PROCESS TECHNIQUES



INSTANT COFFEE GUIDE FOR BARISTAS





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HISTORY OF INSTANT SOLUBLE COFFEE IN BRAZIL

From 1901 until nowadays, instant coffee has gone through a series of transformations to become the product we know today.

The origin of instant coffee dates back to 1901, when Mr. Satori Kako, a Japanese chemist living in Chicago, USA, invented an instant coffee powder, sold during the PanAmerican Exposition in New York. Years later, this product was adapted by an American chemist that created the refined instant coffee, which could be commercialized in larger scale.

Decades went by until a big opportunity arose from the surplus of coffee stored in Brazilian warehouses during the 1930s world crisis. Swiss companies were asked to study ways of transforming this stored coffee into "ice cubes" that could preserve the coffee attributes for longer periods and that could be sold to consumers.

It was Nestlé's chemist, Mr. Max Morgenthaler, that developed a solution and in 1937 presented a coffee powder easy to be dissolved in water for consumption, that also presented features that resembled those of fresh coffee. Nestlé then financed the manufacturing of this innovative product, launching Nescafé in 1938, an immediate success in Europe and the United States; and used by American soldiers during the Second World War (due to its practicality and easy preparation).

In Brazil, instant coffee arrived in 1953; efforts to attract and install instant industries were made from the 1960s onwards, when the majority of the companies associated with ABICS were founded and started activities. Brazil has been the world's leading instant coffee producer and exporter since then.



ELABORATION OF INSTANT COFFEE

BASIC FLOWCHART OF THE PRODUCTION PROCESS



1ST STAGE Raw materials

Both coffee species, *Coffea Arabica* and *Coffea Canephora* (Robusta and Conilon) are used in the production of instant coffee. Defining which one will be used depends on the desired sensory profile – aroma and flavor.

2ND STAGE Blend

Green coffees are graded by their physical and cupping (beverage) features – according to the Brazilian Oficial Grading System – apart from the following analyses: moisture level, Ochratoxin A, foreign bodies, impurities and sensory analysis. Furthermore, the blends are prepared and then roasted.

3RD STAGE Roasting of Beans

The first step in the production process of instant coffee is roasting. During this stage, characteristics such as flavor and aroma are developed. The intensity of roasting is also measured by the color of the coffee beans after they go through this process, which may vary from lighter to darker tones. It is also possible to work with light or dark blends, Arabicas with Conilons. The roasting degree will define the final beverage's sensory profile (aroma and flavor). The verification of color is made using specific equipments in order to guarantee a standardized reading of each lot of roasted coffee.

It is importante to mention that the roasted color of the raw material is not directly associated with the color of the final product, because the sensory profile is defined during roasting, but in instant coffee the color tone of the powder or granules is also evaluated.

Coffee Oil

Coffee oil is another product obtained after roasting, from the cold pressing of the coffee beans; it is a versatile product, used by the industry for different purposes.



FIGURE 1 Coffee Oil

4[™] STAGE Granulation

Roasted coffee is broken into uniformed parts, in order to obtain a larger contact surface between the hot water and the roasted bean, boosting the extraction of the soluble solids. The use of an extremely fine granulometry is not recommended since the small particules could clog the extraction filters at the outlet of the percolator (column). Each broken coffee bean generates 4 to 5 parts.

5TH STAGE Extraction

Right after granulation, comes extraction. The extraction is the percolation of water (under high pressure and temperature) through the coffee to remove the bean's soluble substances by infusion. This is done in stainless steel colums connected by tubes that allow the passing of water from one column to the other successively.

In order to understand this stage, one should picture several coffee filters put one on top of the other; in each filter there is ground coffee. Then hot water is poured in the first filter and this percolates to all the other filters; in the end there is a very dark liquid, called coffee extract. This extract is composed of water and coffee soluble solids; the liquid still contains a lot of water that will be removed in the following stage (concentration). Whenever needed, the extract can be centifugated for the removal of insoluble solids.

Extraction is similar to an espresso (with pressure and temperature), with coffee parts that have distinctive flavor and aromas. The first, with more sugars, until the last one, with less flavor and aroma components.

