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CAVITOIL

EMPOWERING DEVICE

01/07/2025 *(dd/mm/year)*

technology introduction

something about us

We study and develop, on industrial-scale, systems capable of transforming the causes of pollution into a source of wealth.
Our patents range from the denaturation of asbestos to the treatment of almost every type of waste, from water purification to the production of aluminum without waste.
What's the point of devastating the environment around us to collect a few crumbs of resources when we can use our technologies to live great and achieve anything in a sustainable way?

Our goal

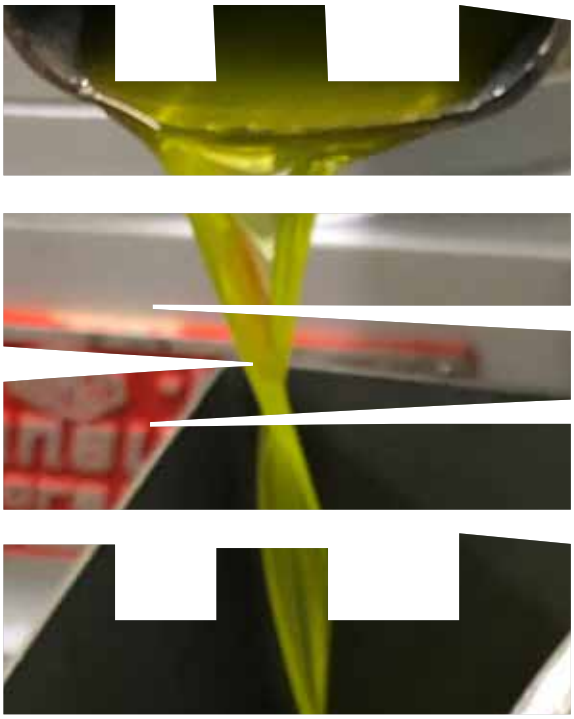
Since we don't have a second home were to go, we need to make our planet more livable without stopping technological development!
Our goal is to make our planet more livable without stopping development.
For this reason we have developed industrial systems that transform the causes of pollution into an immediately usable source of opportunities: low-priced raw materials ready to be reused through further sustainable processes.
Let's protect nature without stopping progress!

Smartly sustainability

Mission:

- **Social progress**
- **Clean environment**
- **Wealth production**
- **Sustainable Development**

index



- acceleration of natural processes without organoleptic alterations
- contained implementation costs
- minimum maintenance: a few hours a year to check seals and bearings
- mature technology as it has already been used for nearly 20 years in various fields
- bacteria, microorganisms, viruses and pathogens removal at room temperature

who we are...

We born close to the COVID pandemic. We immediately became a meeting point for numerous professionals, research institutions and production companies. All this started in Italy and is now spreading to other countries.

Often our projects precede the times of several years.

Our proprietary technology is totally innovative **but consolidated** and is essentially based on: cavitation, gasification and Coanda effect.

After having implemented and made the above more effective, we have adapted it to everyday life by creating complete processes whose application increases both the quantity and quality of the products obtained, decreasing energy requirements but paying great attention to the creation of a greater number of jobs compared to those eliminated by mechanization.

In addition to the real innovations, we are specialized in engineering and then applying improvements of technologies, mature in their field, to other areas often obtaining, this way, several real technological leaps simply because we had the courage to do what was before under everyone's eyes but no one dared to put it into practice.

We develop technology both independently and in collaboration with Universities (Sassari, Perugia, Amsterdam, Algarve, etc.) or with other public institutions (for example the National Research Center - CNR, Fundación Circe etc.).

We boast a vast proprietary product portfolio with several pilots viewable, by appointment, and several completely innovative process lines.

Some of our products have been defined extremely innovative and promising at international events by panels composed of scientists from all over the world. Our technology and our demo site have been deemed valid and usable in several Horizon Europe projects.

Our patents and innovations have made us immediately designate as members of technology suppliers within the Italian Biogas Consortium.

