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MILKCAVIT

EMPOWERING DEVICE

23/10/2024 *(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

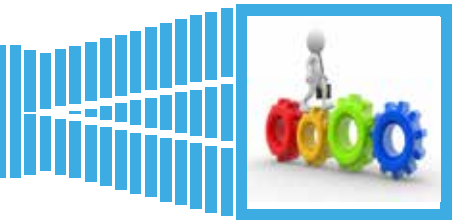
Since we don't have a second home were to go, we need to make our planet more livable without stopping technological development!
Our goal is to make our planet more livable without stopping development.
For this reason we have developed industrial systems that transform the causes of pollution into 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

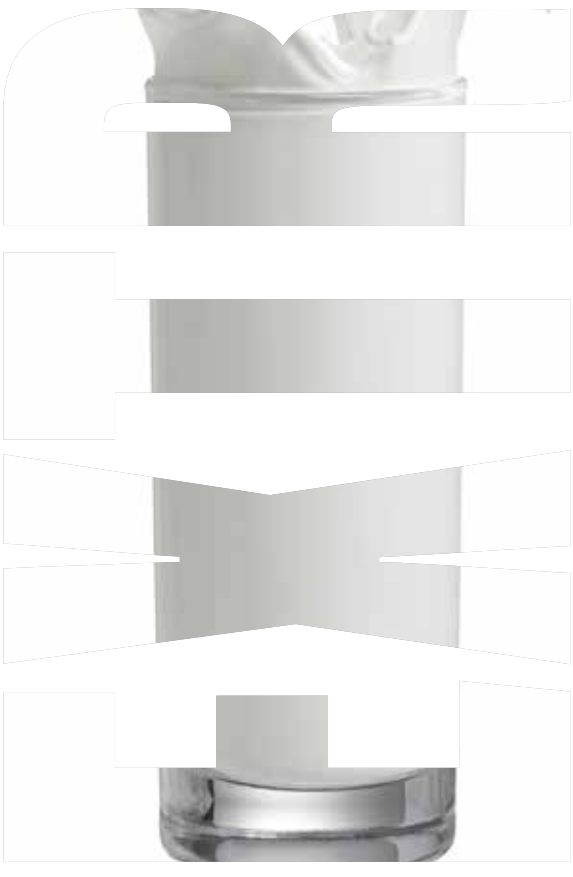
Mission:

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

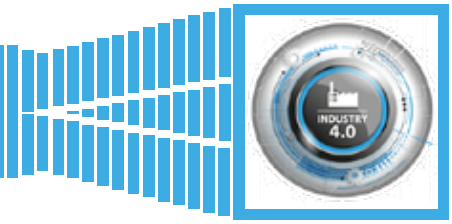
index



- **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

OUR MAIN GOAL: environment and workers' conditions respect

- **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 core team

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CMO

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CTO

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Marketing

Jérémie Saltokod

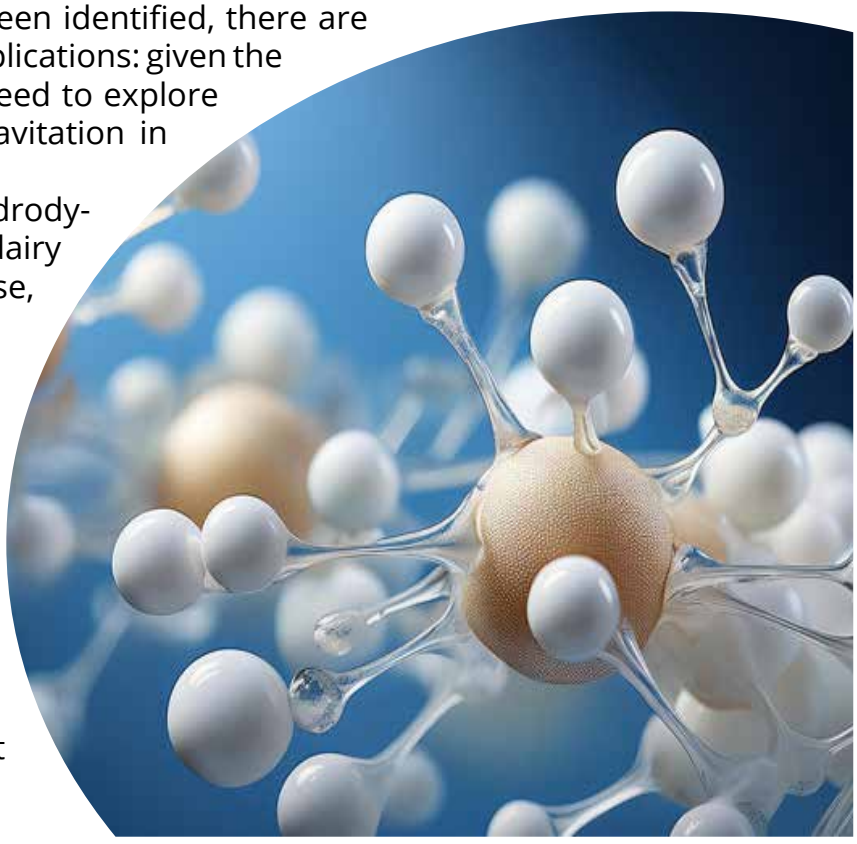
CCIMRDC Italie

why cavitation?

