

PLANTÉRIA®

FRUIT EXTRACTS



7.0

KEY BENEFITS

- Controlling yeast and molds
- Inhibiting Total Plate Count (TPC)
- Enhancing oxidation stability
- Shelf life extension
- Clean label

As consumers increasingly prioritize healthier options, there's a growing demand for natural alternatives to synthetic preservatives like benzoates and sorbates, known for their neurotoxic effects and potential damage to organs with long-term consumption. In response to this, fruit-extracted antimicrobials, under the trademark of Plantéria® by Handary, offer various benefits, including improved safety, longer shelf life, and greater acceptance among flexitarian consumers.

Plantéria® comprises a group of GRAS organic compounds sourced from fruits like berries and citrus, offering multi-hurdle antimicrobial solutions for various food and beverage applications. This includes Plantéria® CF citrus extracts for yeast and Total Plate Count (TPC) control, alongside Plantéria® BF/RF rowanberry extracts to inhibit yeasts and molds.

OUR BRANDS

PLANTÉRIA® CF
Citrus extracts

PLANTÉRIA® BF
Tapioca starch-carried
Rowanberry extracts

PLANTÉRIA® RF
Maltodextrin-carried
Rowanberry extracts



FEATURES

	Plantéria® CF	Plantéria® BF	Plantéria® RF
Code	0701	0702	0712
Product name	Citrus extracts	Tapioca starch-carried Rowanberry extracts	Maltodextrin-carried Rowanberry extracts
Ingredients	Citrus extract (≥15%), Water (≤85%) *	Rowanberry extracts (≥95%), Tapioca starch (≤5%) *	Rowanberry extracts (≥95%), Maltodextrin (≤5%) *
HEAVY METALS			
Arsenic (mg/kg)		≤1	
Lead (mg/kg)		≤1	
Mercury (mg/kg)		≤1	
MICROBIOLOGICAL SPECIFICATIONS			
Total Plate Count (CFU/g)	≤100	≤1,000	≤1,000
Yeasts and Molds (CFU/g)	≤10	≤100	≤100
Enterobacteriaceae (CFU/g)	≤10	≤10	≤10
PHYSICAL / CHEMICAL SPECIFICATIONS			
Appearance*	Honey liquid	Creamy powder	Creamy powder
pH	2.0-3.5	6.5-8.0	6.5-8.0

*The exact percentage and appearance may vary batch to batch.

