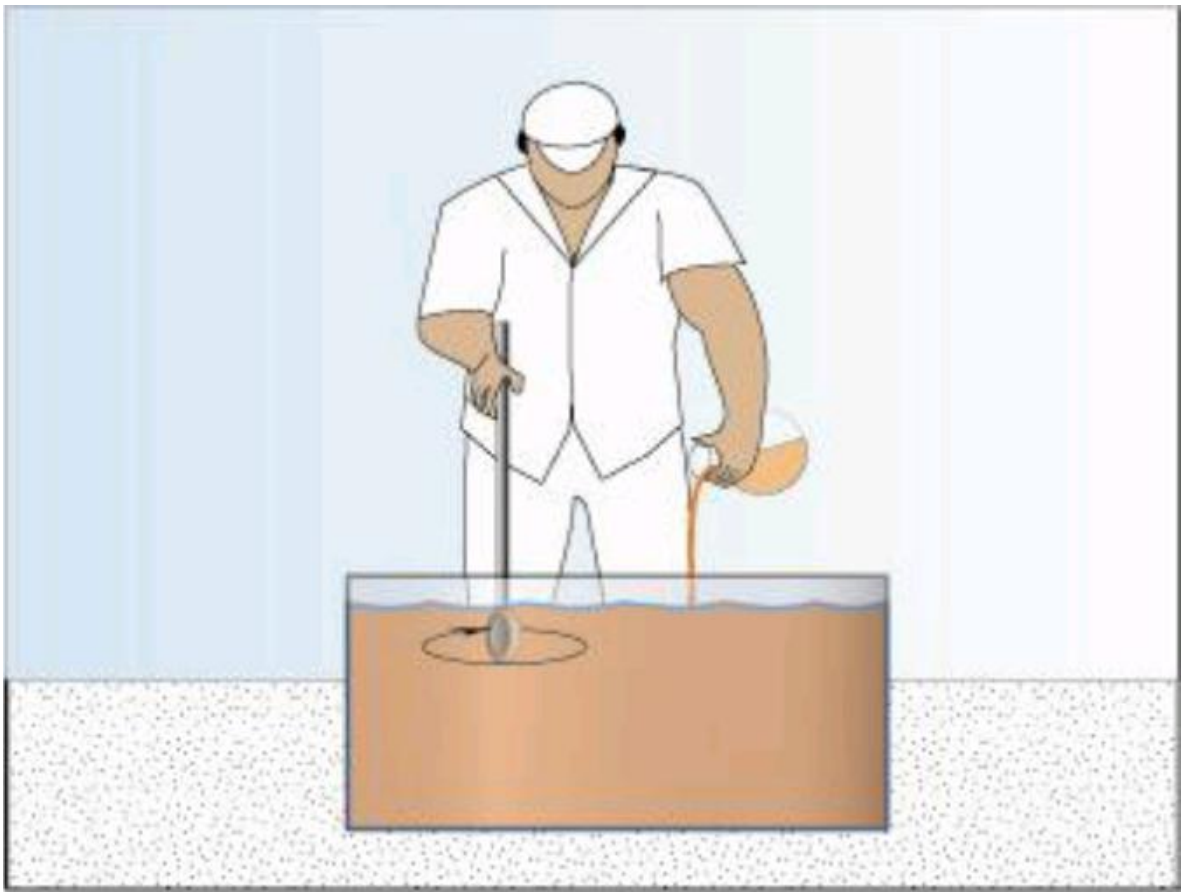

Figure 7- Clarification of cashew juice.

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 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 throughout 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 clarified juice, one must do the pitcher test, a very efficient procedure.

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.

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.

