

Mazza Innovation Ltd ("Mazza") is a Canadian company that is revolutionizing the extraction of phytochemicals from plant sources using its proprietary subcritical water extraction technology called the PhytoClean<sup>™</sup> Method. This technology modifies the properties of water such that it behaves like an organic solvent in terms of its ability to dissolve valuable plant compounds without the numerous drawbacks associated with the use of organic solvents.

PhytoClean<sup>™</sup> ingredients are 100% pure plant extracts—free from any carriers or trace solvents. Watersoluble and standardized for the concentration of the bioactives, PhytoClean<sup>™</sup> ingredients meet the industry's requirements for a clean label offering.

Mazza specializes in extracting bioactive compounds including polyphenols, alkaloids, glycosides, and specialty carbohydrates that are of interest to the dietary supplement, food, beverage, and personal care industries. Founder Dr. Giuseppe (Joe) Mazza drives the company's commitment to environmental integrity and its vision to produce the cleanest, greenest ingredients that benefit our health while preserving a healthy planet.

Participating for the first time in the 2015 Engredea/Natural Products Expo West trade show in California, Mazza launched its first ingredients: green tea, blueberry and cranberry extracts. Standardized to meet minimum bioactive ingredient concentrations and yet free of any carrier or trace solvent, the company's clean ingredients were nominated as the Most Innovative Ingredient part of the 2015 Editors' Choice Awards. Mazza has a robust development pipeline of new ingredients for introduction to customers and industry. Beyond commercializing its proprietary ingredients, Mazza is also seeking interesting projects for joint venture and collaboration with established market players. Mazza works with companies that have specific projects in mind for which they would like to develop solvent-free, standardized extracts to meet the growing demand for clean labels and truly pure products.

Existing technologies leave manufacturers with a choice. Organic solvent extraction will yield products containing solvent residues, sometimes of highly toxic solvents. Operating safely with organic solvents also requires complicated and expensive physical and regulatory infrastructure. If manufacturers desire an ingredient without solvent residue, they must rely on lowperforming water extraction or expensive and complicated supercritical carbon dioxide extraction. Mazza's technology represents the solution to this dichotomy: a method to achieve the high extraction performance of organic solvent without any of the inherent drawbacks.



## The PhytoClean<sup>™</sup> Method:

Unfortunately for natural products extraction, water is generally a poor solvent for the extraction of organic molecules from biomass. In order for an organic molecule to be dissolved by water, it must 'compete' with the hydrogen bonds that already exist between the water molecules. Hydrogen bonds are responsible for many of water's unusual properties. These unusual properties include its relatively high surface tension and high boiling point, for example. Since organic solvents don't have this problem of strong hydrogen bonds, they are much more effective solvents.

The beauty of the Mazza technology is to make water behave like an organic solvent with respect to its dissolution capacity of organic molecules. When water is heated, the kinetic energy of the heated water molecules begins to overcome the hydrogen bonds, freeing up the water molecules to bond with the organic compounds which are the targets of the extraction. The key, however, is to maintain, with the use of pressure, the water in a liquid state even though it is above its atmospheric boiling point of 100°C. The breakdown of the hydrogen bonds in liquid water continues as more heat is applied. It can be measured by a reduction in polarity. In atmospheric conditions, the polarity of water is 80. By increasing its temperature to above 100°C the polarity can be reduced to around 25-35 which is equivalent to the polarities of ethanol and methanol, two extremely prevalent extraction solvents.

Solvent	Dielectric constant, εr		
Water (STP)	80		
Methanol	33		
Ethanol	24.3		
Acetone	20.7		
70% Ethanol/Water	45		
PhytoClean™	45		

In essence, the Mazza technology makes water behave as if it were methanol or ethanol without any of the many negative downsides involved in their use. Moreover, since the biomass spends only minutes at elevated temperatures in a purged and closed system, heat-sensitive compounds can be successfully extracted.

	Phyto- Clean	Hot Water	Super critical CO <sub>2</sub>	Solvent
Solvent Free	$\checkmark$	$\checkmark$	$\checkmark$	×
Fast	$\checkmark$	×	$\checkmark$	×
Low Complexity	$\checkmark$	$\checkmark$	×	$\checkmark$
Scalable	$\checkmark$	$\checkmark$	×	$\checkmark$
High Yields	$\checkmark$	×	$\checkmark$	$\checkmark$
High Selectivity	$\checkmark$	×	$\checkmark$	$\checkmark$

The Phytoclean extractor produces an extract of approximately 1-3% solids in purified water. After extraction, an evaporator is used to remove most of the water. After that, Mazza uses a cutting-edge drying technology called refractance window drying which is extremely gentle and preserves the extract's bioactive contents. This technology removes the remaining moisture in the extract to produce a dry products which can be ground to meet the customer's needs.



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