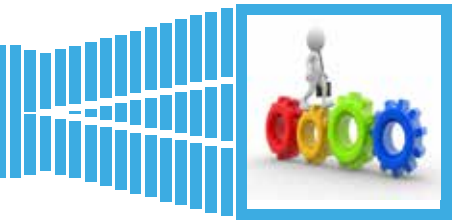
We have a framework agreement with RINA Consulting - Centro Sviluppo Materiali S.p.A. which allows us to request their supervision and therefore also to certify the production and engineering phase of our products wherever we choose to produce them. Therefore, choosing us also gives access to all the wealth of experience and technology gained in over 70 years by Centro Sviluppo Materiali which, I remember to everyone, was since its establishing the research and development department of IRI (Institute for Italian Industrial Reconstruction, among the top 10 companies in the world by turnover up to 1992).

Numerous specialized industrial plants, centres of excellence on their specific sectors, have made the production slots we need available to us; we are equipping ourselves with proprietary factories to carry out final assembly and to start specific productions.

We are present with companies in numerous European countries. We are opening companies in several African countries and in Asia. We have projects underway in various European, African and Asian countries. Our international staff represents our essence: motivated people with a wealth of personal experience who believe in what they are doing and who come from many different countries. In every nation in which we appear we respect local customs and traditions, bringing a bit of Italianness to the place and "*stealing*" part of their culture to ensure that no one is a ***Stranger in a Strange Land***.

Dr Bruno Vaccari

… and what we do



- BIOZIMMI
- EMPOWERING DEVICE
- ZEB
- BIODIGESTERS
- FROM HEAT TO ENERGY
- THERMOELECTRIC PANELS
- ASBESTOS DENATURATION
- GASIFICATION & PLASMA
- INERTIFICATION
- WEEE
- UREA & AMMONIA
- FOOD PROCESSES
- HOSPITAL EQUIPMENT
- SOIL WASHING
- WATER TREATMENT
- WTE & WTC
- DESALINIZATION

OUR MAIN GOAL: environment and workers' conditions respect

our core team

Bruno Vaccari

CEO

Sabrina Saccomanni

LAWYER

Fabrizio Di Gennaro

CMO

Antonio Demarcus

CTO

Paolo Guastalvino

CIVIL WORKS

Gianni Deveronico

LEAD ELECTRICAL ENGINEERS

Faris Alwasity

ENGINEERING

Massimiliano Magni

ENGINEERING

Antonio Piserchia

COMMUNICATIONS EXPERT

Barbara Spelta

LAB

Papa Ndiamé Sylla

COO Senegal

Noel Sciberras

COO Malta

Appiah Fofie Kwasi

COO Ghana

Eugen Raducanu

COO Romania

Awa Khady Ndiaye Grenier

COO Guiné-Bissau

Giorgio Masserini

Marketing

Pantaleo Pedone

Italian energy-intensive

Gianluca Baroni

Hospital Stuff

Stefano Diambu Nkazi

Marketing

Sarr Alioune Badara

Marketing

Jérémie Saltokod

CCIMRDC Italie

olive oil: extraction

The market for machinery for the extraction of extra virgin or EVO oil from olives requires innovations that make it possible to increase yields and, at the same time, preserve the quality of the oil.

The malaxing is the phase in which numerous transformations, of a mechanical, physical, chemical and biochemical nature, desired and unwanted, take place simultaneously and in a sufficiently long period of time so that the control conditions are scarcely reproducible, also due to the rhythms of work. convulsions linked to the brevity and intensity of the oil campaign.

But kneading is also the part of the process that modulates the quantity / quality of oil production: its correct regulation allows to obtain the best yield / quality ratio of the product.

The pressing determines the breaking of the drupe into coarse fragments containing hundreds of cells.

These must pass intact through the mechanical device. Cell rupture is not pushed to the extreme in consideration of two factors negatively linked to a possible surplus of mechanical energy. In this case, in fact, there would be an increase in the temperature of the paste **which would compromise the quality of the oil** with the consequent risk of emulsions that would damage the extraction yields.