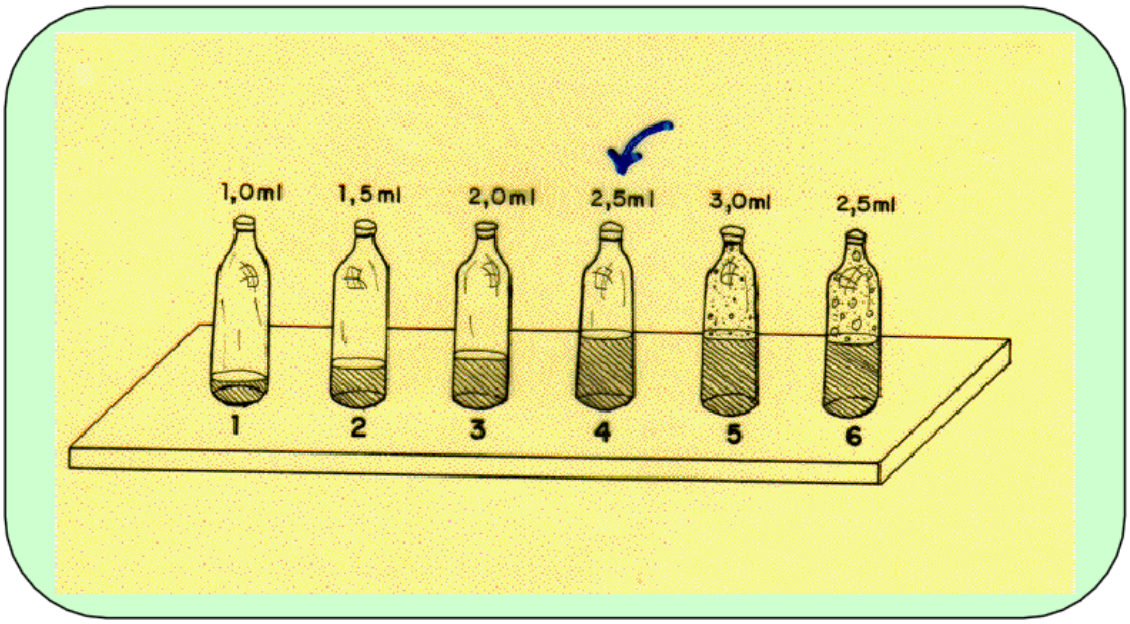

Figure 8 - Testing gelatin and clarified juice.

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.

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.

3.10. 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 placed in supporting rings made of fabric so that they serve as stretching structures.

After this step is completed, one obtains clear, clarified, colorless, transparent juice, resembling white wine in color.

3.11. FORMULATING JUICE

To preserve clarified cashew juice, it is necessary to employ chemical methods in which the amounts of additives used must not change juice properties or cause harm to consumers. All preservatives used in cashew juice are widely used in the food industry and are food grade.

If preservatives are not used, it is not impossible to preserve cashew juice for a long period. Moreover, under common conditions, at room temperature, its maximum shelf live is 48 hours. If kept in refrigeration, its maximum lifespan is one week.

By adding preservatives as recommended in this manual, it is possible to preserve clarified cashew juice in the refrigerator ($5^{o}C$) for about two months, without any significant changes to its organoleptic properties.

For the formulation of cashew juice (Figure 8), it is advisable to use benzoic acid or sodium benzoate (PI) to the maximum amount of 0.1%, sorbic acid or sorbates (PIV) to the maximum amount of 0.2%, and sulfur dioxide (PV) or byproducts that result in SO_2 to the maximum amount of 0.02%.

0.1% = 1 gram per kilogram of benzoate
0.2% = 2 grams per kilogram of sorbate
0.02% = 0,2 gram per sulfur dioxide

Sulfur dioxide must only be used in the processing of products which were pasteurized and cooled, before chemicals are added to them.

3.12. THERMAL TREATMENT

Thermal treatment of cashews is a complementary method to preserve and stabilize juice. One can use this treatment both to bottled juice (Figure 9) and to larger amounts of products stored in drums and buckets, which are intended to cater for the demands from restaurants and snack bars. For any one of those cases, it is important to have previously added authorized chemical additives to the juice. Once again, it is worth mentioning that sulfur dioxide is only recommended for use in pasteurized juice.

