analytik

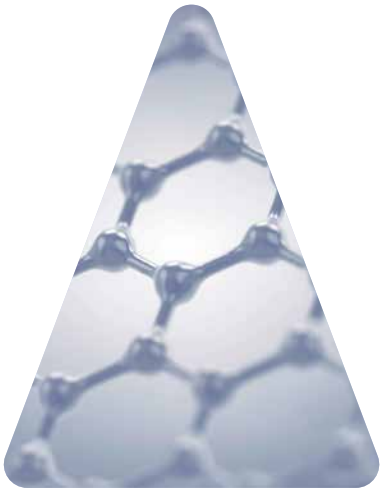
This is ultrasonic innovation

DEBREX

Surfactant-free Nano **Emulsification/Dispersion**

Active Ingredient **Extraction**

Non-biodegradable **Toxin Degradation**



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This is ultrasonic innovation

DEBREX

“ Challenging the impossible through Focused Ultrasonic Technology ”

High Performance Equipment Surpassing the Limitations of Conventional Technology

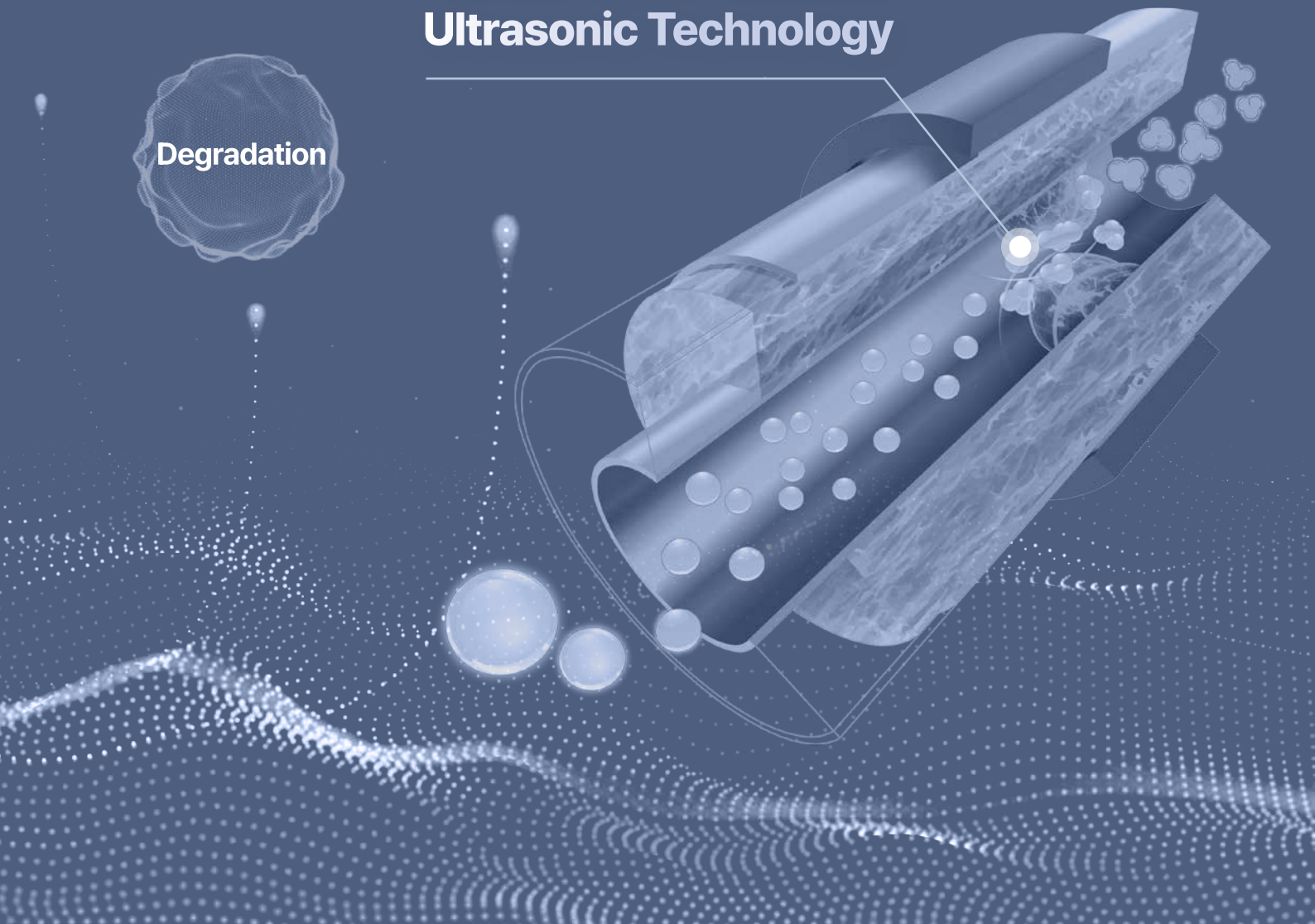
Emulsification

Extraction

Dispersion

Degradation

Circle-type Focused Ultrasonic Technology



Ultrasonic Innovation for Various Industries