Toxicity

Plantéria® CF:
LC₅₀ (96h): = 1,516 mg/L

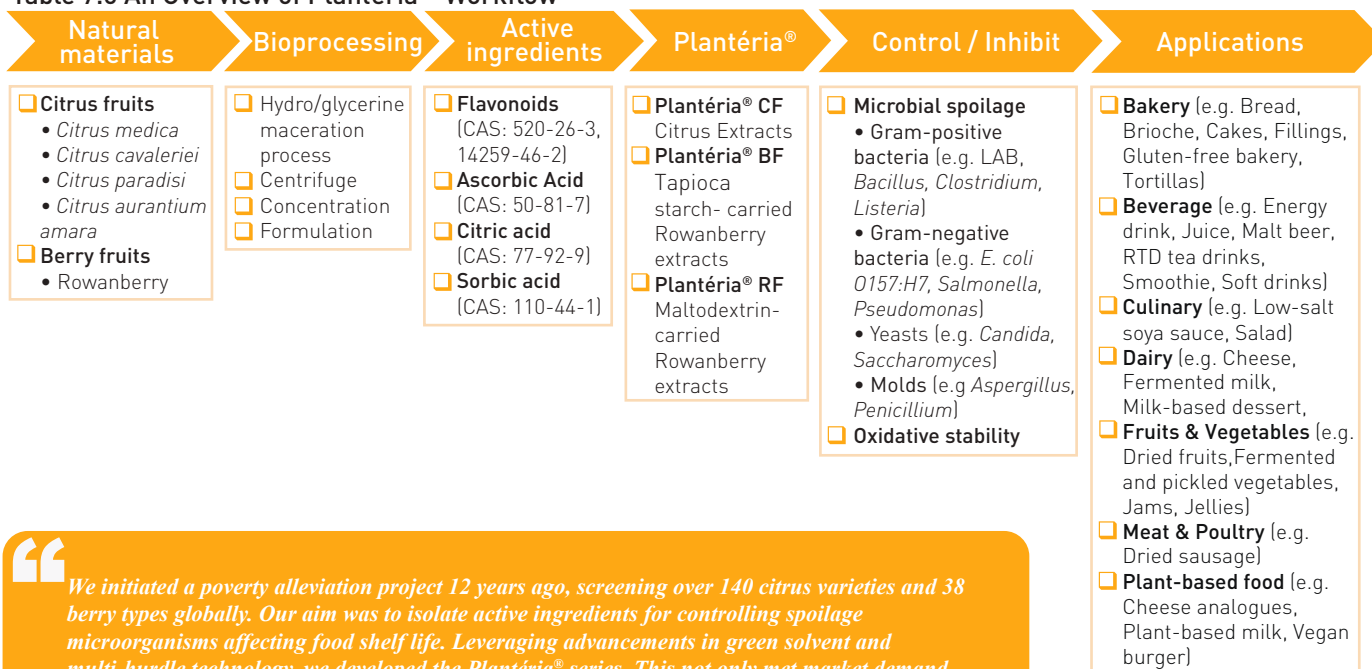
Plantéria® BF:
LC₅₀ (72h): = 729 mg/kg

MIC

Microorganisms	MIC (g/kg)		
	Plantéria® CF	Plantéria® BF	Plantéria® RF
<i>Aspergillus spp.</i>		4	2
<i>Bacillus cereus</i>	0.1		
<i>Brettanomyces bruxellensis</i>	0.1	1	1
<i>Campylobacter spp.</i>	2	0.5	0.5
<i>Candida acutus</i>	0.12	4	2
<i>Cladosporium spp.</i>	0.64	1	1
<i>Clostridium acetobutylicum</i>	0.64	1	1
<i>Escherichia coli</i>	1	4	2
<i>Lactobacillus spp.</i>	0.2	4	2
<i>Listeria monocytogenes</i>	1		
<i>Micrococcus luteus</i>	0.32	1	1
<i>Penicillium spp.</i>		4	2
<i>Pseudomonas spp.</i>	0.06	2-4	2
<i>Raoultella planticola</i>	0.16		
<i>Rhizopus spp.</i>		4	2
<i>Rhodotorula lactase</i>	0.1		
<i>Salmonella Typhimurium</i>	0.32		
<i>Sporobolomyces roseus</i>	0.06	4	2
<i>Staphylococcus aureus</i>	0.23		
<i>Streptococcus spp.</i>	0.08	4	2
<i>Vibrio spp.</i>	0.12	4	2
<i>Yersinia spp.</i>	0.2	4	2
<i>Zygosaccharomyces spp.</i>	0.25		

**MIC is only used for reference.

Table 7.0 An Overview of Plantéria® Workflow



“ We initiated a poverty alleviation project 12 years ago, screening over 140 citrus varieties and 38 berry types globally. Our aim was to isolate active ingredients for controlling spoilage microorganisms affecting food shelf life. Leveraging advancements in green solvent and multi-hurdle technology, we developed the Plantéria® series. This not only met market demand but also empowered mountain fruit farmers economically, promising a brighter societal future. ”

Plantéria® CF	
Code	0701
Labelled as	Citrus extracts
Appearance	Honey liquid
Applications	Beverage (e.g. Energy drink, Juice concentrate, Malt beer, RTD tea drinks, Soft drinks), Culinary (e.g. Low-salt soya sauce, Salad), Plant-based foods (e.g. Plant-based milk)
Dosage	0.01-0.1% (w/w)
Regulations	GRAS

As consumer health awareness grows, food manufacturers seek natural alternatives to synthetic preservatives. **Plantéria® CF**, derived from a blend of organic compounds found in citrus fruits, offers effective control over yeast, Total Plate Count (TPC), and oxidation stability in food and beverage products, making it an excellent replacement option.