In the food industry, the application of hydrodynamic cavitation has gained popularity in various fields such as:

- ➔ non-invasive testing,
- ➔ homogenization,
- ➔ extraction,
- ➔ degassing,
- ➔ cutting of frozen or soft foods,
- ➔ anti-fouling,
- ➔ microbial destruction,
- ➔ etc.

Hydrodynamic cavitation has shown **great potential** in modifying the molecules that compose milk, improving the processing efficiency of milk and dairy products, food safety, microbial destruction, non-destructive analysis, cleaning of equipment surfaces and waste management.
One of the limitations of ultrasonic cavitation is that it is difficult to use in a continuous process with a high flow rate.
Hydrodynamic cavitation, on the other hand, shows an advantage in this case as it is easily applicable in a continuous process.
Although many applications have been identified, there are still many potential and untested applications: given the results obtained so far, there is a need to explore the application of hydrodynamic cavitation in the dairy industry.
Most of the research based on hydrodynamic cavitation has focused on dairy products such as milk, cream, cheese, yogurt and milk protein ingredients. However, as the technology becomes more established in this sector, hydrodynamic cavitation may also be applied to other dairy products such as anhydrous milk fat and butter.
Cavitation can currently offer many benefits to the dairy industry, but with further studies and applications it is highly believed that it can provide a significant boost to the industry.



cavitation effects

Hydrodynamic cavitation has many applications, but care must be taken to avoid any negative impact on the sensory aspects of dairy products. The application should always be tailored to the needs, thus highlighting the great flexibility in the uses of the technology.

A sensory evaluation of cavitated milk samples showed a significant increase in burnt flavour with increasing intensity and duration of treatment.

However, the addition of CO_2 helped to significantly reduce the burnt flavour.

Cavitated milk samples showed better coagulation properties and a better acid flavour.

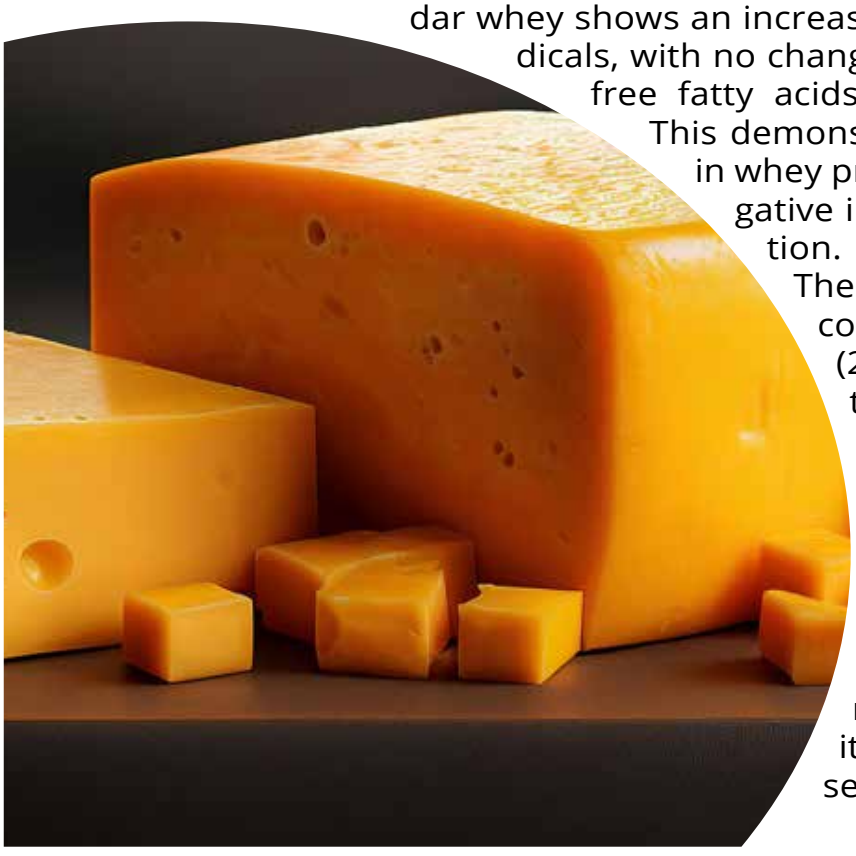
Raw milk, pasteurized by hydrodynamic cavitation, had a flavour score equal to or lower than untreated milk, but the same milk treated with cavitation had a higher score than untreated milk when tasted on the fourth day of storage.

The effect of hydrodynamic cavitation on lipid oxidation in different types of milk can be controlled by reducing the residence time and temperature.