In the traditional olive oil extraction process, to extract a surplus of oil it is necessary to extend the kneading times or, alternatively, to increase the process temperatures. However, this choice could compromise the quality of the product especially if oxygen is present in the head space of the malaxer; in this case oxidation processes can in fact be triggered by the unsaturated fatty acids with a consequent decrease in polyphenolic substances and consequent reduction of the organoleptic characteristics of the product.

The long kneading times, in

addition to being a threat to the quality of the oil, make this phase of mixing and processing the oil paste at a controlled temperature the "bottle-neck" of the continuous process.
In the mill, the limited working capacity of the malaxer penalizes the production efficiency of the decanter.
Currently, the main plant engineering solution adopted to manage this "inefficiency" consists in multiplying the number of kneaders, placing them in series or in parallel, ensuring continuity to the process but with a significant increase in the investments required in the mill. While, the improvements obtained by experimenting vertical malaxers, the use of atmospheres composed solely of nitrogen to lengthen the malaxing up to an hour and a half or the addition of natural micro talc or the addition of specific fluidifying enzymes even if they actually increase yields of up to 3% significantly increase energy and production costs as well as the need to install a large number of additional malaxers to avoid further bottlenecks.

Correctly managing the flow of the production process leads to enormous advantages in terms of efficiency and a reduction in costs, especially in terms of energy.

It goes without saying that the strengthening of the weak link of any process must be such that the advantages obtained with the innovation are greater than the costs that the innovation itself requires.
By acting on macroscopic variables such as time, temperature and composition of the atmosphere in contact with the olive paste, the biochemical reactions that occur simultaneously with the physical pro-

cess of coalescence of the minute droplets of oil released in the pressing are modulated and determines how much and what quality of oil it will be possible to extract.

However, it is known that extraction yield and oil quality are antithetical values and that, therefore, any operational choice made with the machines currently present in the mill requires a choice that favors quality or quantity.

It is therefore necessary to develop a process that is able to carry out a delicate breakage of the cells passed intact to the crusher, avoiding emulsions and unwanted temperature rises, accelerate the coalescence phenomena (physical phenomenon through which the drops of a liquid join together to form larger entities) of the minute droplets of oil released by the elaioplasts (the leucoplasts specialized in storing lipids), allow the dissolution of the biophenols from the aqueous fraction of the olive paste towards the oily fraction and favor the enzymatic synthesis of the volatile compounds while limiting the oxidation reactions of fatty acids.

All harmonized in a system that can operate continuously, transferring the oil paste from the crusher to the decanter without recreating bottlenecks that penalize the latter's working capacity.

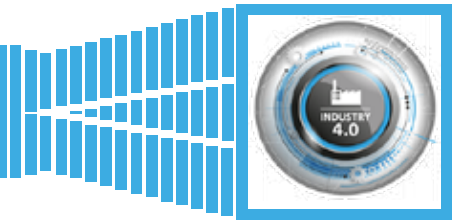
After careful analysis and research, mature technologies capable of guaranteeing the improvements required in the process have not been identified in the agri-food sector.

To obtain them it is necessary to adopt technological innovations initially designed for other areas; among these, **controlled cavitation represents the trump card** to eliminate the bottleneck that was created due to the weak link in the continuous extraction process of extra virgin olive oil thanks to the effects that this induces within the same pasta oil during processing.

When conditions arise that lead to cavitation of a fluid, when negative pressure values are

