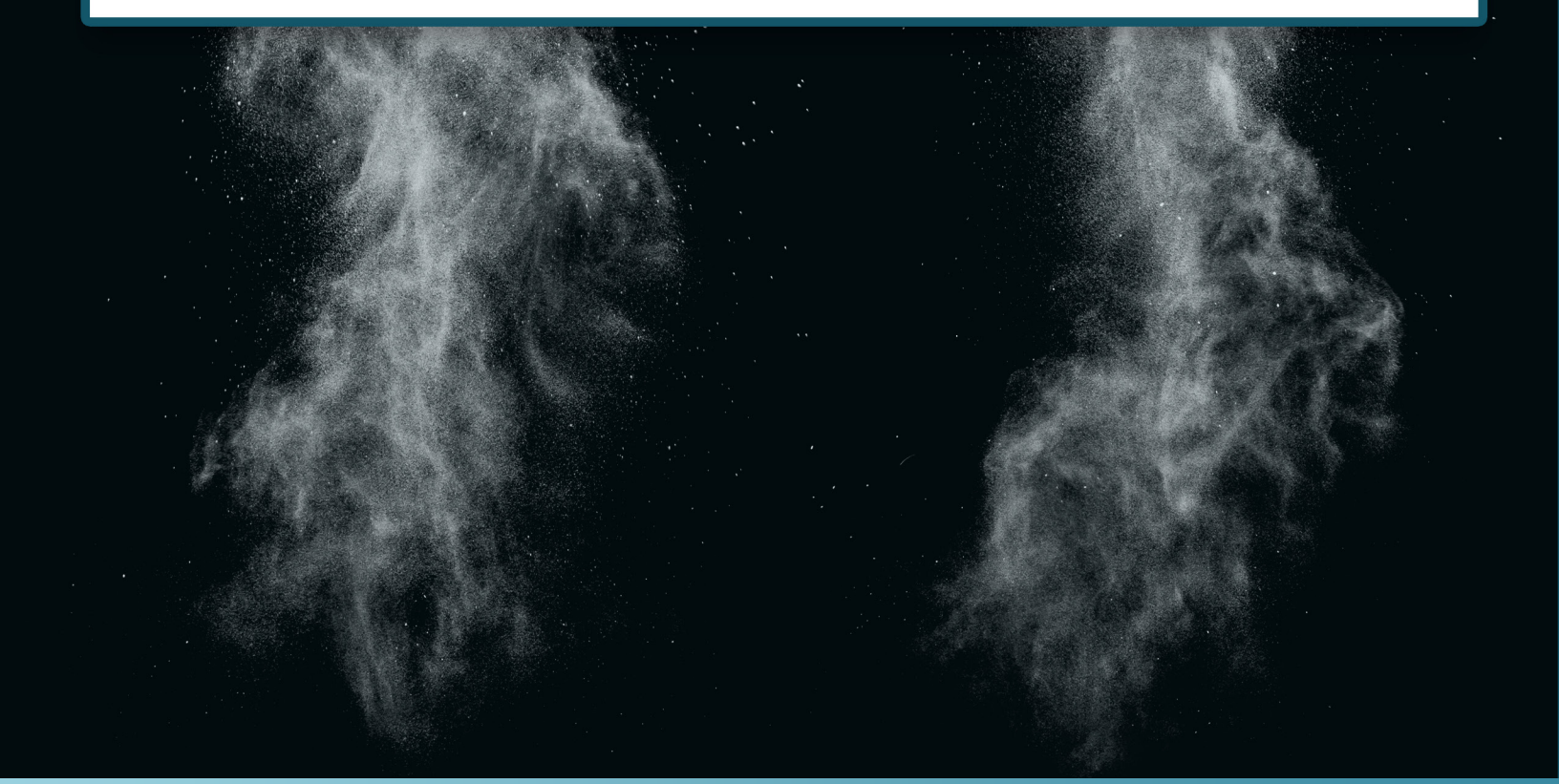
BEE INTERNATIONAL
NEXT GENERATION HOMOGENIZERS

Filtración y Análisis

PBX: (4) 2507554
Medellín (Colombia)
www.filtracionyanalisis.com

HOW TO ACHIEVE EFFICIENT & CONSISTENT PARTICLE SIZE REDUCTION



4 Key Benefits of Particle Size Reduction

Particle size reduction is the mechanical process of grinding (also referred to as milling, granulating, comminuting, etc.) particles in a material, in order to reduce their average size.

