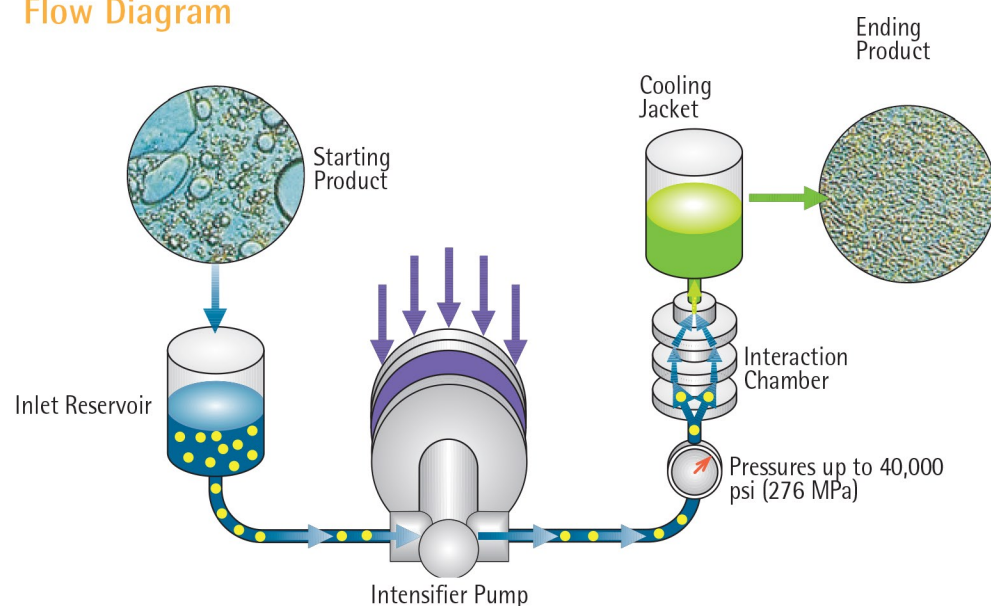


How Microfluidizer Processors Work

Microfluidizer processor technology revolutionizes fluids processing with its fixed-geometry (no moving parts) interaction chamber. Within the interaction chamber, highly-pressurized liquid product streams travel at high velocities through precisely defined microchannels producing high-shear forces which are orders of magnitude higher than other particle size reduction methods. Unlike alternate processing technologies, Microfluidizer processors technology expose virtually 100% of your product to consistent processing conditions leading to uniform and repeatable results. The Microfluidizer processor's efficiency enables you to achieve more aggressive product quality goals with less energy than ever before.

Flow Diagram



Learn More

Microfluidics offers more than just machines. Need help with process and formulation optimization? **Proof of Concept Testing** provides a detailed analysis and results reporting compiled by our dedicated engineers and achieved through various process parameters based on your goals. **Process Development** is comprehensive consulting by experienced nanotechnology application experts to enhance and achieve your product goals. To learn more, visit our website at www.microfluidicscorp.com.

Manufactured by Microfluidics, distributed in the UK and Ireland by **analytik**.

Scaleup
Guaranteed



from laboratory

(as small as 1 ml)



through pilot

(100–400 ml/min)



to production

(up to 57 lpm)

Nanomaterials for Cosmetics

Quality, Stability and Delivery

The High Shear Microfluidizer® Processor Difference

Cosmetic/Cosmeceutical companies have demanding particle size distribution requirements for the formulation and manufacture of their innovative products; particles too large can lead to inconsistent quality or unpleasant feel while unstable emulsions or suspensions have a short shelf life. By utilizing Microfluidizer processors, customers can precisely control particle size, improving the texture, color, stability and feel of their product. Additionally, these processors offer advantages in controlling customers' processes, lowering operating costs while guaranteeing the same results from laboratory through production.