Key Benefits

- Inhibiting yeast and Total Plate Count (TPC)
- Enhancing oxidation stability
- Shelf life extension
- Clean label

Application cases

7.1.1 Salad

Salad was inoculated with a *L. monocytogenes* culture and treated with **Plantéria® CF** at a concentration of 0.01-0.02% after 30 minutes. The results in **Figure 7.1.1** demonstrate that *L. monocytogenes* levels were reduced to below the detection limit of 1CFU/cm² after 12 days of storage at 7°C.

7.1.2 Malt Beer

In malt beer, off-tastes and odors are often produced by Lactic acid bacteria, such as *Lactobacillus* and *Pediococcus*. **Figure 7.1.2** illustrates that the addition of 0.01% **Plantéria® CF** during the late stages of the brewing process effectively inhibits *Lactobacillus* spp. in malt beer.

7.1.3 Oat Milk

Oat milk can develop off-odors, off-tastes, and visual defects due to spore formers and yeast. **Figure 7.1.3** shows that when oat milk is treated with 0.01% **Plantéria® CF** and stored at 4°C, the microbial load is reduced by 2 log values, indicating an extended shelf-life of more than 34 days.

7.1.4 Low-salt Soya Sauce

Low-salt soya sauce is susceptible to spoilage bacteria, including Gram-positive bacteria like LAB, *S. aureus*, and *B. subtilis*, as well as yeasts like *S. cerevisiae*. **Figure 7.1.4** demonstrates that 0.015% **Plantéria® CF** effectively controls Total Plate Count (TPC) for up to 240 days at 15°C in low-salt soy sauce.

Listeria monocytogenes

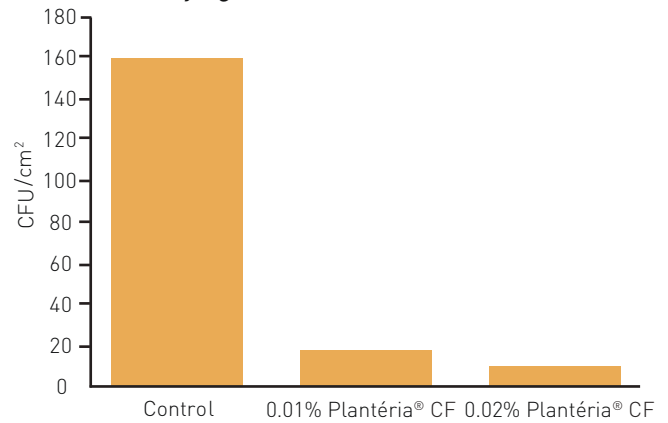


Figure 7.1.1 Salad

Lactobacillus spp.

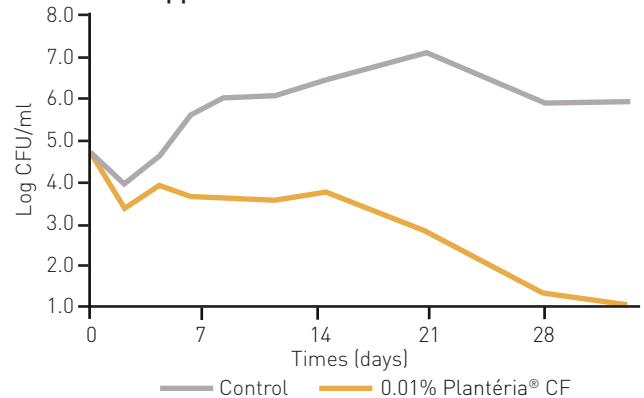


Figure 7.1.2 Malt Beer

Total Plate Count (TPC)