In general, particle size reduction enables 4 key benefits for manufacturers in several industries, including pharmaceutical, biotechnology, chemical, mining, cosmetic, food and others.

1. Improved Performance & Efficiency

Particle size reduction enables manufacturers to obtain the smallest particle size possible, which improves drug bioavailability, supports targeted drug delivery, enables more efficient downstream processing and more.

In the pharmaceutical industry, researchers have to isolate particles of a specific size because they have to overcome obstacles in drug molecules (insufficient bioavailability, poor water solubility, fluctuating plasma levels, and high food dependency). They also have to ensure that the drug particles they are creating can pass through targeted membranes without affecting other parts of the body.

Further, for chemical products, particle size reduction benefits include improved effectiveness of high-performance materials, maximizes particle packing, increases conductivity and more!

2. Tighter Distribution of Particles

Since particle size is critical to drug efficacy, it makes sense that a tight distribution of particles is beneficial. Particles outside the required particle size range are filtered and removed from the final product, which means waste.

This tight distribution of particles also improves product stability, extends shelf life, optimizes desirable characteristics (such as gloss, reactivity), establishes standardized and uniform product features (such as temperature, quality, viscosity etc.), etc.

For ceramics, electronics and fuel cells, controlling the distribution of materials such as alumina (aluminum oxide), iron oxide, PZT (lead zirconium titanate), engineered solar glass and bio glass powders can be more difficult for manufacturers.

To achieve successful particle size reduction and distribution, it is necessary to generate forces directly to the individual particle. This can be done in a variety of ways. However as these high tech industries require a trend toward smaller particle sizes, current methods of processing become more expensive and less efficient. Many technologies tend to waste significant energy that is absorbed by the grinding media; or lose the precision to effect the individual particle when processing down to and below 1 micron.

3. Improved Manufacturing Efficiency

When optimal particle size reduction helps manufacturers obtain the smallest and tightest particles in as few passes as possible, it makes the manufacturing process more cost effective and efficient. Efficiency is also essential for scaling up from laboratory scale, to pilot scale, and then to industrial scale.

This scalability is especially critical in pharmaceuticals where researchers have to take their product for research & development to pilot testing and then to market. Ensuring that they have an efficient, reproducible method of creating their product can save time & money!

4. Reliable Consistency

Particle size reduction ensures that products consistently meet consumer expectations for characteristics such as transparency, viscosity, gloss, hue and texture. It also impacts parameters such as taste and flavoring (e.g. coffee grounds, drink crystals, etc).

For food and beverages, consistency means desirability and keeping customers happy! Once manufacturers fine-tune a method of particle size reduction that creates the ideal product, they need to reproduce it again and again. Consumers will expect the product to be the same in taste and looks and manufacturers have to deliver or else will suffer financially.

Consequences of Inefficient Particle Size Reduction

We have already highlighted the key benefits of efficient particle size reduction, as well as some common applications used in different industries. However, manufacturers can only exploit these benefits if they achieve efficient particle size reduction. Unfortunately, this is not always the case.

Here are the 3 major consequences of inefficient particle size reduction:

1. Excessive Cost

Inefficient particle size reduction forces manufacturers to invest more time and resources in the manufacturing process, since they must conduct additional passes. This leads to cost overruns and missed deadlines that can quickly become excessive and unsustainable.

2. Diminished Shelf Life

Inefficient particle size reduction leads to relatively unstable end products that, in turn, have a shorter shelf life. This leads to excess costs as products must removed and replaced. It also leads to added risks, since buyers and end users may shift to a competitor's products that may be inferior with respect to quality or other characteristics, yet have a longer shelf life and are therefore more versatile, practical and cost-effective.

3. Weaker Sensorial and Biophysical Properties

Inefficient particle size reduction leads to weaker sensorial and biophysical properties – both of which negatively impact end product distribution.

Why Conventional Equipment is NOT the Solution

Clearly, manufacturers need to achieve efficient particle size reduction in order to carry out their important work in a consistent, cost-effective, reliable, efficient and scaleable manner.