Through hydrodynamic cavitation, the formation of volatiles such as benzene, toluene, 1,3-butadiene, 5-methyl-1,3-cyclopentadiene and a series of aliphatic 1-alkenes, which were predominantly hydrocarbons, is possible.

These compounds are believed to be of pyrolytic origin and probably generated at the localized high temperatures associated with ultrasonic cavitation.

An example of the effects of cavitation on lipid oxidation in freshly pasteurized cheddar whey shows an increased concentration of hydroxyl radicals, with no changes in phospholipid composition, free fatty acids and increased lipid oxidation. This demonstrates that the use of cavitation in whey processing applications has no negative impact on lipid profile and oxidation.



The use of hydrodynamic cavitation combined with moderate pressure (2 kg pressure, 40 °C) improved the properties of yogurt.

Hydrodynamic cavitation has a less invasive impact on sensory properties than ultrasound, since the collapse intensity of hydrodynamic cavitation is lower than that of ultrasound.

This suggests that hydrodynamic cavitation may be a more suitable method for preserving the sensory qualities of dairy products.

milk components

It is a drink with a great thirst-quenching power and is composed of 80% water but contains the right amount of mineral salts, calcium, water-soluble and hyposoluble vitamins, fats and proteins.
Calcium and vitamin D are the basis of healthy bones, teeth, muscles and other tissues. Milk also contains a part of sugars, lactose, which is present only in this food among those in nature and is useful for good intestinal balance.
The energy released by high-pressure homogenization, with hydrodynamic cavitation, has been used to modify the physical-chemical properties of various milk components.
Various changes in the composition of milk have been observed, such as an increase in the levels of free fatty acids, oxidation and a decrease in the somatic cell count and pH.
An increase in the oxidation of lipids, volatile compounds due to cavitation, has also been noted.
When combined with heat treatment (63 °C) on milk, no effects on color were reported, but there was a decrease in pH to 6.22, an increase in lactic acid content by 0.015%, a decrease in density, and a depression of freezing point.
Continuous flow high energy hydrodynamic cavitation showed no significant effects on alkaline phosphatase, lactoperoxidase, and γ-glutamyltranspeptidase.
However, when combined with heat (61, 70, and 75.5 °C), hydrodynamic cavitation demonstrated a synergistic effect in the inactivation of alkaline phosphatase, γ-glutamyltranspeptidase, and lactoperoxidase.
Hydrodynamic cavitation can be applied in combination in the downstream treatment of lactoperoxidase from whey for two-step extraction for concentration and purification of lactoperoxidase.

milk fats

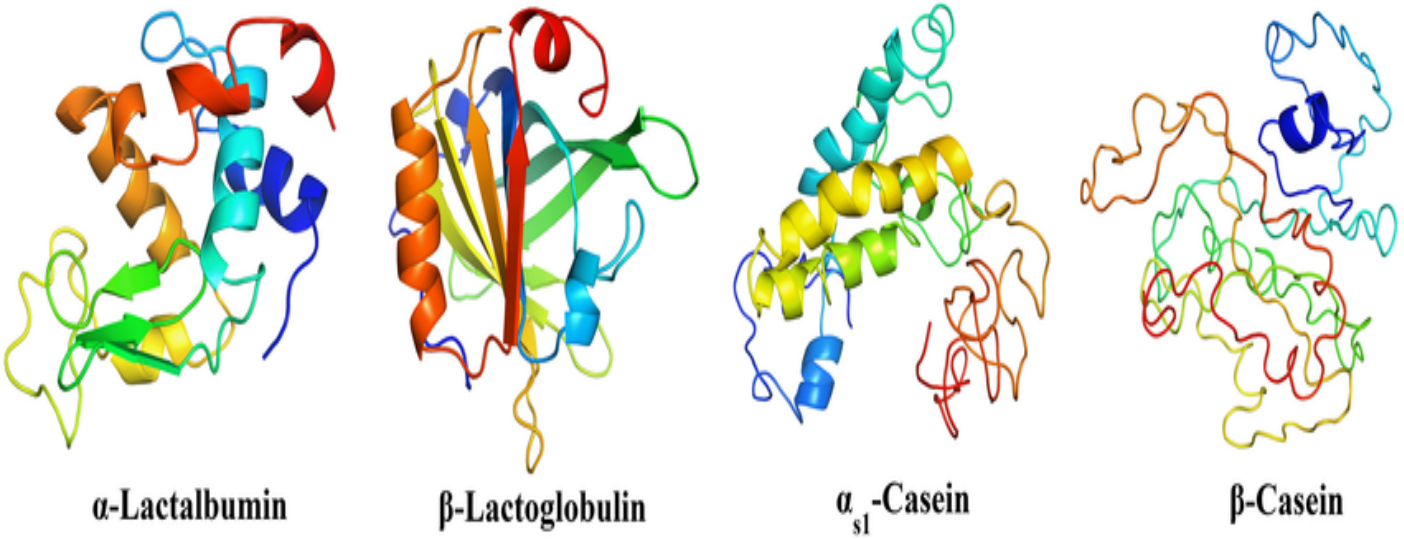
Lipids, or fats, are substances that are insoluble in water and soluble in non-polar organic solvents. They perform various functions, one of the most important being that they are an excellent source of energy (calorie intake greater than 9 kcal/g), for this reason they are very common in both the plant and animal worlds.
Fat is the most variable component of milk as it depends on the stage of lactation of the animal, its diet, its breed, and individual and non-individual characteristics; for example, in cow's milk the quantity can vary from 3 to 4.6% depending on the season. In milk, lipids are found in emulsion in the form of spherical globules with a diameter ranging from 0.1 to 10 μm, and are synthesized by the secretory cells of the mammary gland epithelium. However, milk fats do not have a homogeneous structure, but a concentric lamellar structure, due to the superposition of layers of triglycerides: the high-melting ones are arranged externally in the globule, the low-melting ones internally. This stratification arises from the fractional crystallization of the fat during cooling.
The application of hydrodynamic cavitation has shown promising results in the modification of milk fat and milk fat globules.
Cavitation treatments on skimmed milk samples reduce the size of fat globules to about 10 nm.
A substantial reduction (up to 81.5%) of fat globule size occurs for samples treated in combination with heat, which showed a better particle distribution compared to cold cavitation.
Effective homogenization of milk fat particle size down to nanometer size and uniform dispersion has been demonstrated using hydrodynamic cavitation treatment, producing a superior homogenization effect compared to conventional methods.
Improved homogenization highlights the potential of cavitation treatment to improve milk fat fractionation in the dairy system and achieve separation of larger fat globules from smaller ones.
Although significant progress has been made in homogenizing milk fat globules using hydrodynamic cavitation, these technologies are still waiting to reach their full potential for use in industrial applications.
Hydrodynamic cavitation has the potential to be used in continuous milk processing plants.