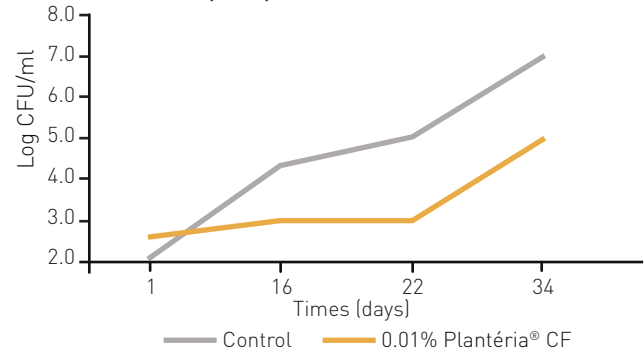


Figure 7.1.3 Oat Milk

Total Plate Count (TPC)

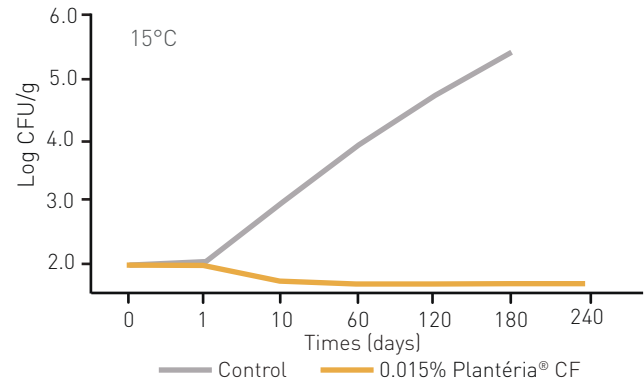


Figure 7.1.4 Low-salt Soya Sauce



ROWANBERRY EXTRACTS

	Plantéria® BF	Plantéria® RF
Code	0702	0712
Labelled as	Rowanberry extracts, Tapioca starch	Rowanberry extracts, Maltodextrin
Appearance	Creamy powder	
Applications	Bakery (e.g. Gluten-free bakery, Bread, Brioche, Cakes, Fillings, Tortillas); Culinary (e.g. Salad, Dips, Sauce), Plant-based food (e.g. Cheese analogues, Vegan burger)	Beverage (e.g. Juice, Iced peach tea, Lemonade, Smoothie); Dairy (e.g. Cheese, Fermented milk, Milk-based dessert, Fruits & Vegetables (e.g. Dried fruits, Fermented & pickled vegetables), Meat & poultry (e.g. Dried sausage); Plant-based food (e.g. Plant-based milk)
Dosage	0.1-0.3%	
Regulations	GRAS	

As consumer awareness of health issues rises, food manufacturers seek natural alternatives to potassium sorbate. Rowanberry, rich in nutrients and sorbic acid, emerges as an excellent replacement. **Plantéria® BF**, a tapioca starch-based extract, prevents mold in bakery, culinary and plant-based food, while **Plantéria® RF**, a maltodextrin-based extract, inhibits yeasts and molds growth in beverages, dairy, fruit and vegetable, and plant-based food.

KEY BENEFITS

- Inhibition of yeast and mold growth
- Enhancing oxidative stability
- Shelf life extension
- Clean label

