

Coffivino process: A new era of coffee fermentation

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ABSTRACT

Developing the quality of fermentation is a crucial step in developing regular coffee to specialty coffee. Therefore, the Arabica Research Team, Rajamangala University of Technology Lanna, Thailand, has invented a new fermentation technique called the “Coffivino process.” The aim is to create specialty coffee with a consistent level of quality in every season on an industrial level. This technique is inspired by wine fermentation technology, which combines the Semi-carbonic maceration process with the Yeast process. The new process matches the type and quantity of nutrients with the desired coffee cherry quality. Analyzing and controlling the quality of the entire fermentation process shows that the Coffivino process can create coffee with unique attributes, a wider variety of flavors, and higher intensity than the traditional process. This new technique would be the perfect solution for the fermentation of unhealthy quality coffee cherries on an industrial level and improve them to the sensory quality of specialty coffee.

Keywords: Coffivino, coffee, fermentation, semi-carbonic maceration, yeast, Arabica

INTRODUCTION

The unique characteristics of each type of coffee depend on its origin (climate, latitude, altitude, and farm and process management (Alves et al., 2011; Joet et al., 2010). Within the world of specialty coffee, coffee cultivated in suitable environments is born to be remarkable. In other words, they can effortlessly display their unique features, deserving of the name “specialty coffee.” However, what about coffee, which was not born to be unique? Not all coffee was cultivated from the ideal environments; these coffees require extra efforts to elevate their sensory property to “Specialty coffee.”

Elevating regular coffee to specialty coffee is a challenging topic for any scientists involved in the industry of coffee production. Many research papers agree that in addition to coffee variety, and coffee origin, the development of the coffee fermentation process also plays a major role in developing coffee quality (Ribeiro et al., 2017).

As time passes, consumers are increasingly aware of coffee quality and the property of good coffee. Hence, the standard of coffee is getting higher and higher (Ashihara and Crozier, 2001; Upadhyay and Mohan, 2013). As such, process developers in the 21st Century have turned their interests to control coffee quality through technologies and innovations, hoping to produce a larger quantity of coffee at a similar rate in every harvest season.

At present, wine fermentation technologies are gaining popularity in coffee fermentation

processes, including the pre-treatment of coffee cherries by using the Semi-carbonic maceration process (Promsri, 2018; Junior et al., 2020; Jitjaroen et al., 2021) and the Yeast process (Evangelista et al., 2014; Martinez et al., 2017; Jitjaroen et al., 2021). However, worldwide, there are currently only a small number of researches to support this. The Arabica Research Team, Rajamangala University of Technology Lanna, Thailand, is the first to study this new technique using scientific research methods. The purpose of this research is to improve the quality of Thai coffee, with “Specialty coffee go green by using innovative process” at its core. This leads to the improvement of coffee, with an origin of fewer than 1,000 meters above sea level, into specialty coffee (Jitjaroen et al., 2021).

Arabica Research Team has started developing the quality of Arabica coffee by using this new process since 2018 (Jitjaroen et al., 2018; 2021). The research was a success, and the team was able to train farmers, processors, and the general public during the 2021 harvest. Arabica Research Team has combined knowledge and experience to develop this new coffee processing technique by using “Full wine fermentation style” This new coffee processing technique has been named “Coffivino process (CV).”

COFFIVINO PROCESS

Principle of Coffivino Process

Coffivino process (Coffee-vi-no) is a simple combination of the words “Coffee” and “Vino.” The

word “coffee” means coffee, and the word “vino” (vino) is an Italian and Spanish word for “wine” in honor of the wine fermentation process, which has been integrated with the knowledge of coffee making. This new process has been designed to meet the requirement of “creating floral fragrances, increase fruity acidity, heavier body, a balance in taste, and a long aftertaste.”

Knowing and understanding the quality of coffee is the key to the Coffivino process, especially understanding the quality of intact mucilage, which varies depending on the coffee variety and the maturation stage of coffee cherries (Meenakshi and Jagan, 2007). The chemical characteristics of mucilage can be easily determined; hence, it is used as the primary parameter in designing a fermentation profile in the Coffivino process.

The quality of intact mucilage will affect important fermentation precursors such as sugar, nutrients, and necessary minerals. Once the quality of the coffee cherry has been determined, the coffee cherries will be treated using the Semi-carbonic maceration process by controlling temperature, and carbon dioxide within the closed fermentation tank, creating an anaerobic fermentation. This will result in the coffee cherries changing from oxygen-based respiration to an intracellular fermentation, creating many important substances and a small amount of ethanol (Tesniere and Flanzy, 2011; Liu et al., 2014; Aiemchai 2020; Soykaew 2020), which are needed to create desirable flavors during the following fermentation process. At the same time, coffee mucilage will be degraded into monosaccharides (Cheng, 2017), and a number of important substances will be extracted from the coffee cherries. The semi-carbonic maceration process help reduce the greeny stench, and it increases the flavors of citrus fruits and spices and creates brighter acidity from the malic and citric groups (Jitjaroen et al., 2021).