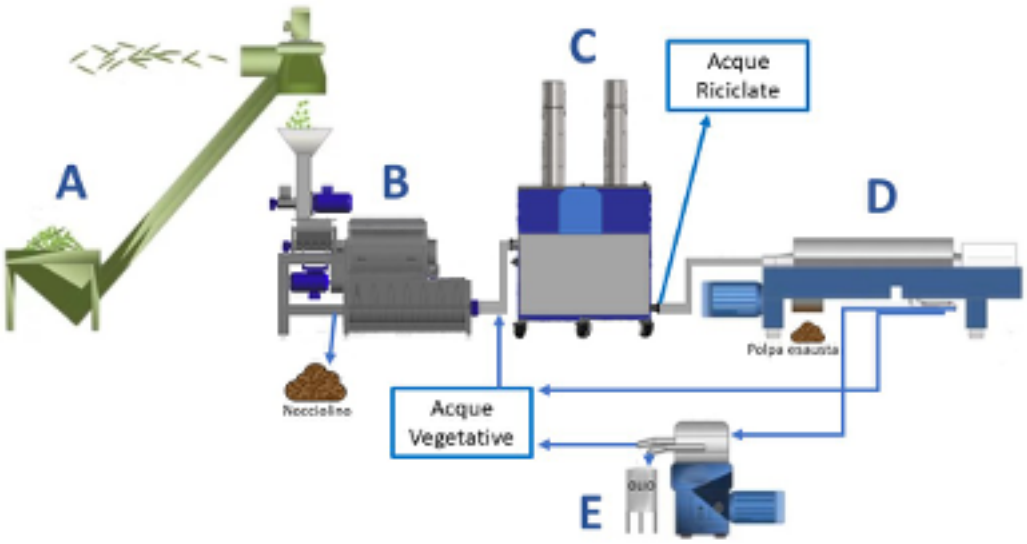
below the vapor pressure of the fluid itself, it undergoes a phase change from liquid to gas, forming cavities containing vapor and giving rise to the phenomenon cavitation.
Therefore cavitation is a physical phenomenon consisting in the formation of vapor bubbles inside a fluid that are formed not by an increase in temperature, but by pressure variations, these implode producing shock waves, i.e. pressure waves that can be extremely intense. If the implosion occurs near the cell wall of the drupe, it generates micro jets that break the wall, releasing the contents of the cell, all within a few microseconds.

CavitOil process

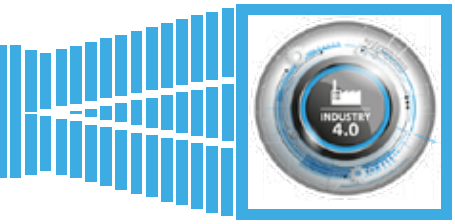


Our device, unique in its kind both in terms of flow rate and type of treatments carried out, if placed between the crusher / stoner and the decanter, helps to make the extraction process continuous, reduces the times of the extraction process, increases the capacity of processing of the crusher, at the same time improves yields and determines an increase in minor compounds.
The high efficiency that characterizes the treatment guarantees sustainable processing and a rapid return on investment, thus improving company competitiveness and increasing profits.
The new process, which we call **CavitOil**, is based on the hydrodynamic controlled cavitation treatment of the olive paste, tested and developed starting from the studies conducted by the Polytechnic of Bari and the University of Bari Aldo Moro.
The mechanical effect of cavitation breaks the cells passed to the crusher, thus releasing all the oil trapped in them, any minor compound and part of the oil trapped in the stone fragments.
Furthermore, the swirling motions imparted to the pasta by the pressure transients determine the coalescence of the lipid droplets.
The cavitator replaces the kneaders and can process about 7 tons per hour of ground / crushed olives with an electrical consumption per processing cycle of 0.572 kW (equal to 200 kg) or 2.862 kW per ton processed. Each processing cycle lasts less than 2 minutes (about 108 seconds) against the 20/45 minutes required by the kneaders. Given the particular geometry of our machinery, the whole process takes place at room temperature, so there is no need to use thermal energy except for drying the pomace.
The performance of **CavitOil** was measured in terms of the efficiency of the mechanical action and was evaluated by measuring the concentration of pigments and minor compounds in the product.
The quantitative effects of the plant are determined in terms of higher yields, while the qualitative ones are determined by evaluating the main analytical parameters required by the legislation: the content of polyphenols and tocopherols as well as the concentration of volatile compounds.
The final result is represented both by the ability to extract a greater quantity of extra virgin olive oil, approximately 20% increase or approximately 3 liters more every 15 liters produced by working 100 kg of olives, and to obtain a product richer in biophenols (> 20%), with an organoleptic profile conforming to the varietal characteristics and characterized by greater harmony between the olfactory component and perceptions of spiciness.
CavitOil therefore introduces a radical type of innovation in the processing of olives and oil production as the previous processing process is altered by replacing an entire phase, the kneading, introducing previously non-existent equipment and making the two plant solutions different from each other.
The oil obtained with **CavitOil** can therefore obtain a premium price on the market because it is endowed with unique and recognizable organoleptic characteristics, different from those offered by competitors who continue to use traditional methods and which the consumer can perceive as a product with a superior quality value.
This will ensure that the greater quantity of extracted oil is accompanied by a higher commercial value due to the increased and recognizable health effects, combined in an organoleptic