Example of percolation: in this extract, the solid concentration can vary between 6 and 32%, depending on various factors such as blend, roasting, etc.

FIGURE 2 Drawing of the percolation column



Extraction can be performed using different methods, with the goal of obtaining distinctive flavors from the same raw material: a continuous flow or the separation of extracts in different parts, for instance, similar to a short or long espresso.



FIGURE 3 Graph of temperature profile in the extraction column

6[™] STAGE Treatment of the extract

The extract is treated (centrifugated/ filtered) before the concentration stage, preventing insoluble particules from remaining in the process.

7[™] STAGE Aroma recovery

Before the extract is sent to concentration, it is processed in the aroma recovery system. In this phase, the aromatic componentes of the extract are separated by means of steam extraction, condensed and stored in a hermetic tank. The extract is sent to the evaporator to increase the concentration of soluble solids. After the defined concentration is reached, the coffee aromatic fraction is reincorporated to the product that will be sent to the drying stage.

8[™] STAGE Concentration

Part of the water contained in the coffee extract is removed during concentration, until reaching concentration of soluble solids that allow the drying to result in soluble powder.

After concentration, the coffee extract is ready to be dried in this stage, or to be packed into drums or jerry cans and frozen, in order to be shipped to countries like Japan, for example.

The extract concentration can be elevated to levels close to 60% of soluble solids to facilitate drying. This process can be conducted in two ways, basically: using heating (hot) or freezing (cold) methods.

Concentration by evaporation (heating)

During hot concentration, approximately half of the remaining water is eliminated from the extract, increasing its concentration.

In hot concentrators, the water present in the extract is evaporated using a vacuum system, with temperatures lower than the boiling point of water, avoiding the excessive waste of coffee aromas.

Cold concentration

Cold concentration is based on the crystallization of part of the water present in the extract, with the removal of ice crystals, which eliminates around 40% of the initial water content. With this process, the aromatic components are preserved, enhancing the aromas of the final beverage.

Coffee Extract

After concentration, the extract can be stored in drums that will be exported frozen or sent for the final drying stage.

> FIGURE 4 Coffee extract

Captures and consistently preserves the flavor and aroma of high quality coffee beans by means of extract freezing, which is then supplied to selected clients.

9[™] STAGE Drying

The drying of the coffee extract can be made using two processes: by heating (evaporation) – spray dried, or by freezing (sublimation) – freeze dried.

In order to better understand this stage of the process, check the graph about the triple point of water.



The passing of water from the liquid to the gaseous stage occur when it reaches temperatures of about 100° C. However for the water to go straight from the solid to the gaseous stage - without passing through the liquid stage - it is necessary to subject it to low pressure processes. Therefore the sublimation of water takes place in these conditions, consequently, in low temperatures.

Spray Dried - Sprinkling

The extract is sent to the drying tower, where it is pumped to its top. In parallel, there is injection of hot air (around 200° C or more to cause water evaporation to start)

The extract is injected, by means of a spray, in droplets that form small spheres, and the water contained in these extract particules are evaporated during their fall within the tower.

The dry powder is removed from the lower part of the tower; its final temperature is 32° C, on average, with a 3% moisture level¹.

Concentrated coffee extract at 4°C – 33% soluble solids



Freeze Dried



Another method of coffee dehydration. After concentration, the extract is freezed in a cold chamber in 3 stages: -5° C, -20° C and -50° C, enabling it to preserve its attributes.

The frozen extract is ground, granulated and graded in screens (definition of the particles' size). Afterwards, it is deposited in a tray. The granulated product is sent to a vacum chamber, where it is dehydrated at low temperatures, which makes the water go straight from the solid to the gaseous stage (by sublimation).

The tray is unloaded, generating a dried product which will later be sifted, according to the granulometry specifications.



FIGURE 8 Aspect of the crystals and granules of freezedried coffee

Agglomeration

Process that consists of grinding the spray dried coffee into even finer and smaller particles (similar to a powder), that are then moisturized when in contact with steam, resulting in a granulated product. This will later go through screens to define the size of the particles, in order to specify the granulometry.



FIGURE 9 Aspect of agglomerated powder

By these QRCodes it is possible to access infographics and animation with details about the process you have just learned about. Access it for further understanding.