milk proteins

Milk proteins play a crucial role in dairy products as they influence various physical, chemical and sensory characteristics.
These proteins can be modified using various physical and chemical methods; however, there is an increasing demand for clean label products, leading to the need for chemical-free processes.
High-pressure homogenization (hydrodynamic cavitation) is a physical process that shows great potential in manipulating the structure and functionality of milk proteins required for various dairy products.
Fresh skimmed milk and reconstituted micellar casein samples were subjected to cavitation, with no changes observed in the size of casein micelles, free casein content and soluble calcium concentration.
There was a slight increase in soluble whey proteins and a corresponding decrease in viscosity, as well as a temporary decrease in pH.
However, cavitation led to the release of proteins from the micellar phase to the whey phase and the rupture of casein micelles in the reconstituted skimmed milk samples.
This suggests a potential application of cavitation in the development of milk with novel functionalities by altering micelle size and redistributing caseins between the micellar and serum phases.
Casein micelles can be partially disrupted by cavitation, particularly at high pH, resulting in an increase in surface area, which may be useful for improving rennet coagulation and acid gelation.
An increase in turbidity and a reduction in particle diameter can occur at any given pH value for the casein solution with increasing potency. A greater reduction in diameter of reassembled micelles is observed at higher pH, suggesting an interaction between cavitation and pH.

This may be related to the looser structure of casein micelles at higher pH, which promotes the action of ultrasound-induced shear forces upon disruption of reassembled casein micelles.

The effect of high intensity continuous flow cavitation (with and without heat generation) on whey proteins (α-lactalbumin [α-La] and β-lactoglobulin [β-Lg]) showed greater protein denaturation than heat alone when combined with heat (61, 70 and 75.5 °C). In addition, significant synergy between controlled cavitation and heat was observed for the denaturation of α-La and β-Lg.
Hydrodynamic cavitation for 15 min generated the highest β-sheet and SS content, while treatment for 30 min resulted in the lowest dityrosine, carbonyl and antioxidant activity.
The obtained data suggest that hydrodynamic cavitation has the potential to enhance the antioxidant activity of β-Lg.
Similar observations were made regarding the antioxidant activity of skim milk in a linoleate emulsion system using hemoglobin as a pro-oxidant, resulting in increased antioxidant activity of skim milk and casein fractions.
This increase in antioxidant capacity of skim milk may be related to the increase in effective casein concentration following possible ultrasound-induced disruption of the casein micelle.
Various treatments showed a progressive increase in surface hydrophobicity and reactive thiol content of pure β-Lg, while α-La protein was even more affected by cavitation with a significant increase in surface hydrophobicity.
There are many applications of cavitation for manipulating the characteristics of milk proteins. Hydrodynamic cavitation has great potential for application and can be used in continuous processes due to its pump-like design.
Different treatments showed a progressive increase in surface hydrophobicity and reactive thiol content of pure β-Lg, while α-La protein was even more affected by cavitation with a significant increase in surface hydrophobicity.
The applications of cavitation to manipulate the characteristics of milk proteins are numerous. Hydrodynamic cavitation has great application potential and can be used in continuous processes due to its pump-like design.



food safety

The energy released during cavitation has great potential to improve food safety by destroying microorganisms and pathogens, as well as detecting foreign material and making it easily removable.