profile that is more appreciated by consumers.
The pomace, including pits, in addition to traditional uses (biomass for heating or compost) can be used to produce the energy needed for the mill with a high-performance cogeneration system of our production capable of completely reducing energy consumption.
The vegetative and washing waters, if destined for disposal, can be purified at night, when the crusher is not in operation, always using the cavitator: in this way not only will they not have to be sent to specialized disposal centers but also contribute to the daily cleaning of the cavitator and can also be reused in the process or for irrigation purposes.
Furthermore, the system developed by us, working at room temperature, is not affected by climatic changes and therefore also fits perfectly with the progressive advance of the harvest time and the inevitable mitigation of autumn temperatures, allowing the application of low temperatures. during the manufacturing process.
CavitOil has been conceived, designed and manufactured by carefully dosing the power of hydrodynamic cavitation: this will allow maximum modulation of the product quality as the device can be calibrated taking into account the processing needs of each particular cultivar.

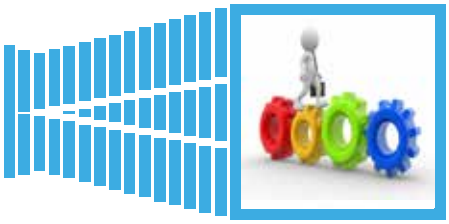


CavitOil: example



Practical example on a small to medium-sized oil mill designed to process **about 6,500 quintals of olives** per year, partly on its own and partly on behalf of third parties.
From the moment of harvest, the olives must be processed possibly on the same day or, at the latest, within 2 days to prevent fermentation and / or degradation reactions of the olives. Considering that almost all the olives of a certain geographical area reach maturity and are harvested in extremely short times, it goes without saying that the mills have to concentrate their activity in a few weeks a year and that therefore their dimensions must be calibrated to divide the total expected load over a period of about 2 months.
Consider a production of EVO oil between 10 and 20 liters per 100 kg of processed olives; each liter of oil weighs about 920 grams. With our process we get about 20% more quality product than a traditional manufacturing process so we will get closer to obtaining 20 liters rather than 10: if from 100kg of olives we obtain 15 liters with the traditional system with **CavitOil** we will obtain about 18 liters of oil.
Instead of separating pits and pomace, we will limit ourselves to drying them both to bring them to 10% humidity and use them in the micro-gasification plant supplied with the system.
Knowing that electricity represents 75 to 83% of the costs of an oil mill, the transformation of processing waste into immediately usable energy for the processing itself represents an additional benefit of the **CavitOil** system. The gasification process heat will be used, during the normal operation of the mill, to dry the pomace and the pits and subsequently it will be available for district heating, greenhouses, heat pumps, etc.
Furthermore, the **CavitOil** processing process takes place at room temperature so there is no need to use thermal energy, making the approximately 4,400 kcal of pomace with pits fully available.
The dried weight of the pomace, including the pits, is approximately 25% of the total weight of the incoming olives (**about 162.5 tons compared to 6500 quintals of olives**). In 60 days, 108 quintals of olives will be processed every day (7 per hour) with an estimated consumption of 32 kWeh. Therefore, we prudently believe we need an energy system capable of delivering 50 kWh through gasification.
Therefore, considering a prudent average between dried pomace and pits equal to 4.4 kcal per kilogram and an electrical transformation yield of about 35%, a potential quantity of energy is obtained that is able to power the crusher electrically for the period of processing as well as produce the necessary to power the structure for a good part of the year (over 310 days a year for 16 hours a day).
Finally, it must be borne in mind that since it is self-produced electricity, it completely cuts the costs of the energy bill and not only the components relating to the energy item.
The higher oil yield leads to the production of about 19,500 liters more of product, 15,000 from proprietary olives.
Keeping the values envisaged for the quantities of olives firm, the annual savings added to the higher income from extra oil production **can exceed € 230,000.00 each year.** Without taking into account that with the adoption of the cavitation system and the decanter, the plant could manage much larger quantities annually.