Figure 9 - Thermal treatment of bottled juice.

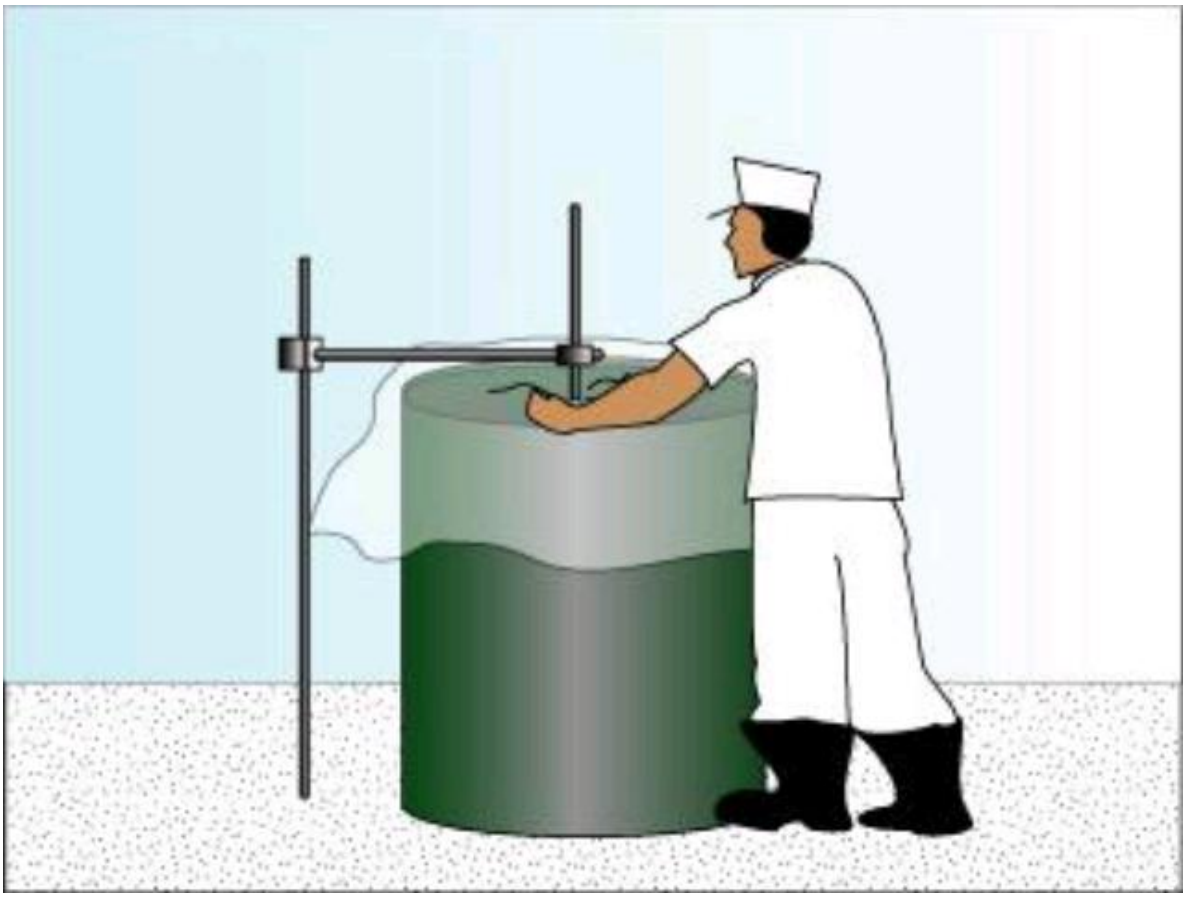

Figure 10 - Thermal treatment of juice stored in drums.