The first application of cavitation in microbial inactivation was reported in the late 1920s (Harvey & Loomis, 1929); however, the overall lethal effects were limited to achieving sterilization. Rapid advances in cavitation-related technologies in recent decades have rekindled interest in its application for microbial inactivation.

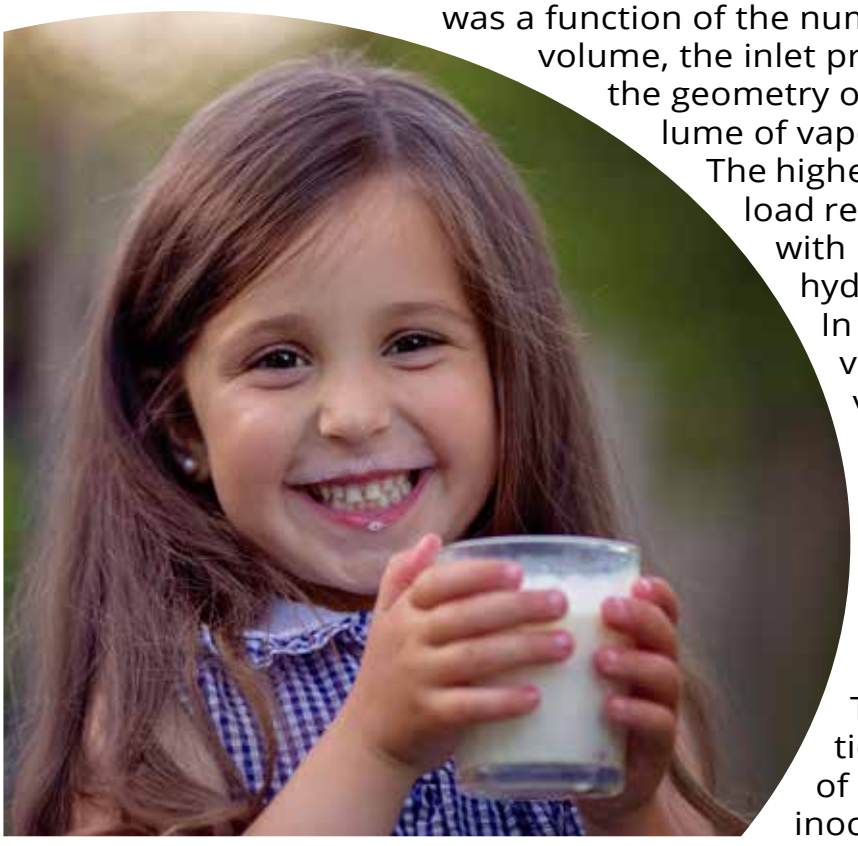
Recently, there has been a trend towards non-thermal technologies as an alternative to heat treatment for food processing, mainly due to the preservation of the sensory qualities of the product, which are typically heat-sensitive.

Riding this wave, hydrodynamic cavitation technology has an advantage in pasteurization and dairy preservation through the elimination of microorganisms and enzymatic inactivation.

For example, the combined effect of hydrodynamic cavitation/heat treatment on total viable counts and psychrotrophic bacteria in raw, pasteurized, and sterilized milk resulted in a 1-2.1 log cfu mL-1 reduction in total viable counts and psychrotrophic bacteria for all three types of milk samples up to 6 days of storage.

This demonstrates that hydrodynamic cavitation with closed-loop reactors can be used effectively for homogenization and microbial inactivation in untreated milk.

In the case of hydrodynamic cavitation, the percentage of microbial reduction was a function of the number of cavitation events per unit volume, the inlet pressure to the cavitation element, the geometry of the cavitation plate, and the volume of vapor generated.



The highest volume of vapor and microbial load reduction (up to 88%) was achieved with a monocentric rectangular bore hydrodynamic cavitation plate.

In the case of ultrasound, an inactivation efficiency of 95% was achieved; however, it required the addition of CO_2, a higher applied power and a treatment time of 10 minutes.

Hydrodynamic cavitation combined with a suitable gas would therefore be even more effective for commercial application.

The use of hydrodynamic cavitation resulted in 100% elimination of Escherichia coli in milk samples inoculated with 1 × 104 and 1 × 106

cfu mL-1 of E. coli, 99% and 99.14% elimination of Listeria monocytogenes in milk samples inoculated with 1 × 104 and 1 × 106 cfu mL-1 of L. monocytogenes, respectively, while in the case of milk samples inoculated with 1 × 104 and 1 × 106 cfu mL-1 of Pseudomonas fluorescens, shorter residence times were required to achieve 100% elimination.

Hydrodynamic cavitation in combination with heat treatment (63 °C) resulted in the inactivation of Listeria cells in nonfat milk; however, the rate of inactivation decreased with increasing fat content

After treatment with hydrodynamic cavitation, a reduction of E. coli and Saccharomyces cerevisiae > 99% (in both saline and UHT milk suspension), a 72% reduction of Lactobacillus acidophilus in saline, and an 84% reduction of L. acidophilus in UHT milk were observed compared to the initial inoculation level of 1 × 10^4 cfu mL−1.