CavitOil: seed oils



Regarding the application of **CavitOil** in the production of seed oils, the production process provides, as a first step, a pre-washing and washing of the seeds from the various powders and impurities, these mainly organic substances are transported via a conveyor belt in a collection tank for the collection of waste biomass: material that will be gasified or biodigested to produce the energy necessary for the plant and, the excess, fed into the national distribution network.
Once the seeds have been cleaned of impurities, they will be peeled and then peeled first and, then, the skins will be separated from the seeds. Depending on the seeds used, the technology used changes. For example, the machine for peeling soybean or sunflower seeds will be different from that for peanuts; nothing prohibits equipping a plant with both machines even with automatic sending to processing. The skins will also flow into the central biomass collection tank.
The dehusked seeds will be sent to the **EMPOWERING DEVICE** which, thanks to controlled cavitation, will increase the production and quality of the product, without the use of chemical additives.
The pasta produced with the **EMPOWERING DEVICE** will be carried to a press that will separate the pulp from the oil where the solid part will always be collected in the tank destined for biomass.
Scientific research in recent years has been consolidating the idea that the future of the art of olive oil milling lies in low-frequency ultrasound: a technology that, by overturning the historical paradigm between quantity and quality of the product, allows for an increase in oil yield while preserving polyphenols.
EMPOWERING DEVICE being able to exploit two types of controlled cavitation, mechanical and sonic, enhances the effect in oils since the rotor is designed for water, present in oils but not in very large quantities, so its effect is present but has a secondary effect, managing to shred the pasta better and therefore to increase the yield of the extraction press.
Once produced, still raw, very nutritious and rich in polyphenols, the oil can be bottled. Alternatively, it can be sent to a cyclone that will eliminate the water and suspended materials, typical of crude oils, and can also be stored in settling tanks, to obtain a clearer and more limpid product.
On average, for every 2 tons of seed oil yield, about 3 tons of vegetable waste with a high calorific value are obtained.
The innovation generated is of a radical type since it is not a slight change of pre-existing solutions and the economic analysis reveals that the use of this continuous cavitation system can guarantee, even in Western countries, an increase in revenues such as to repay the plant in a very short time.