Furthermore, the Yeast fermentation process has also been integrated (Jearanai, 2020) into the Coffivino process. The main idea for this integration is to create the perfect environment for the fermentation process by tailoring the type and amount of nutrients and selecting specific yeast to match the desired coffee quality. It is essential to maintain a stable temperature and quality control, such as the amount of sugar, ethanol, pH, and acid, to stop the fermentation process at the desired “endpoint” (in winemaking, this point is called “complete fermentation”) (Jitjaroen, 2013; 2021).

Identity of Coffivino Process

Coffivino process can create and intensify coffee's unique characteristics, especially desirable

aroma and fragrances such as floral, berries, citrus, nutty, and the soft and complex acidity of malic, tartaric, and citric acids, and finish with the natural sweetness of the coffee.

The “double anaerobic fermentation,” a process that combines the leftover precursor of the first fermentation process (Coffivino process) with the newly created from that same process, will create additional aromatic and acidic substances needed for the Maillard and caramelization reactions of green bean coffee during the roasting process (Sunarharum et al., 2014).

Additionally, the carbon dioxide created during the fermentation process, both the added carbon dioxide gas during the Semi-carbonic maceration step and the ones created during the Yeast step will accelerate the degradation of mucilage, which helps decrease the stickiness and increase simple sugars, adding more sweetness to the coffee. Furthermore, carbon dioxide can enlarge the cell structure of coffee beans, resulting in faster water evaporation within the cells during the drying process, which helps reduce the drying time (Liu et al., 2014). This process helps decrease waste created through the fermentation process and decrease water and labor costs, making it eco-friendly.

Thus, the Coffivino process answers unhealthy coffee cherries caused by plantation management, irrigation, fertilization, soil, and/or climatic conditions by designing individual fermentation profiles. Furthermore, if the Coffivino process is applied to the fermentation of healthy coffee cherries, 90 plus cup scores are guaranteed.

COFFIVINO FERMENTATION PROFILE

Arabica Research Team picked Arabica coffee cherries from Pa Kia village, Chiang Dao district, Chiang Mai province, situated at 1,530 meters above sea level, for its Coffivino research project. The last crop of the 2021 harvest year was considered the least desirable crop of each year; they are mainly processed into low-quality coffee (commercial grade). The research started by testing the property of intact mucilage (medium quality level with total soluble solids of 15-16 °Brix, and pH 4.9-5.1). The next step was choosing the most suitable fermentation profile, “Rosé Coffivino” (Rosé, a French word, which means pink-red wine). The aim was to create a specialty coffee, outstanding in its floral fragrances, complex acidity, slight Rosé winey character, great body, and a long balanced aftertaste.

The key to the Coffivino process is to control and analyze the quality of coffee cherries throughout the entire fermentation process. For example, maintaining a stable fermentation

temperature, randomly analyzing the chemical properties of samples in a laboratory, and regularly conducting sensory tests by smelling and tasting. Tight control of the entire fermentation process will help avert any problems or crises that might arise during the process, such as sluggish fermentation and stuck fermentation. Furthermore, it will assist in stopping the fermentation at the right moment when the quality of the coffee cherries is at its peak (complete coffee fermentation) (Jitjaroen, 2013; 2021).

Coffivino Process Integrated with LTLH Drying Technique

The most critical step after stopping the fermentation is drying the coffee beans until they

have no more than 12.5% moisture within the fruit (Coste, 1992; Instrução Normativa N° 8, 2003). Sun drying is a long-standing traditional method, where the cherries will be exposed to the uncertain climate, intense sun, and/or rainfall. The coffee cherries are at risk of contamination and overly dehydration, which would cause the coffee cherries to shrink, leading to a low-quality aroma. It needs a lot of laborers to spread the coffee cherries. Hench, Coffivino process utilizes a drying process called “Low Temperature, Low Humidity (LTLH).” It is a great way to preserve aromas and fragrances created during the fermentation process. In recent years, LTLH has gained acceptance and popularity among industrial specialty coffee processors in Thailand (LTLH, 2021).