SUMMARY OF THE PRODUCTION PROCESS OF INSTANT COFFEE

Coffee and Water



CERTIFICATIONS OF PRODUCT THE INSTANT COFFEE ANALYSIS INDUSTRIES

In order to cater for to the requirements and specific demands worldwide, instant coffee industries are audited and accredited by international certification standards. Some of these are listed below, in Table 1.

Kosher

- 🖯 Halal
- ISO 9001
- FSSC 22000
- IBD Certified Orgânico
- HACCP
- Fair Trade
- JAS CERES
- ISO 14001
- ISO 22000
- BRC Food Certified
- Rostest
- UTZ
- USDA Organic
- Demeter
- Rainforest Alliance
- ABIC's Seal

5S Program

TABLE 1

Certifications

In the instant coffee industry, all of the processes are monitored with rigorous care. There are continous testing and improvements, from sourcing of raw materials to shipment, to guarantee the best quality of the final product. Check below some of these analyses:

Physicochemical analysis during the process

- Moisture level;
- PH;
- Density; Concentration
- Sediment;
 - (Brix degree).

Final product analysis

- Ochratoxin A;
- Moisture;

Acrylamide;

- PH;
- Ashes;
 - Carbohydrates;
 - Aflatoxin;
- Caffeine.

Microbiology

- Mold and yeast; 🗢 E. Coli (Escherichia Coli);
- Fecal coliforms:
 - Salmonellas.

END OF THE PROCESS

The production process of instant coffee is conducted with the use of only two ingredients: roasted coffee and water. Using physics (temperature and pressure) and technology it is possible to create completely different recipes and profiles, adapted according to the final use of the product, that ranges from ingredient to the food and beverage industries to instant coffee itself, for the final consumer.

The instant coffee industry is deeply committed to sustainability: each residue generated through the production process is transformed in biomass, later used as fuel for the boilers. All the water used is treated and returned to the environment in even better conditions than they originally were. These procedures are carried out in accordance with norms established by federal and state agencies.

The sensory physicochemical and microbiological analyses are usually conducted in laboratories located within the instant coffee industries, which have state-of-the-art equipment, regularly audited by accredited institutions authorized by state and federal bodies.



WHY ONE SHOULD NOT COMPARE INSTANT AND ROAST AND GROUND COFFEE?

Instant coffee is not similar to R&G in regard to physical and sensorial features. Although we instinctively tend to look for a known flavor, they are technically different.

Instant coffee has a complexity of flavors and aromas due to the the conditions of preparation during all of its distinct processes: temperature and pressure to which the beans are submitted to be transformed into powder (spray dried) or granules (freeze dried). It is important to note that only coffee (beans), water, temperature and pressure are used to conduct all of the processes.

The differences found are related to the uniqueness of the production process that varies according to the desired final result. In the case of roast and ground coffee, the process involves roasting and grinding. In instant there are the same two stages, followed by extraction, concentration and drying.

RESULT R&G RESULT SOLUBLE DETERMINATION (Each 100g) (Each 100g) Energetic value by 278kcal 227kcal calculation Carbohydrates 14,3g 49,1g by difference Protein 16,3g 19,7g Fat 11,6g 0,3g Saturated Fat 5,0g Less than 0,2g **Trans Fat** Less than 0,1g Less than 0,2g **Total Dietary Fiber** 49,7g 19,6g

Nutritional difference between R&G and instant coffees

IMPORTANT: The results shown are valid only for the analyzed samples under specific conditions, and are not extensive to other lots.

TABLE 2Comparison betweenroast and groundand instant coffees.Source: Cia Iguaçu

Fat, saturated fat and trans fat: presented in higher levels in R&G, when extraction alone is not enough to transfer the lipids molecules, which remain in the coffee grounds leftover in the filter.

Total dietary fiber: presented in higher level in R&G for the same reasons. A large part of the total fibers are formed by cellulose and lignin molecules that remain in the coffee grounds, in the filter.

Differences in preparation of Instant and R&G coffees

When we compare preparation methods, espresso coffee is the one "closest" to instant due to the high pressure. We can separate the process in 3 stages: **1^O WETTING:** In this stage the coffee particules are prepared for the extraction of soluble solids.