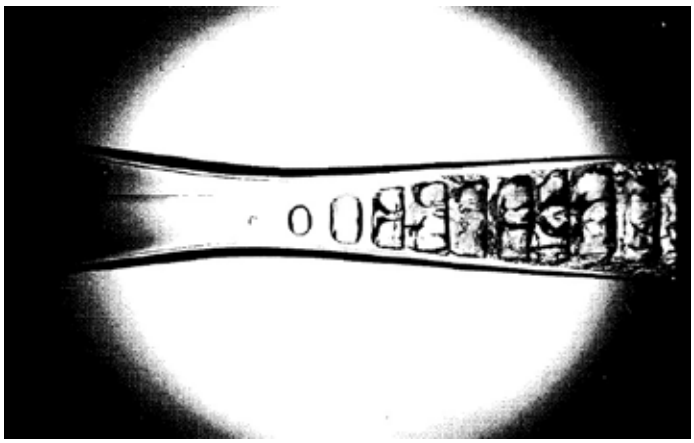
pasteurization

The persistence of microbiological activity in food liquids is one of the critical aspects of the production processes, given the considerable risk of development not only of metabolites with negative impact on the organoleptic and qualitative properties, but above all for the potential release of compounds toxic to human health.
The microbiological stabilization process of food drinks therefore requires extreme care and attention in order to break down the totality of microorganisms such as yeasts or bacteria present in solution.
Thanks to recent studies conducted by the main government bodies, cavitation has proven to be the simplest, most flexible and controllable technology as well as the most energy efficient, while the potential advantages of its application to the pasteurization and homogenization of food liquids, aimed at their introduction to the consumption, derives not so much from energy efficiency, comparable with that of an ordinary electrical resistance, but from the homogeneity of the heating obtained. The combined effect of the average temperature of the liquid and the localized, diffuse and homogeneous release of large quantities of thermal and mechanical energy, allows to reach the required food safety parameters, at average temperatures significantly lower than those of traditional processes. As a direct consequence, there is a marked energy saving and superior ability to control critical issues in the food process and product quality.
A research conducted by the Italian CNR has aimed to inactivate Saccharomyces cerevisiae, the yeasts most commonly used in the food industry for the fermentation of wine and beer, but at the same time responsible for the alterations and deterioration of the juices fruit and milk, as well as among the microorganisms most resistant to thermal and mechanical shocks.
Cavitation applied in food areas has several benefits:

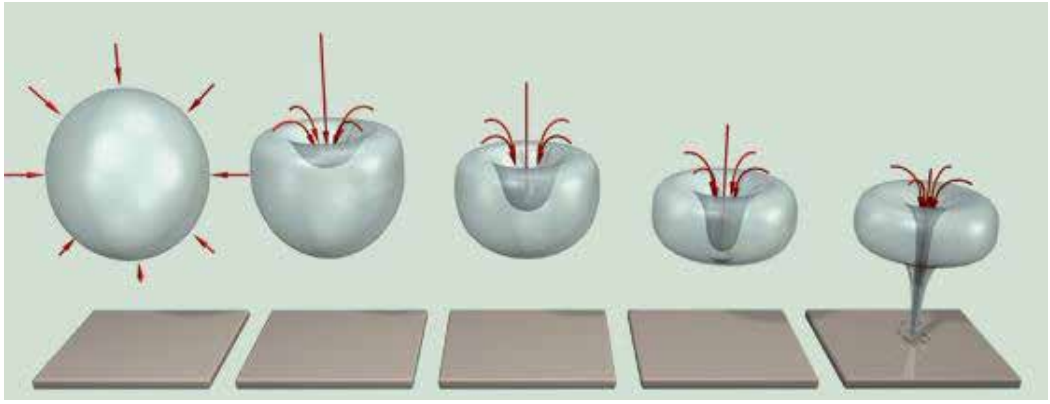
- bacteria and microorganisms are eliminated at lower temperatures than traditional systems;
- less energy consumption for the same results obtained;
- preservation of the organoleptic and nutritional qualities of the products.

It can be applied at the entrance, at the exit or on the whole process. The use in the queue also minimizes any risk of oxidative processes.
The synergistic application of thermal and cavitation processes allows the temperature associated with the mortality of yeasts to be lowered by several degrees in an aqueous solution, therefore, in addition to the obvious benefits in terms of the quality of liquid foods, energy savings are quite significant: at least 2.7% for every 1 ° C drop in the maximum process temperature.

cavitation



Water has the ability to convey many substances thanks to its particular chemical and physical properties: very high solvent power, high chemical reactivity and considerable specific heat. Moreover, its molecular capacity, two hydrogen atoms bound to an oxygen atom, allows it to behave like a crystal: not only in the solid state (ice) but also in the liquid state.
Cavitation applied to water acts mainly on this characteristic.
Through the violent implosion of the bubbles, it causes the release of nascent oxygen, allows the elimination of viruses and bacteria present; furthermore, it supports the magnetic conversion of calcite (responsible for the formation of scale) insoluble in soluble aragonite and not able to aggregate in the formation of limestone.
Finally, since the molecular structure of water is not uniform, the distance between the molecules is never the same, nor is the reciprocal attraction force; there are therefore areas or points of emptiness or pockets of gas (oxygen, nitrogen) and foreign bodies, sometimes not totally wet.