Industry Specification

A single technology for **various industries**

Cosmetics
Surfactant-free, high-concentration, low-viscosity material production

Chemical
Highly uniform nano-sized dispersion / emulsification

Pharmaceutical
Highly uniform, highly stable nano liposome, drug delivery system, LNPs development

Degradation
Non-biodegradable, residual toxin degradation

Paints&Coatings
Surfactant-free / low-surfactant emulsification & uniform dispersion

Health&Functional Foods
Surfactant-free and synthetical additive-free

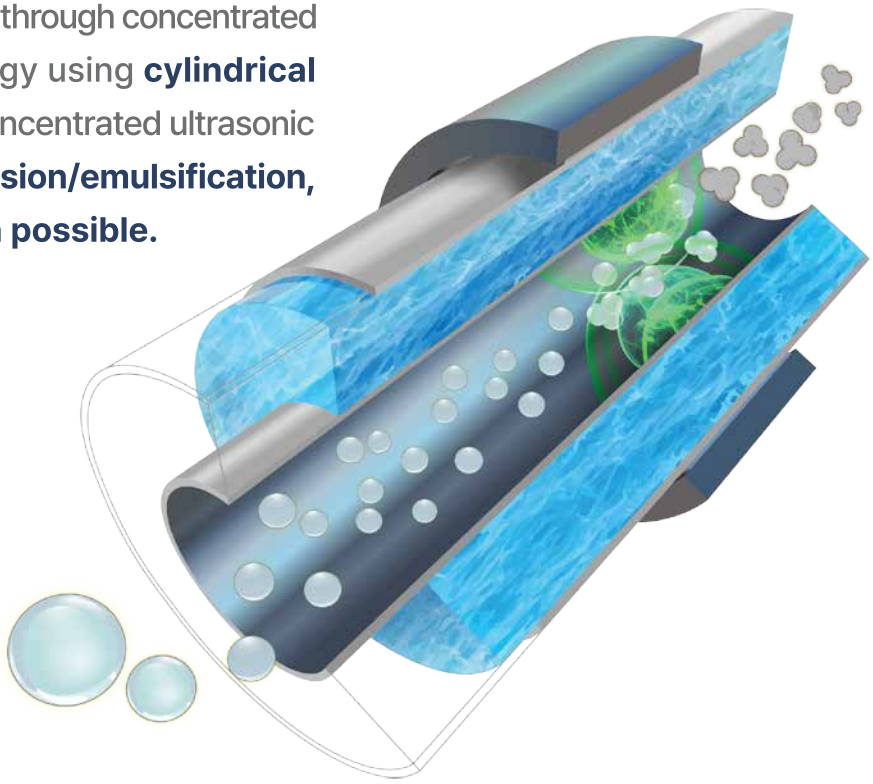
Active Ingredient Extraction
Large extraction of variety of natural active ingredients