2[•] EXTRACTION: The extraction of soluble solids occurs rapidly, after water absorption.

3^O HYDROLYSIS: It is the breaking of insoluble carbohydrates in water into smaller particules, that become soluble, and because of that end up being a part of the extract.

In roast and ground coffee (R&G) the process ends in the extraction stage, whereas in instant coffee it continues until the hydrolysis phase, whose temperatures reach 160°C to 175° C, under pressure.



FIGURE 10 Extraction profile graph



Apart from the 3 stages already mentioned, there are another 3 technical factors that differentiate instant coffee from the standard roast and ground:

1. COLLOIDAL MATERIAL: Roast

and ground coffee has a larger share of colloidal material/oils extracted during its preparation. Instant coffee has less colloidal matter in the beverage.

2. AROMA: The more aromas reincorporated, the greater the resemblance between instant and

ORGANIC AND DECAFFEINATED COFFEES

It is important to observe that both instant and roast and ground coffees can be made from decaffeinated or organic beans.

The decaffeination process is conducted with the green bean, before roasting (raw material). Afterwards the solubilization process is similar to the regular coffee, passing through all of the stages previously mentioned.

The caffeine base present in instant coffee follows the green coffee one, since it is thermostable. R&G coffees. Roasted coffee is extremely aromatic and when submitted to high temperature and pressure, these aromas are more perceptible. During the extraction process, they are captured by means of water vapor and, are later, reincorporated to the process, making the aroma of instant coffee similar to the one of roast and ground coffees.

3. HYDROLYSIS: the more intense, the higher the deviation of coffee flavor.

CUP OF 50ML OF WA- TER TO 1G OF POWDER	CAFFEINE
Arabica	26mg
Canephora	40mg
Decaffeinated	3mg

Sources: Sivetz e RDC 277 of 22 September, 2005

In the industrialization of an organic coffee, however, the entire process line has to be adapted so that no residue of non-organic coffees is found.

SENSORY Analysis

Due to all of the processes which these products go through, a methodology with the main sensory attributes of these coffees has been designed, so that we can understand them better.

The attributes to be evaluated are: aroma, flavor, sweetness, acidity, astringency, caramelization, bitterness, body, balance and aftertaste. In regard to attributes such as bitterness and astringency, the figures in the form are inversely proportional to intensity, meaning that: the lower the perception of intensity, the higher the grades will be, and vice-versa.

Some of them are similar to roast and ground coffees, like: aroma, flavor, body, acidity, sweetness, balance, and aftertaste.

Another importante feature is caramelization. Due to the high temperatures to which the product is subjected, these notes present a high intensity among outstanding coffees.

Positive caramelization should resemble a "candy from the pot", thus receiveing higher grades.

The sum of attributes will rate coffees in 3 different categories:

O EXCELLENT

- → More delicate notes, little bitterness, high acidity, herbal flavors
- → Good acidity
- ➡ Fruity coffees
- Positive and pleasant caramelization
- → Good balance

 Pleasant aftertaste, elegant and flavorful

O PREMIUM

- → Caramel notes
- → Good body
- → Balanced bitterness and astringency
- → Medium pleasant acidity
- Present and delicate
- caramelization
- Sweet and elegant finish

O CLASSIC

- → Good body
- Bitterness and astringency
- Medium and mild caramelization
- ➡ Low acidity
- ➡ Powerful in the palate
- Long and lasting finish
- Often consumed with milk



Sample preparation

Sample should be prepared in the following conditions:





APPLICATION AND USES OF INSTANT COFFEES FOR THE FINAL CONSUMER

Instant coffee is often used in mixes to be prepared with water or milk, known as 3 in 1 or 2 in 1 coffee mixes. The 3 in 1 is composed of instant coffee, chocolate powder and milk powder; 2 in 1 is composed of instant coffee and milk powder. These mixes are often commercialized as cappuccinos or coffee with milk, and often sold in supermarkets; they are also used a lot in food service – hotels, hair salons, etc – as a good and practical alternative. This type of product has longer expiration dates and their practicity avoid losses/waste.