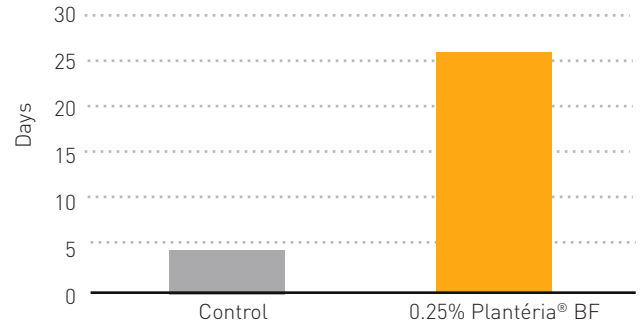
APPLICATION CASES

7.2.1 Vegan Burger

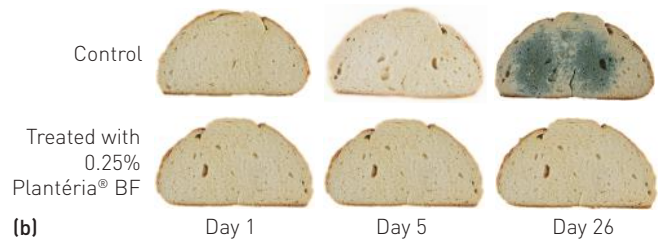
Vegan burgers, due to their near-neutral pH and high protein and moisture content, are prone to microbial growth, including spore-forming bacteria, as well as molds. Adding 0.25% **Plantéria® BF** to vegan burgers stored at cooling temperatures significantly inhibits spore development for up to 16 days, as depicted in **Figure 7.2.1**. In contrast, the control group shows mold growth as early as 4 days, leading to complete spoilage by day 12.



Figure 7.2.1 Vegan Burger



(a) First Appearance of Mold on Sliced Wheat Bread



(b) 7.2.2 Sliced Wheat Bread

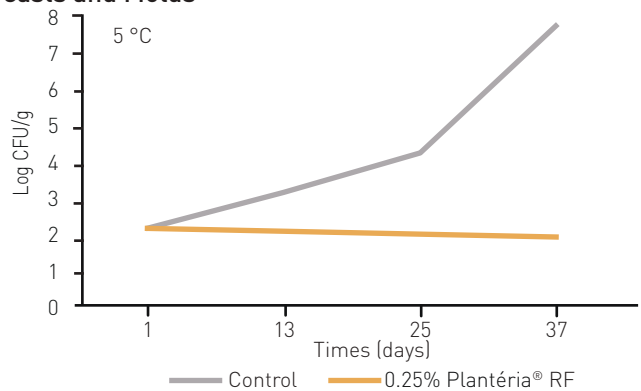
7.2.2 Sliced Wheat Bread

Mold growth and *Bacillus* spp. occurs in a few days in humid conditions of sliced wheat bread. **Figure 7.2.2** demonstrated that 0.25% **Plantéria® BF** added to sliced wheat bread, stored at room temperature, effectively extends its shelf life up to 26 days without any signs of molds or ropiness. In contrast, the control group exhibited mold growth after only 5 days, with complete spoilage observed by day 13.

7.2.3 Iced Peach Tea

Iced peach tea spoilage is typically marked by unpleasant odors, strange flavors, cloudiness, or moldy. **Figure 7.2.3** demonstrated that 0.25% **Plantéria® RF** added to peach iced tea at 5°C can effectively inhibit the growth of yeasts and molds.

Yeasts and Molds



7.2.3 Peach Ice Tea

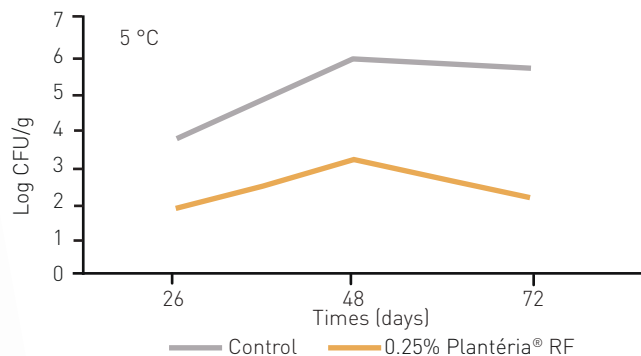
7.2.4 Sparkling Lemonade

Chilled sparkling lemonade products are prone to spoilage from fermentative yeasts, molds, and a limited presence of acid-resistant aerobic bacteria. **Figure 7.2.4** demonstrated that 0.25% **Plantéria® RF** added

to sparkling lemonade stored at 5-7°C, the growth of yeasts and molds can be effectively inhibited for a duration of up to 72 days.



Yeasts and Molds



7.2.4 Sparkling Lemonade