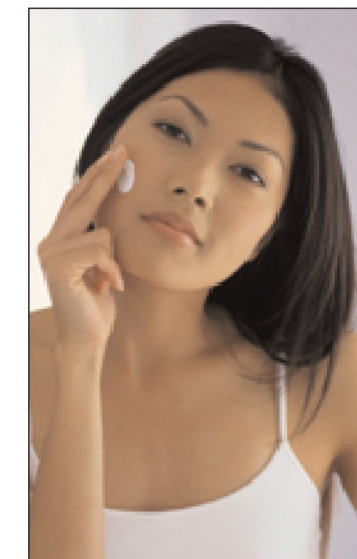
- Produce controlled particle size and tight distribution for stable results
- Highest shear force means less time and energy to achieve desired results
- Reproducible results, batch to batch, day to day
- Scaleup guaranteed

Precise Control of Particle Size

- Not just "nano" - reach the size you require
- Targeted delivery of actives
- Improved appearance and feel of product
- Color depth/range/intensity
- Nutrient/fragrance encapsulation

Return on Investment

- Prolonged shelf life
- Continuous production & fewer raw materials
- Less processing energy (passes, operation, cleaning)
- Simplified downstream processing



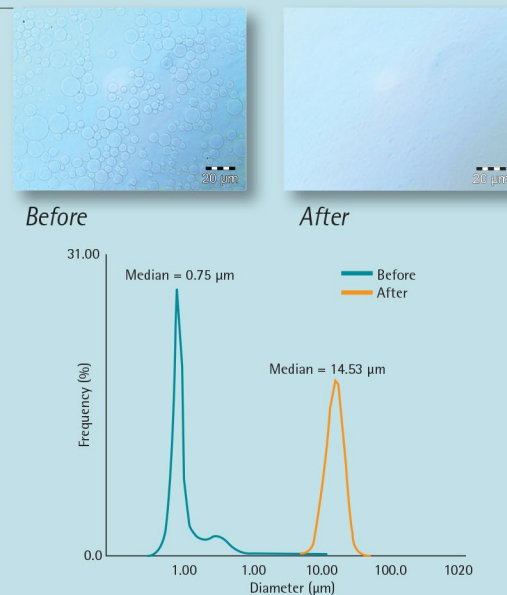
Going "Au Natural"

By utilizing Microfluidizer processors, cosmetic companies can achieve the required end result through particle size. This means fewer additives are needed to achieve the desired look, feel, texture, color, and stability of the cosmetic. And fewer chemical additives is just what the end user wants to hear and is willing to pay for.

Reduced Particle Size for Topical Nutrient Delivery in Lotions

Emulsion: Oxygen Carrier – Perfluorocarbon

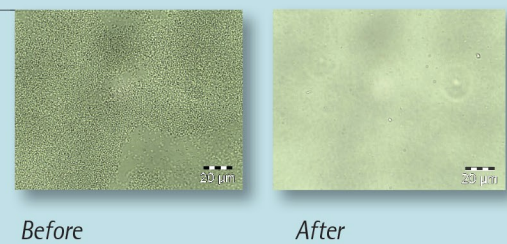
Perfluorocarbon can increase the oxygen content of skin, which in turn can aid in rapidly healing damaged tissue and minimize scarring. It further aids in skin hydration and “plumps” the skin to produce a smoother feel and reduce the appearance of fine lines. Our customer was able to encapsulate the perfluorocarbon in an oil in water emulsion and to reduce the median particle size to $<0.1 \mu\text{m}$ for topical delivery on the skin.



Innovative Applications By Lysing Plant Cell Membranes

Cell Disruption: *Micrococcus Luteus*

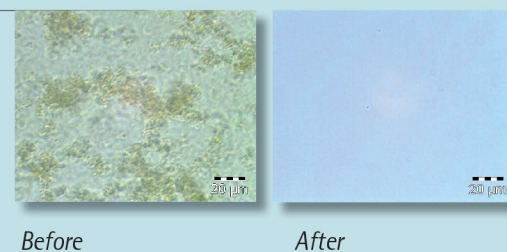
Lysing plant cell membranes allows the release of important proteins, nucleic acids, enzymes, and peptides from the confines of the cell wall, separating them from the mixture for use in various formulations. These intracellular components can be incorporated as ingredients into cosmetic formulations. Our customer was able to lyse a high a percentage of cells in a single pass though our equipment. Uniform shear, reduced energy and temperature control throughout the process minimizes denaturation and decreases production costs.