Secondary Cell Battery
Nano dispersion technology for carbon derivatives, conductive additive, and nano-bubble

This is ultrasonic innovation

Circle-type Focused Ultrasonic Technology

A strong energy field is formed through concentrated and focused ultrasonic energy using **cylindrical piezoelectric ceramic.** The concentrated ultrasonic energy allows uniform **dispersion/emulsification, extraction, and degradation possible.**



- **Ultrasonic energy concentration using cylindrical-shaped piezoelectric ceramic**
- Ultrasonic **control&tracking** function ····> **process reproducibility**
- Real-time cooling & temperature control function ····> **30 consecutive days of operation**
- Medium frequency (**200k Hz ~ 1M Hz**) ····> **Large application area**

Advantages based on different features

DEBREX Industrial Advantages

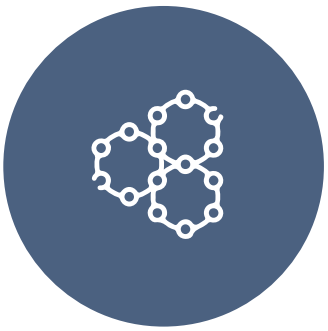
Emulsification/Dispersion

- Surfactant-free emulsification/ dispersion
- Uniformity 80% or higher, Nano-scale 100nm or below
- Low viscosity & High-concentration material production

Extraction

- Greater amount of active ingredient extraction compared to conventional extraction technology

Degradation



- Non-biodegradable, toxic material degradation
- No filter and no additives (ozone, hydrogen peroxide)
- Degradation with ultrasonic energy only

DEBREX Features

1.

Continuous Manufacturing

- In-line process that is free from preprocessing

2.

Cooling System

- Material thermal damage protection
- Equipment thermal management &30 consecutive days of operation

3.

Sample Contamination Prevention

- Separate injection tube for sample contamination prevention

4.

Ultrasonic frequency & power control

- Ultrasonic frequency & power control for larger application

5.

Easy Control

- One display with all control functions

6.

Real-time operation status check

- Real-time operation status check function to secure reproducibility

Driving innovation in industries

Industry Specific Application

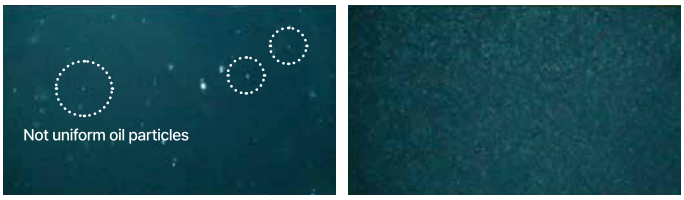
Pharmaceutical Industry

• Surfactant-free eye-drop

Testing condition

- Oil: tocopheryl acetate
- Solvent: distilled water
- **No surfactant**

Tocopherol dispersion test result
-Microscopic image of tocopherol dispersion-



Eyedrop with surfactant for sale

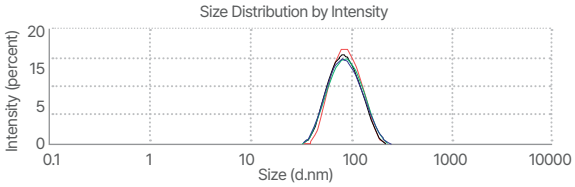
Conventional eyedrop's tocopherol content: 0.05%
+ Surfactant must be added

Surfactant-free eyedrop produced using DEBREX

DEBREX
- High concentration tocopherol (0.5~1%) content without surfactant

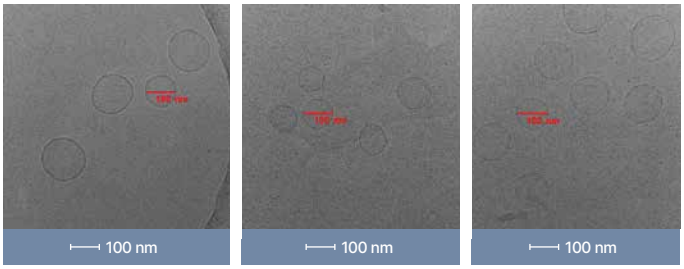
• Nano Liposome production

Stability Test Result: 3 months of room-temperature stability secured without reaggregation