Besides the powder format, instant coffee also comes in capsules known as "multi-beverages", suitable for machines that prepare not only coffee, but also coffees with milk, cappuccinos and moccaccinos. There is a combination of several ingredients within the capsule, resulting in a tasty and nutritious cup for the final consumer.

Other products that also use instant coffee as ingredient are: cereal bars with dried fruits, functional food products for sports, etc.

Preparation Tips

In Brazil, where the consumers appreciate stronger coffees so, the reccomendation is 1 teaspoon of instant coffee for 50ml of boiling water. For others consumers around the world, this measure may vary (use more or less coffee, depending on the individual taste).



Use a teaspoon for measurement;

Heat the water until approximately 85° C. There is no need to boil the water.



Close the coffee pot firmly; moisture is an enemy of instant coffee: the product can absorb it and change color, texture and flavor.



After opening the package, keep it in the fridge (or even in the freezer).



To obtain a milder flavor, dilute the coffee in cold water in the cup, and stir well, then pour the hot water.

With milk and plant based beverages

A very commom way of consuming instant coffee at home is with milk. Since we often drink coffee with milk in larger cups (mugs) – of around 150 to 200ml – the quantity of instant coffee also tends to be increased. It is important to remember that this is also a matter of personal taste.

The recommendation is 2 teaspoons of instant coffee for each 150ml of milk, which corresponds to 3 to 4 grams per cup, on average.

Another important factor is the product's solubility: in agglomerated coffees it is usually higher and faster than in freeze dried.

These same recommendations apply to plant based beverages, like soy milk, almond, rice, nut milk, etc. Each one of them has a unique flavor that harmonizes with all coffees.

Applicability

Despite being highly consumed with milk, instant coffee applicability is very wide, with possible uses in gastronomy and confectionery as a versatile ingredient for cakes, puddings, meringues and more creativity permitting. It can be also be an ingredient in cold cocktails, being diluted directly in cold water and used in large volumes.

Other ingredients, besides dairy milk, also harmonize well with it, like plant based beverage made from almonds, nuts and rice, at any temperature.

After knowing all the technology involved in the making of instant coffee, baristas can feel free to **explore** their own coffee recipe and **enjoy** it with clients and friends. The brand "Explore & Enjoy" comes exactly to represent all of this creativity and versatility.

EXPLORE RENJOY INSTAN COFFEE BRA7II **INSTANT COFFEE GUIDE FOR BARISTAS**



Coffee with Whisky (Bartender Bertone's Recipe)

- 1 teaspoon of freeze dried instant coffee
- 40 ml of "cachaça" (sugar cane spirit) or American whisky

20 ml of brown sugar syrup

- 20 ml of lemon juice
- 4 drops of Angostura bitter
- 🗢 2 slices of Sicilian lemon
- I sprig of rosemary
- 🖯 lce

How to prepare it: Shake the coffee, the "cachaça" or whisky, the syrup and the lemon, and pour in a glass or mug. Add the Angostura bitter, the lemon slices and the rosemary sprig.

Dalgona Coffee

- 2 tablespoons of instant coffee
- ➡ 2 tablespoons of sugar
- 2 tablespoons of boiling water
- Milk to serve

How to prepare it: Shake in the mixer or fouet (egg whisker) until forming a dense and thick cream. Pour milk in the cup and cover with the coffee cream. Serve it with biscuits/cookies and sweet sauces on the side.



EPILOGUE

The challenges of the coffee production chain are huge, and in each one of them we are faced with novelties and unique specificities, shaped by different and exclusive realities. The universe of instant coffee is equally interesting, seductive, and technological, with highly qualified professionals.

The world of instant coffee is also fascinating because it uses only two ingredients: water and coffee combined with the laws of physics – pressure and temperature. Based on these factors, all of the Brazilian coffee aromas and flavors can be found in cups all around the world, making Brazil the largest exporter of instant coffees since 1953.

I hope that I managed to share with you another perspective of such a national and highly complex product! Do explore this experience, appreciate its flavors, create your recipe and appreciate it with friends and clients!

Sincerely,

Eliana Relvas

For additional information, watch the institutional video of instant coffee by scanning the code below with your smartphone camera or QRCode app.



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