Sterile Delivery

Liposome: Coenzyme Q10

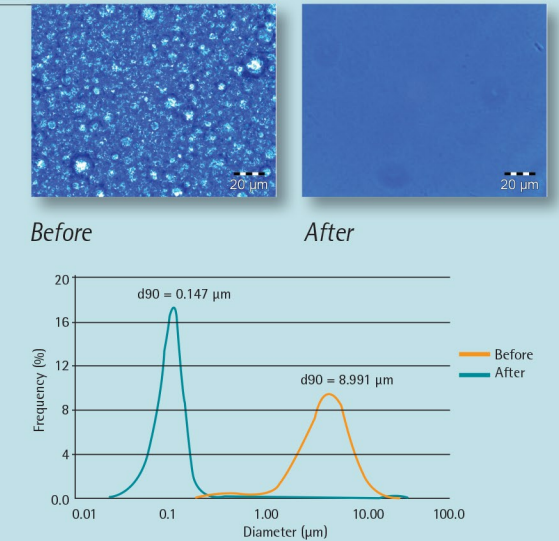
Coenzyme Q10 is a powerful anti-oxidant that helps balance free radicals in the human body and can prevent signs of aging. By encapsulating 3–7% of this anti-oxidant in a liposome for sterile delivery, it is possible to deliver benefits directly to the targeted area. Ten formulations were processed and all had a median size of $< 0.115 \mu\text{m}$, sufficiently meeting requirements for such an encapsulation process.



Targeted Delivery

Liposome: *Botulinum Toxin*

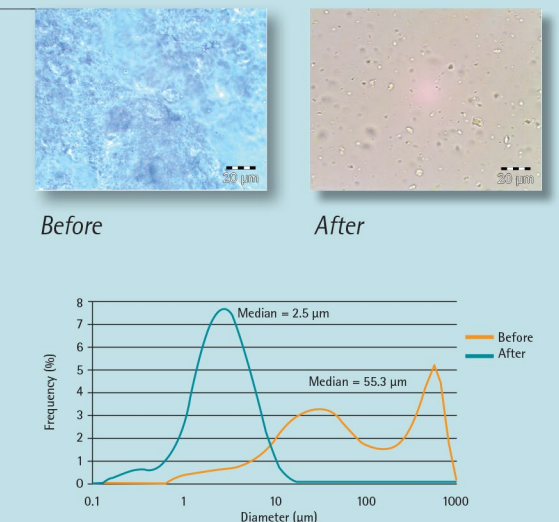
Cosmetics companies are innovative – imagine creating a transdermal delivery formulation of *Botulinum* toxin. This concept required a tiny particle size to penetrate the surface of the skin and deliver the toxin to damaged or burned skin. Different concentrations of phospholipids were utilized to create stable liposomes of multiple formulations. Particle size as small as a median size of $.0097 \mu\text{m}$ were created and successful transdermal delivery of actives was demonstrated.



Improved Texture/Appearance

Dispersion: *Avena Sativa* (Oat) Bran

Avena Sativa or oat bran is frequently a major component for skin treatments, body scrubs and facial exfoliating scrubs. Various cosmetic products require a very mild abrasiveness for exfoliation and cleaning purposes. Reducing the average particle size to less than $5 \mu\text{m}$, while maintaining the majority of the sample over $1 \mu\text{m}$, gave the desired exfoliation feel and provided a homogeneity to the sample that was lacking previously. The dispersion resulted in improved stability and a significantly longer shelf life without compromising the texture of the product.



Dispersion: Lipstick

Processing lipstick with nanomaterials can improve attributes such as consistency, color, texture and feel, while creating a more uniform dispersion. After processing in a Microfluidizer processor, formulators stated that the color was significantly brighter and fuller than the unprocessed sample.