	Z-Average(d.nm)	PDI
Stay 3 days	81.76	0.102
Stay 30 days	81.83	0.114
Stay 60 days	80.61	0.129
Stay 90 days	80.14	0.129

Uniform 80nm sized liposome production

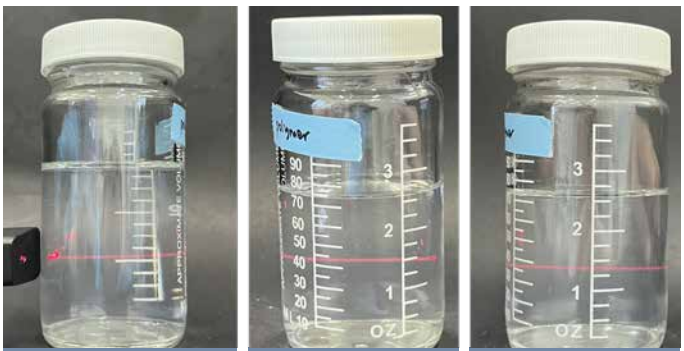


Cryo-TEM image analysis of Nanoliposome produced by DEBREX

• Polyethylene glycol (PEG) lipid production

- LNP capsule development
- LNP capsules ensure the stability of lipid nanoparticles in the body
- Uniform size and stability after manufacturing are crucial

Storing Period	Particle Size	Distribution
Post-Manufacture	82.4 nm	0.32
Post 15 days	89.2 nm	0.25
Post 30 days	76.1 nm	0.29



Immediate after production | 15 days after | 30 days after

Cosmetics /Health &Functional Foods

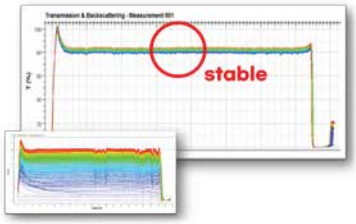
Surfactant-free Facemask Production

- Oil concentration: **10~30%** (thickener agent 0.1%)
- Emulsion stability: more than **18 months**
- Emulsion moisture content: constant

Harsh Condition Stability Test

- **Method** : 10 harsh cycling condition
- **Result** : no phase separation

General conditions



Room temperature

Harsh conditions

-15 > 23> 45 23°C

Health & Functional Food in Gummy Form

- **Omega-3 concentration of 42% can be produced in gummy form**

No Omega-3 | Omega-3 10% | Omega-3 42%

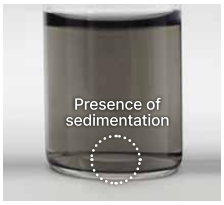
Driving innovation in industries

Industry Specific Application

Batteries & Microelectronics

• SWCNT for Secondary Battery

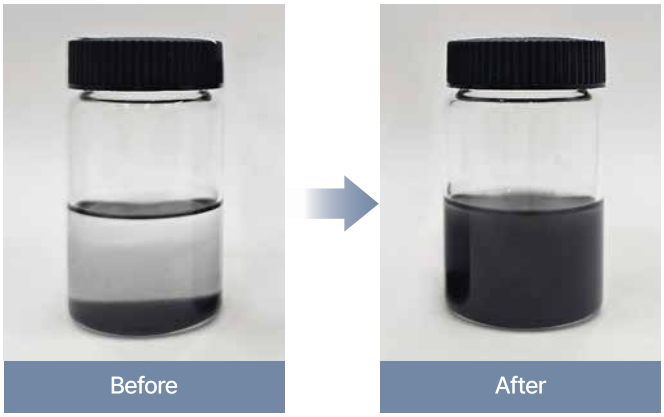
- **SWCNT** dispersion test using different dispersion technology
- Test condition : **SWCNT(1%) / WATER(97%) / THICKNER(2%)**