As the pressure decreases, the air pockets expand, the liquid evaporates and the steam fills them. The subsequent phase of implosion violates the oxygen, which can thus exert all its oxidative action on the surrounding organic substrate, mimicking the action of hydrogen peroxide.
Another fundamental aspect of cavitation with respect to all other water purification and filtering treatments consists in the fact that with cavitation they are the same water molecules that, after the implosion phase, assume a homogeneous crystalline configuration, which gives the water the original characteristics of the formation from the source.
Therefore, unlike the other treatments applicable to water, nothing is added or removed, such as ion exchange resins for inserting and subtracting ions or magnetic filtering to subtract iron, but on the contrary it is amplified and enhances the natural ability of water to biodegrade and break down pathogens by oxidation.
Furthermore, our equipment also includes an ozonator that further enhances the oxidation of any pollutants present.

EMPOWERING DEVICE

EMPOWERING DEVICE has been fully conceived, developed and implemented by our team and is able to simultaneously manage different types of controlled cavitation, of which 5 of a different nature but which coexist harmoniously to the point that no significant vibrations are detected.

The summation of the effects produced by each cavitation further implements the efficiency of the chemical, physical and biological processes that take place within the apparatus, resulting in a subsequent cut in the already low energy consumption as well as a sharp reduction in processing times.

A prototype with a special set-up, prepared for experimentation and of 1:1 size, has been used by us since the beginning of 2017 to conduct the required tests on the samples of materials brought by our customers.

Our machinery is equipped with test certificates and international operating certifications with different types of liquids on different chemical, physical and biological processes.

What makes our system, today, unique compared to what the market offers in the field of controlled cavitation is the fact that although it is already extremely difficult to control a cavitation, in our system there are controlled cavitation's numerous and of different kinds, at least one of which is sonic.

The machine body has an element, with the functions of a static mixer, called by us "Il Cedro" (the Cedar) for the peculiar conformation of the "leaves" that make up its design.

This special monobloc mixer, in the presence of processes that involve the formation of crystalline chemical elements, has the ability to favor the formation of Crystallization Germs, with further acceleration of chemical reactions.

Another significant improvement compared to what has existed so far is represented by the evident lower pressure drops compared to machines equipped with motors of similar installed power, with a sensible and consequent energy savings during operation: the **EMPOWERING DEVICE** requires only a fraction of the electrical energy used by the other cavitators.

This is due to the fact that the machine body of the **EMPOWERING DEVICE** is structured to form a true "diffuser", with the consequent recovery of a percentage of the outlet

pressure.
Furthermore, it has been designed to be easily and quickly reconfigured according to the use: some of its parts can be removed if very dense and / or viscous liquids have to be treated and / or with extensive granularity or they can be added, inlet or outlet, accessory elements suitable for almost any use.
Moreover, in the presence of organic matter, cavitation leads to the consequent partial physical destructuring, a lysis of the cell walls and the consequent release of the intracellular content.
This action translates into a greater availability of cellular juices, an acceleration of hydrolysis processes and, consequently, an acceleration of the anaerobic digestion process as a whole.
In our cavitator, based on experiments conducted and certified by third parties, the rate of bacterial degradation can accelerate from 4/5 times to over 10 times compared to conventional treatments.
The certifications performed by the Rina Group show that the COD of the waste water from a gasifier is reduced by 90% in just 15 minutes.
By using the supplied inverter system, at the start, consumption is less than the 25kWh of rated installed power, similarly during full use; in the absence of an inverter, at least 36kWh would be required to start.
The standard version can treat up to 60 cubic meters of fluid per hour.
Compactness, simplicity of installation and use, are undoubtedly some of the peculiarities of our cavitation apparatus but it is the total flexibility of use that makes it unique.

SAMPLE	COD mg/L
AS IS material	15.380
after cavitation material	1.508
COD reduction percentuage	90,2%

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