However, it is just as clear that conventional particle size reduction equipment is NOT the solution. This is because conventional equipment utilizes only one mechanical force, as illustrated in the following table:

Type of Conventional Equipment	Mechanical Force Used for Particle Size Reduction
Stirrers	Shear
Agitators	Shear
Sonic Mixers	Cavitation
High Shear Mixers	Shear
Bead Mills	Impact

Using just one mechanical force is HIGHLY inefficient when manufacturers are working with various cells and biological materials, since to achieve optimal results, each material may (and often does) require a different process. For example, some materials need harsher force, while others need gentler force.

This "one-process-fits-all" approach that is built into conventional equipment is simply not flexible or versatile enough. And yet for years, this has been the only option for manufacturers who found it cost prohibitive, impractical, or unjustifiable to purchase multiple types of equipment, and ensure that their people were trained to use them properly and safely.

Fortunately however, recent technological advancements have led to breakthroughs in particle size reduction equipment -- and BEE International's high pressure homogenizers are leading the way!

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The BEE International Advantage

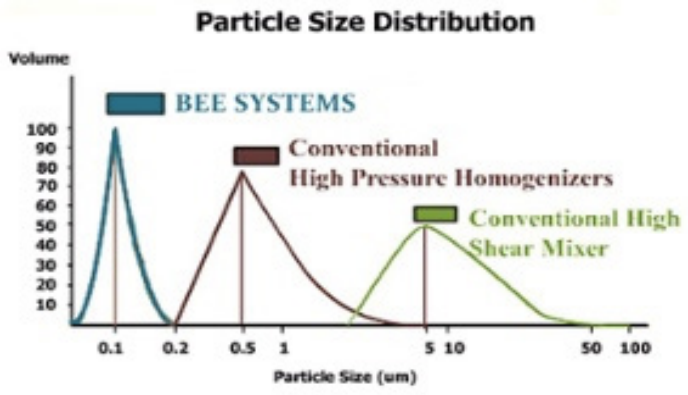
At BEE International, our high pressure homogenizers are designed with proprietary particle size reduction technology that is modular—which means that manufacturers can utilize and fine-tune ALL mechanical forces to achieve the best results for a given product, including cavitation, high shear and impact. For example, with our high pressure homogenizers:

- Cavitation can be intensified or reduced
- Shear process time can be shortened or lengthened
- Impact can be maximized via reverse flow setup.

Furthermore, the process intensity is easily adjustable from 2,000 - 45,000 psi/150 - 3,100 bar, and manufacturers can reduce particles down to the nanometer. In fact our homogenizers are the only ones currently on the market that can reach 45,000 psi (most only reach 30,000 psi).

The bottom-line for manufacturers who take advantage of our high pressure homogenizers is that they can consistently and cost-effectively achieve efficient particle size reduction, which is characterized by:

- Maximum particle size reduction in fewer passes
- Tighter distribution of smaller particles
- Increased manufacturing efficiency and reduced cost
- Longer product shelf life and extended efficacy
- Improved sensorial properties (e.g. rapid penetration and merging textures)
- Improved biophysical properties (e.g. hydrating power)



And just as importantly, instead of "going back to the drawing board" to manage the transition between phases as they move from one type of equipment to another, manufacturers who use our high pressure homogenizers can go from laboratory scale, to pilot scale, and then to industrial scale – and all without having to change their process.

Simply put, our high pressure homogenizers deliver an optimized in-line process that reduces costs by achieving better results in less time. Indeed, as both emerging and established manufacturers around the world will confirm, on today's competitive business landscape achieving efficient and consistent particle size reduction isn't just important: it's essential!

Learn More about the BEE

BEE International is a worldwide supplier of high pressure homogenizers for the pharmaceutical, biotech, chemical, cosmetic and food industries. In the laboratory, our systems process fluids producing uniform particle size reduction to nanoparticles, and high yield cell disruption.

All our systems produce the same results. Scaling up to pilot and clinical trial settings, our high pressure homogenizers consistently produce the same results and have a reputation for reliability. These qualities continue into manufacturing, where the in-line process reduces costs by achieving better results in less time.

Contact us to learn more about our high pressure homogenization products and technology!

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ABOUT BEE INTERNATIONAL

BEE International was established in Israel in 1994 for the sole purpose of developing and bringing to the market innovative homogenizing technology and equipment.

The company began in cooperation with Technion University Israel Institute of Technology which is among the top science and technology research universities in the world.

In 1998 BEE International opened a US operation. Today, BEE International has representation and equipment installations worldwide.

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