3.10. PACKAGING AND CLOSING

Clarified juice is normally packaged in different types of containers. So as to live up to consumers' expectations, 500-mililiter glass or plastic bottles are generally used. One can hand fill them or use a semi-automatic filler for the same purpose. Afterward, they are closed with screw caps or metal caps fastened in place with a table top capper.

After filled (Figure 11), bottles are then closed with plastic or metal screw caps in a specific capper, available in specialized stores, and thermally treated as recommended in the previous item.

With regard to retail sales, when products are made available on shelves, packaging must be done immediately after the thermal treatment.

For any case mentioned, it is advisable to keep products in refrigeration until they are consumed.

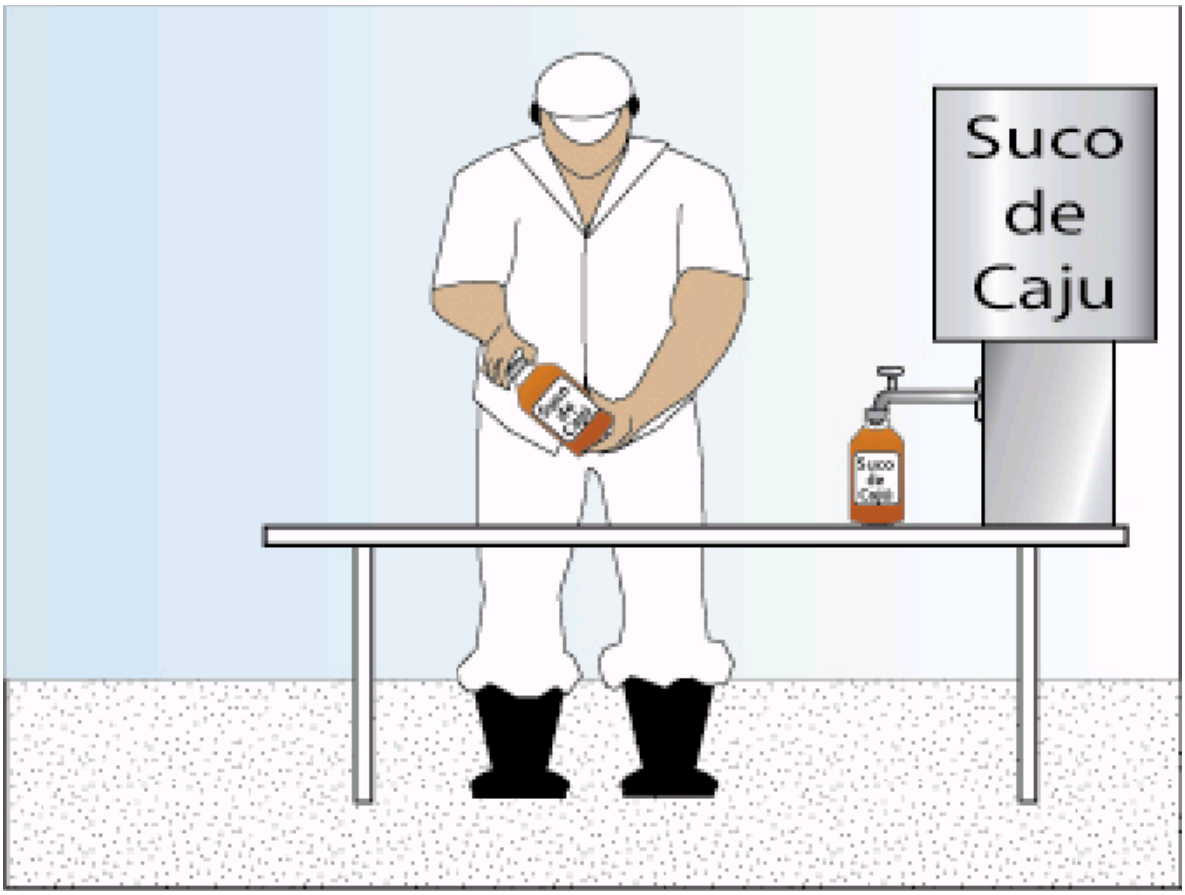

Figure 11- Bottling of juice.