Scanning electron microscopy suggested that cavitation causes extensive external and internal damage to all three microbes tested, with lipopolysaccharide vesicles forming on the E. coli cell wall, leading to fragmentation following emulsion formation. When treated at rotor speeds of 3,000 and 3,600 rpm (hydrodynamic cavitation), skim milk showed a reduction of 0.69 and 2.84 log-cfu cycles (Clostridium sporogenes anaerobic putrefactive 3,679 spores).

In addition, hydrodynamic cavitation was found to be effective in reducing the biofilm-forming ability of various spores (Geobacillus stearothermophilus, Bacillus licheniformis and Bacillus sporothermodurans) on stainless steel surfaces.

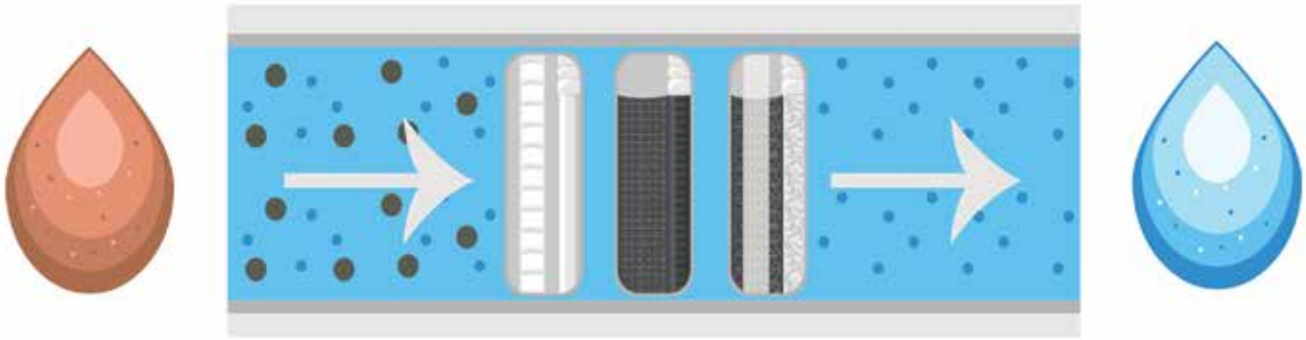
This low-speed technology can be used for the decontamination of milk from heavy metals without compromising its physical, chemical and microbiological properties.

Hydrodynamic cavitation has been shown to be highly effective in reducing microbial load.

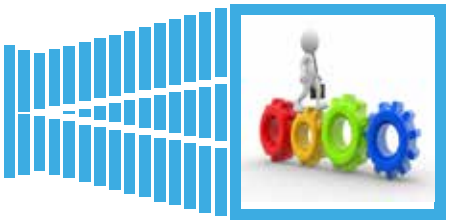
Its application in combination with traditional industrial methods such as heating, or alone, will be a more efficient and cost-effective system for improving food quality and safety.

sanitization

The cleaning and disinfection process in a traditional system consists of a complex series of operations and steps that typically involve long times, large volumes of water, and large amounts of energy.
Hydrodynamic cavitation has found its way into a wide range of applications, including the reduction of heat-induced contamination of milk.
The motion induced by cavitation ultrasound prevents molecules from remaining on the surface long enough to deposit as a film around the heating surface.
Pre-treatment of whey protein concentrate (WPC) with cavitation ultrasound prior to ultrafiltration increases membrane life by reducing pore clogging, thereby retarding fouling growth.
A higher solids content in the fluid further improves the reduction of pore clogging and fouling growth.
The concentration of permeated proteins remained unchanged under all test conditions.
Numerous studies and specific pilot plants have demonstrated the potential application of ultrasound in the WPC process also especially for reducing energy consumption in ultrafiltration, since cavitation reduces the viscosity of the feed solution.
The cavitation effect leads to a decrease in the number of cleaning cycles required for complete membrane cleaning.
This application has also proven to be effective in the pretreatment of desalination solutions in reverse osmosis processes.
Due to its strength, hydrodynamic cavitation can be used for the cleaning of membranes soiled with whey and has shown better flow recovery after fouling compared to traditional cleaning systems.
Furthermore, a synergistic effect of the combination of hydrodynamic cavitation and surfactants has been observed.
The cavitation cleaning system did not cause any damage to the membrane surface even after repeated cleaning over months. Furthermore, the application of cavitation at room temperature in combination with various cleaning agents reduces cleaning times.