	SWCNT Dispersion	1 month stability assessment: evaluation of sedimentation in diluted solution
DEBREX		
Horn-type Ultrasonic Method		
High-Pressure Method		

• Semiconductor material

- Stable Nickel dispersion for replacement of MLCC's high-cost silver

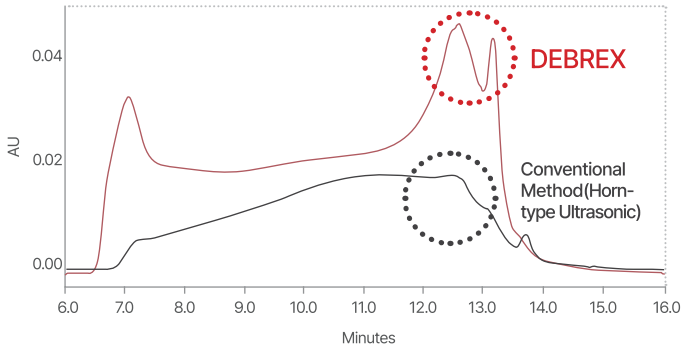
Nickel Powder Dispersion



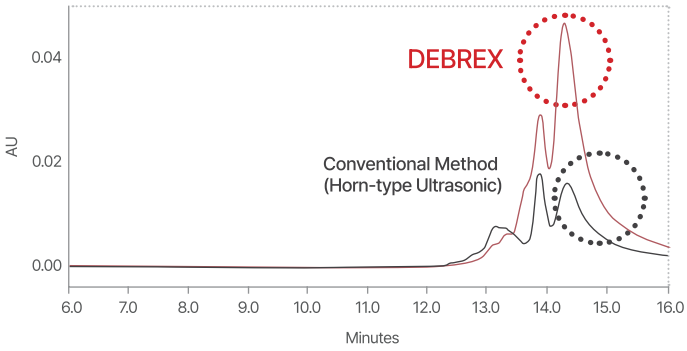
Extraction

Active Ingredient Extraction

- Compared to conventional extraction method, DEBREX ensures **greater amount of extraction of various active ingredients**



Chaga Mushroom Extraction Result



Green Tea Leaf Extraction Result

Degradation

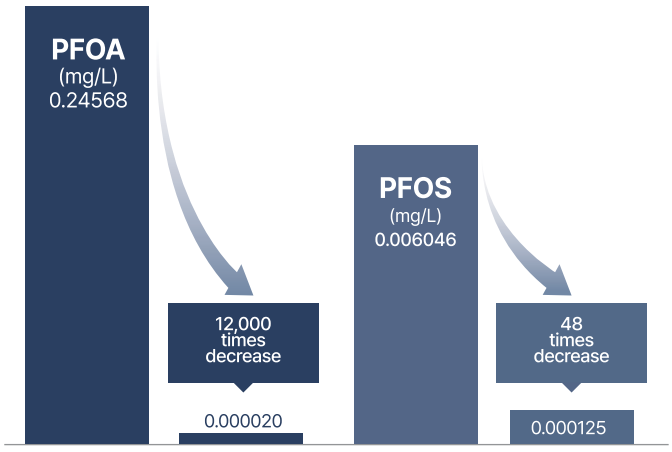
Per-and Polyfluoroalkyl Substances, PFAS

PFAS regulation in the US and EU

0 ppt allowed
EPA's proposal MCLG on PFAS

No. 2020/2184
Commission Directive

No. 2022/2388
Commission Regulation



Degradation of PFAS with ultrasonic energy below EU regulations

PFAS treatment from real-wastewater

Sample	Ultrasonic Treatment	Results per toxin [mg/L]	
		PFOA	br_PFOS
Groundwater 1	Before	2.07	0.104
	After	Not detected	Not detected
Groundwater 2	Before	0.592	0.155
	After	Not detected	Not detected
Waterworks	Before	10.4	0.336
	After	Not detected	Not detected