3.12. STORING

Clarified cashew juice must be kept in refrigeration until it is consumed. Recommended temperature varies from 0°C to 5°C. Household refrigerators capable of maintaining temperature within the recommended range may also be used (Figure 12).

The basic rule of stock movement must be applied with regard to inflow and outflow of products: first product in, first product out, due to expiry date.

The following information must be printed on the package label:

- Name: clarified (clear) cashew juice;
- Amount in milliliters;
- Date of production;
- Expiry date;
- Expressions: 100% whole juice (in case additives were used, they need to be informed);

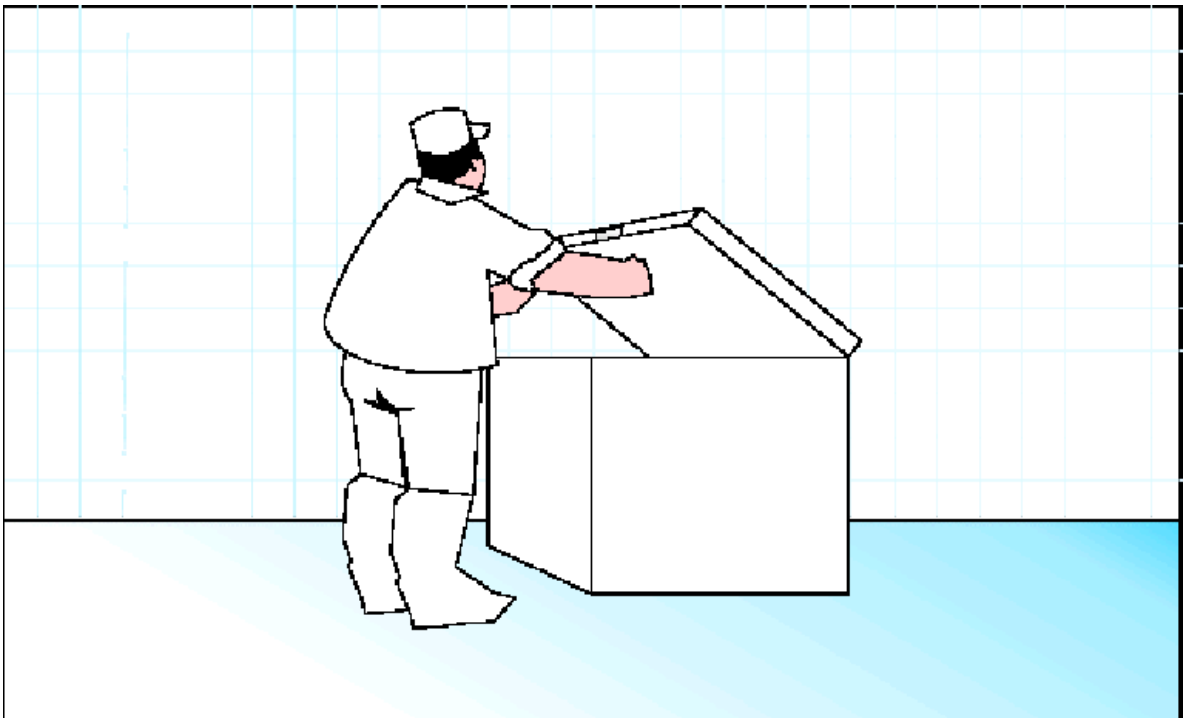

Figure 12 – Clarified juice already packaged and kept in refrigeration.