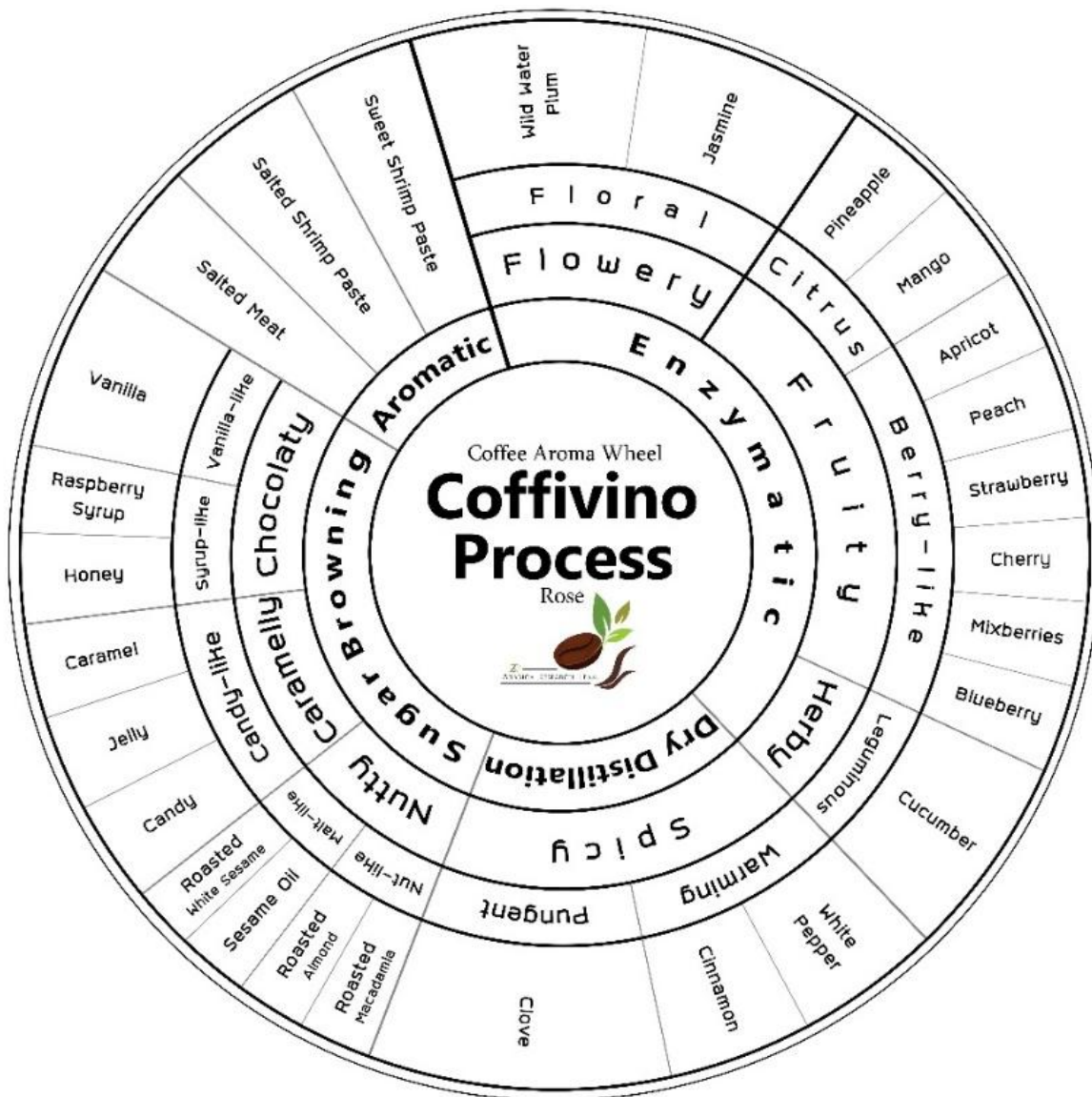


Figure 1. Coffee aroma wheel produced during Coffivino Process (CV): a new coffee fermentation technique, investigated by Gas Chromatography Olfactory (GC-O)

Coffivino Aroma Wheel

A way to confirm the type and amount of coffee aromas that have been widely accepted and cited in the research is by using Gas Chromatography Olfactory (GC-O) (Mahattanatawee, 2010). A sensory expert has discovered that the Coffivino process can create more fragrances than traditional processes (Figure 1). By considering the Enzymatic group, which has been developing while the coffee cherries were growing on coffee trees and has been further developed during the fermentation process (Lenoir, 1997), it is clear that coffee fermented by the Coffivino process possesses outstanding floral, berries, and citrus aromas, as well as a creamy body and a lingering sweetness. Due to the unique characteristic of Rosé flavor during the cupping process, Q Arabica graders have given 4-5 extra scores more than the Natural process, and roastmasters have indicated that this is a 90 plus coffee. Therefore, it can be summarized that high-quality fermentation can create a high-quality aroma (Haile and Kang, 2019). The various physiological changes of the coffee beans during the fermentation will affect the quality of precursors for coffee aromas and fragrances (Vaast et al., 2006).

CONCLUSIONS

The coffivino process is a new coffee fermentation technique, which wine fermentation technologies have inspired. Analyzing and controlling the quality of the entire fermentation process shows that the Coffivino process can create coffee with unique qualities, a wider variety of flavors, and higher intensity than the traditional process. This new technique would be the perfect solution for the fermentation of lesser quality coffee cherries on an industrial level and elevate them to the sensory quality of specialty coffee.

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