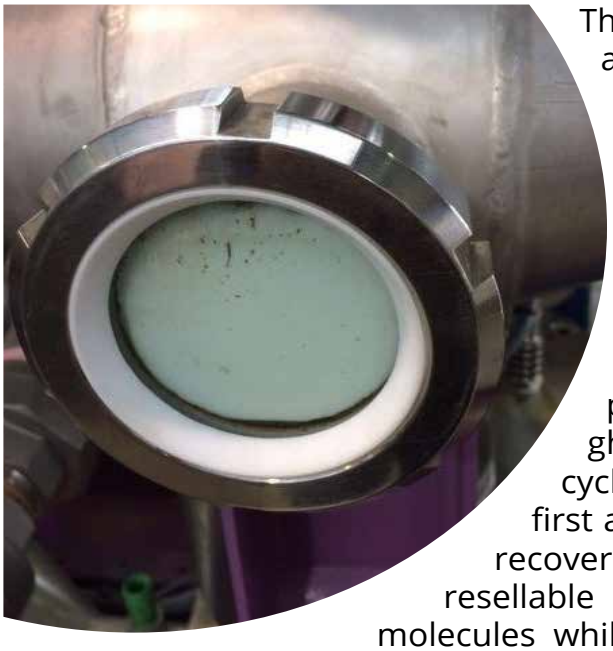


scrap recovery



The application of cavitation in waste management has been widely studied in other industries; however, in the dairy industry, the development is relatively recent, but is gaining great attention.
The use of cavitation dramatically reduces the reaction time from 24 hours to 40 minutes compared to conventional stirring, with improved efficiency in treating dairy wastewater for enzyme-catalyzed fat removal.
Samples of whey and dairy wash water were subjected to loop cycles and the results were excellent: valuable nutrients were extracted that can be used for pharmaceutical or dietary supplements.
In addition, the treatment significantly reduced the organic and biochemical load in the treated liquids, while also improving their conductivity.
In fact, when cavitation bubbles implode on the surface of solids (such as particles, plant cells, tissues, etc.), microjets and interparticle collisions generate effects such as surface peeling, erosion, particle disintegration, perforation of cell walls and cell membranes.
Furthermore, the implosion of cavitation bubbles in liquid media creates macro-turbulence and micro-mixing.
Modulating the intensity of this phenomenon allows for pasteurizing a fluid or treating waste liquids, thus releasing bioactive molecules that are easily separable.
With hydrodynamic cavitation, it is possible to recover unexpected and large quantities of nutrients present in waste water intended for treatment.
After the **first** cycle, 80% of proteins and 85% of animal oils and fats could be extracted.
A **second** cavitation cycle on the fat-free liquid will allow a significant reduction in COD and BOD in order to bring it within the permitted limits.
In addition, an interesting increase in fluid conductivity is achieved.
The effect of cavitation treatment on hydrogen production from whey was evaluated, showing that within a few minutes of treatment, more hydrogen can be produced than heating and sonication treatments.
When combined with alkaline conditions, cavitation treatment was found to be more effective in increasing soluble nutrients, completely removing methanogens, increasing hydrogen gas purity (48%), and improving lactose yield.
In addition, cavitation pretreatment in combination with alkaline conditions can effectively treat organic-rich wastewater and cheese whey to reduce fouling problems and improve hydrogen production.
In conclusion, the application of cavitation technology in the dairy industry shows great promise for improving waste management practices and increasing production efficiency.
This innovative approach offers a more sustainable and effective solution for treating dairy wastewater and maximizing resource recovery.

practical example



The whey, the whey permeate and the washing water are in turn sucked up by a pump after passing through a membrane filter that has the purpose of retaining the coarsest impurities.

The cavitation treatment inside the **EMPOWERING DEVICE** will take place through 2 distinct cycles: the first aimed at recovering the resellable food molecules while the second will purify the water transforming it from special waste to normal water for agricultural use.

Once subjected to cavitation at low speed, so as not to ruin the precious protein molecules and animal fats contained, the water flows into a tank equipped with an overflow where an automatic system will push the **centrifuged cream** into a refrigerated container, while the water will be reintroduced into the loop.

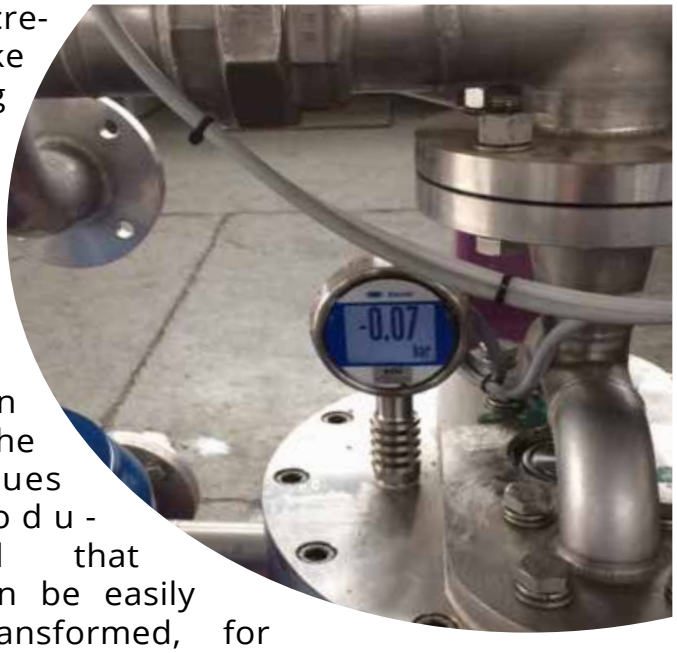
This allows for **the recovery of the unexpected but large quantities of nutrients still present**.

