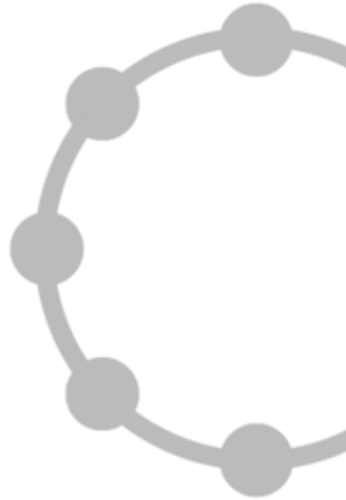




CARBOHYDE
REVOLUTION OF
CYCLODEXTRINS

Cyclodextrins

In Nutraceuticals

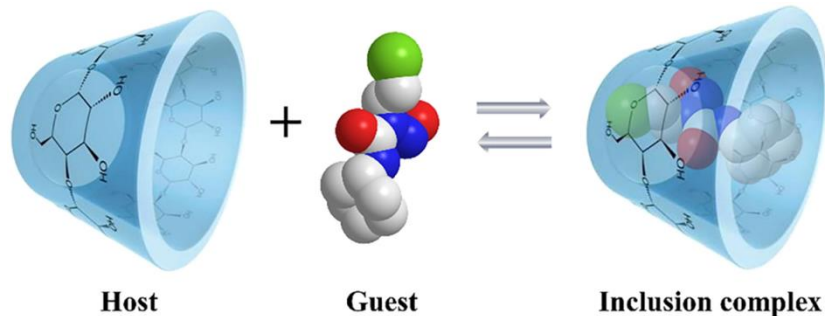




What are Cyclodextrins (CDs)?

Properties

- Vegan, natural, cyclic molecules, composed of sugars.
- Toroid structure with **interior hydrophobic** cavities and **exterior hydrophilic** rims.
- Hydrophobic molecules can be incorporated.
- Often, the **aim** is to increase the solubility, dissolution rate, and stability.



Dynamic host-guest interaction



Medicine



Household



Food &
Drinks



CD



Agriculture



Cosmetics

The structure and application areas of CDs



A Powerful Tool in Traditional Application

CDs as multifunctional excipients

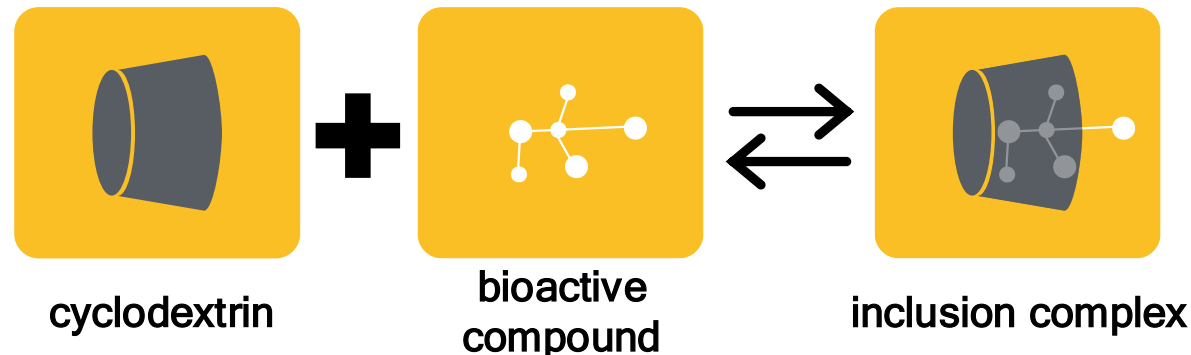
Cyclodextrins can be used to improve the stability and bioavailability of vitamins, minerals, and other active ingredients in nutraceuticals and dietary supplements.

With cyclodextrins we can **increase** 
your bioactive compound's

- Solubility, dissolution rate
- Stability
- Wetting
- Absorbed quantity, bioavailability

With cyclodextrins we can **decrease** 
your bioactive compound's

- Dose for the same efficacy
- Taste and smell
- Interactions
- Toxicity, side effects





Cyclodextrins in Nutraceuticals

Safety of CDs

Cyclodextrins have been extensively studied in food and nutraceuticals, with regulatory agencies approving their inclusion due to their low toxicity and minimal risk to human health.

Food approval	α -cyclodextrin (ACD)	β -cyclodextrin (BCD)	γ -cyclodextrin (GCD)
USA	GRAS	GRAS	GRAS
EU	Novel food ingredient	Food additive (E-459)	Novel food ingredient
Total daily oral dose (mg/day)	6 000	500	10 000

¹Generally recognized as safe (GRAS)

²https://food.ec.europa.eu/safety/novel-food/authorisations/list-authorisations-under-former-novel-food-regulation_en

Area of application

By forming inclusion complexes with a range of guest molecules, cyclodextrins can **protect volatile compounds** from degradation, **mask unwanted tastes and odors**, and even improve the overall taste profile of the food/nutraceutical.

Many bioactive compounds have poor water solubility, which can limit their absorption in the body. Cyclodextrins can **improve the solubility** of these compounds, aiding in their absorption and bioavailability.