4. 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;
- 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;
- 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, made by installing a burner (industrial stove type), so that juice can be prepared inside. One or more valves to fill bottles must be installed;
- 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;
- Sorting tables (made of stainless steel);
- Preparation tables (made of stainless steel);
- Scale with holding capacity of 1kg;
- Shredder or industrial blender (made of stainless steel);
- Bottler or filler (made of stainless steel);
- Industrial stove to heat pulp with preservatives;
- Refrigerator or freezer;
- Buckets, knives, stirrer, waste baskets and plastic crates.

5. 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 juice 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.

6. BIBLIOGRAPHY

ABREU, F.A.P. Aspectos tecnológicos da gaseificação do vinho de caju - Anacardium occidentale L. (dissertação de mestrado). Fortaleza: Departamento de Tecnologia de Alimentos. Universidade Federal do Ceará, 1997. 86 p.

ARAUJO, J. P. P. de; SILVA, V.V. Cajucultura: modernas técnicas de produção. Fortaleza: EMBRAPA-CNPAT, 1995. p. 23-41.

CAJU. Pós-colheita/editor técnico Ricardo Elesbão Alves; Embrapa Agroindústria Tropical (Fortaleza,CE). – Brasília: Embrapa Informação Tecnológica, 2002. 36p.; (Frutas do Brasil;31).

CASIMIRO, A.R.S.; AGUIAR, L.M.B.A.; MEDEIROS, M. das C. - Vinho de Caju. Série implantação - alimentos. Fundação Núcleo de Tecnologia Industrial - NUTEC. Fortaleza, 1989.

DA SILVA NETO, R.M. Inspeção em indústria de beneficiamento da castanha de caju visando a implantação das boas práticas de fabricação. (dissertação de mestrado). Fortaleza: Departamento de Tecnologia de Alimentos. Universidade Federal do Ceará, 2000.128p.

LEITE, Lucas Antonio de Sousa. A agroindústria do caju no Brasil: políticas públicas e transformações econômicas. Fortaleza: Embrapa,
1994, 195p.

LIMA, Vicente de Paula Maia Santos. A cultura do cajueiro no Nordeste do Brasil. Fortaleza: Banco do Nordeste-ETENE, 1988. 486p. (BNB-ETENE. Estudos Econômicos e Sociais, 35).

LOPES NETO, Alfredo. Agroindústria do caju. Fortaleza: Edições Iplance, 1997

MEDINA, J.C. Caju: da cultura ao processamento e comercialização.

MOTA, Mauro. O cajueiro nordestino. Prefeitura da cidade de Recife, Secretaria de Educação e Cultura, Fundação de Cultura Cidade do Recife, 1982. 168p.

PAIVA, F.F. de A.; GARRUTI,D. dos S.; DA SILVA NETO, R.M.. Aproveitamento Industrial do caju. Fortaleza: Embrapa – CNPAT/SEBRAE/CE, 2000.88p. (Embrapa-CNPAT. Documentos,38).

SILVA, V.V. CAJU: Coleção 500 perguntas 500 respostas – o produtor pergunta a EMBRAPA responde. Brasília, 1998. 220 p.

SOARES, Juarez .Braga. O caju: aspectos tecnológicos. Fortaleza: BNB, 1986. 256p.

SOCIEDADE BRASILEIRA DE CIÊNCIA E TECNOLOGIA DE ALIMENTOS São Paulo,. Manual de boas práticas de fabricação para indústria de alimentos. São Paulo, 1990. 27p. (SBCT. Publicações Avulsas, 1).

SOUZA FILHO, M. de S. M. Aspectos da avaliação física, química, físico-química e aproveitamento industrial de diferentes clones de caju (Anacardium occidentale, L.). (Dissertação de mestrado) Fortaleza: Departamento de Tecnologia de Alimentos, Universidade Federal de Ceará, 1987.

TREVAS FILHO, V. Tecnologia dos produtos do pedúnculo do caju. 1a Semana do caju, p.25 - 31. Out., 1971. (mimeografado). (BNB. Monografias, 24).

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