Once this first cycle is completed, the same water will be subjected to more intense cavitation to break down the pollutants.

Based on the customer's needs, the water can be brought to different levels of purity:

- ➔ suitable for being thrown into the sewer;
- ➔ suitable for reuse as washing water;
- ➔ suitable for being used for watering;
- ➔ made drinkable.

The **centrifuged cream** obtained is a whey cream, which, as is, can be sold, used to make butter or added to the skimming cream, lending itself to becoming an interesting source of additional income thanks to the extraction of the residues produced that can be easily transformed, for example, into pharmaceutical and/or food supplements.In particular, after the **first cycle**, 35% of the proteins and 80% of the animal oils and fats are extracted from the whey samples, while 80% of the proteins and 85% of the animal oils and fats are extracted from the washing water of the dairies.



Oils and fats are arranged on the surface and can therefore be removed with simple spatula systems.

Once the fats have been removed, during the **second cycle** on waters now free of fat and protein molecules, the **COD** and **BOD** will be reduced.

From experiments conducted, after the treatment, the whey sees both values reduced by 36% while the washing waters of the dairies see both values reduced by 11%.

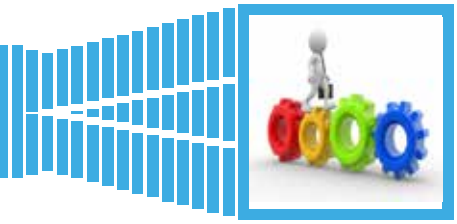
Finally, from the laboratory analyses an unexpected action emerges: in the liquids subjected to the two cycles, dissolved salts are also involved producing an **interesting increase in the conductivity of the fluids**.

pasteurization

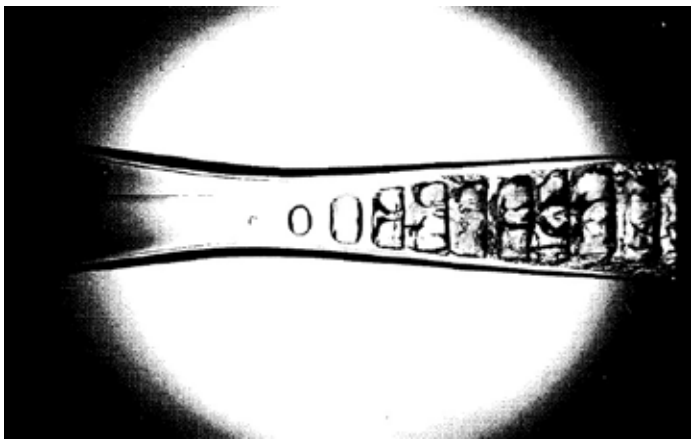
The persistence of microbiological activity in food liquids is one of the critical aspects of the production processes, given the considerable risk of development not only of metabolites with negative impact on the organoleptic and qualitative properties, but above all for the potential release of compounds 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.

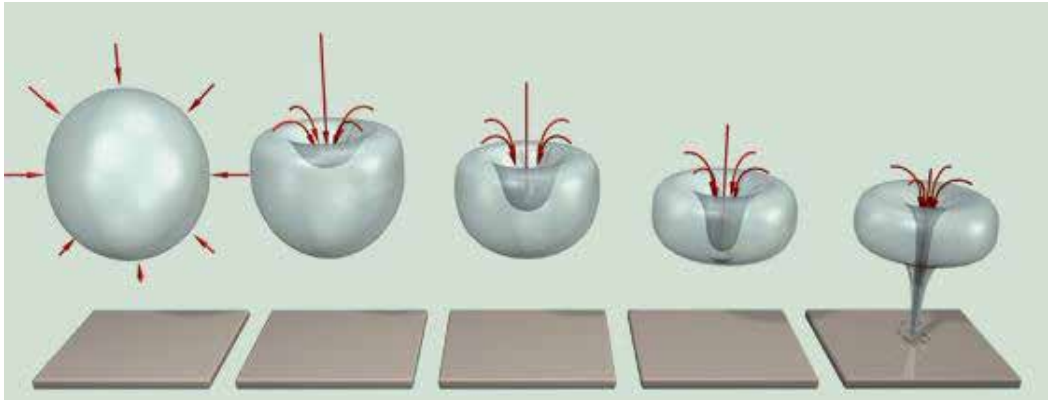
It can be applied at the entrance, at the exit or on the whole process. The use in the queue also minimizes any risk of oxidative processes.
The synergistic application of thermal and cavitation processes allows the temperature associated with the mortality of yeasts to be lowered by several degrees 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%

Chemical Empowering

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