Focusing on high-performance and precision

DEBREX

Focused Ultrasonic Processor	Max output Power Frequency Size	100W main : 380 ± 10 kHz 520×370×470(mm)
Generator	Max power Frequency Rated Power Size	100 W 360~400 kHz AC220V/60HZ, 250W 460×420×170(mm)
Display Controller	Ultrasonic Resonant Frequency Tracking Rated Power Size	360~400 kHz AC100~240V, 50/60Hz, 55W 460×420×240(mm)
Pump	Aqueous peristaltic pump speed Lipid peristaltic pump speed	0~100mL/min (resolution : 5mL/min) 0.3~5ml/min (resolution : 0.1mL/min)

- **DEBREX Lab**
  Lab-scale

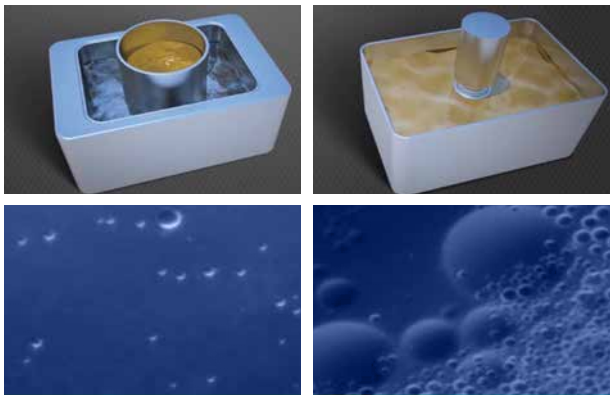
- **DEBREX SS**
  Small-scale

Overcoming limitations of conventional equipment

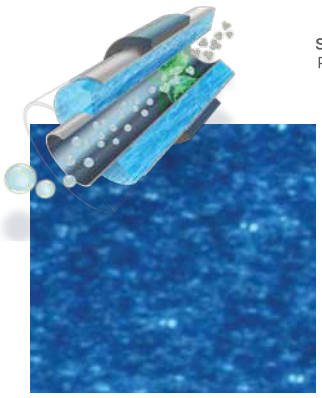
Ultrasonic Innovation

Comparison with conventional ultrasonic equipment

Conventional Ultrasonic Equipment



DEBREX



Stability Test Comparison

Conventional Technology Surfactant-free Emulsification: Phase separation within 2 days

DEBREX Surfactant-free Emulsification: Maintain stability for 6 months to 1 year or longer

- Low frequency of 20kHz(Not suitable for nano-level emulsification/dispersion).
- Inconsistent particle sizes after dispersion.
- Difficult to control heat & noise.
- Susceptibility to contamination in the dispersion medium

- High-frequency ultrasonic (hundreds of kHz) enables nano-level emulsification /dispersion.
- **Uniform dispersion of nanoparticles.**
- Allows temperature control of the dispersion medium.
- **Allows Surfactant-free dispersion.**
- Prevents contamination in the dispersion medium.

Comparison with conventional high-pressure technology

Products	High-Pressure	DEBREX
Tech used for Emulsification/ Dispersion	High-pressure dispersion (30,000psi)	Focused ultrasonic dispersion
Particle Size	100nm~Several μm	50nm~500nm
Particle Uniformity	Average	High
Dispersion Stability (additive-free dispersion)	Low (Less than 6 month)	High (Over 24 month)
Retail Price of Equipment	About 60,000 USD	• Lab-scale 53,000 USD • Small-scale 73,000 USD
Temperature Control	Not possible (Needs to cooling the sample after dispersion)	Possible (Able to cool and disperse the sample at the same time)
Continuous Process	Not possible	O