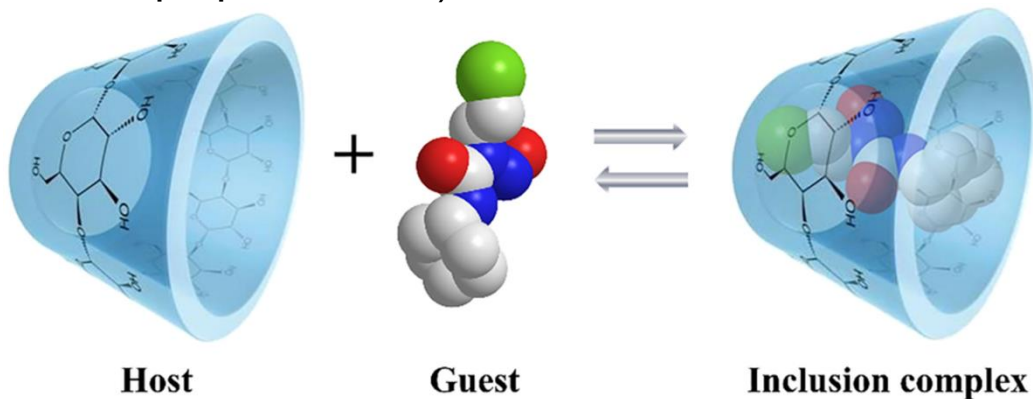
Cyclodextrins have a **prebiotic** effect in lower guts.



Utility of Cyclodextrins in Food

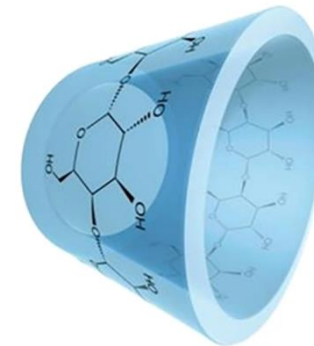
Encapsulation agents/additive

- **Stabilization** of flavours, colorants, etc.
- **Solubilization** purposes (beverages)
- **Controlled-release** of food additives
- **Higher bioavailability** of active compound
- **Improving food properties** (against hygroscopicity, improving powder properties, etc.)



„Empty” non-complexed CDs

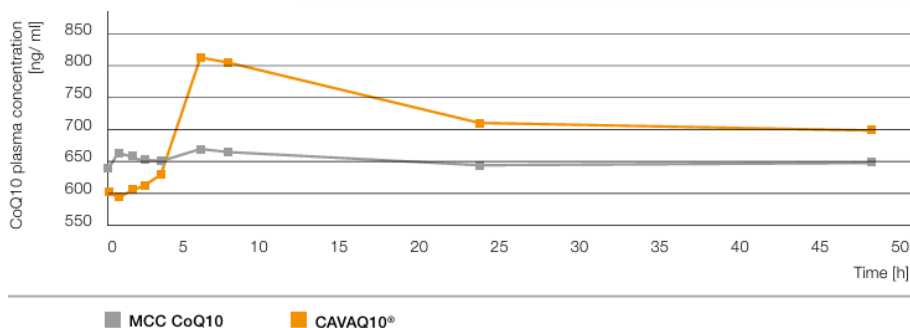
- **Tastes and odor masking** agents
- **Dietary fibers**, affecting human microflora
- Human **lipid status-altering** agents
- **Glycemic response** affecting agents





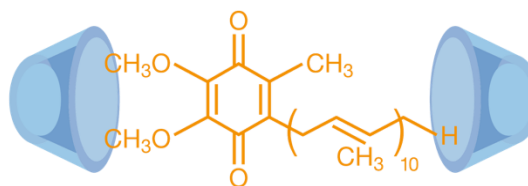
The Power of Cyclodextrins

Bioavailability enhancement of coenzyme Q10 (CoQ10)



18x higher bioavailability of GCD-CoQ10 complex than reference CoQ10

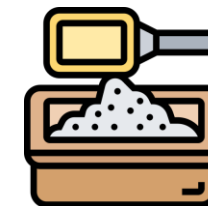
CAVAQ10® – HIGHLY BIOAVAILABLE COQ10 – Info sheet



Converting into powder: tableting omega-3 oil



Without CD: not possible to tablet



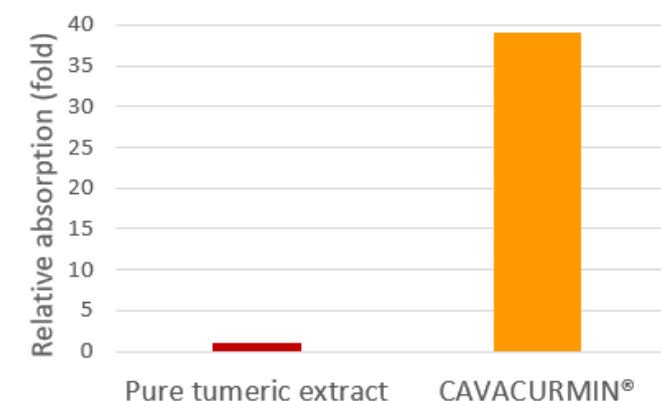
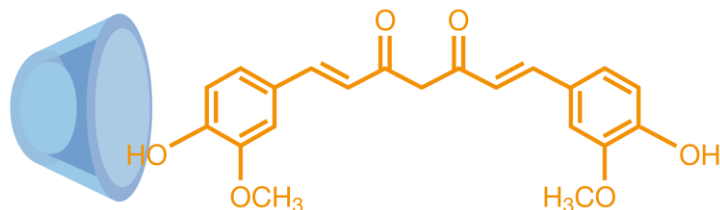
With BCD: powder suitable for tableting

[Expanding the innovative ingredient options': Glanbia launches omega-3 powder](#)
Vestland, T. L., et al. (2016). *Food Chemistry*, 197, 496-502.

Antioxidant with higher absorption: curcumin

Curcumin is a powerful antioxidant that forms a complex with GCD, resulting in a free-flowing powder.

Independent studies show that GCD enhances absorption by approximately 40 times.



The relative absorption of CAVACURMIN® compared to pure pure tumeric extract¹

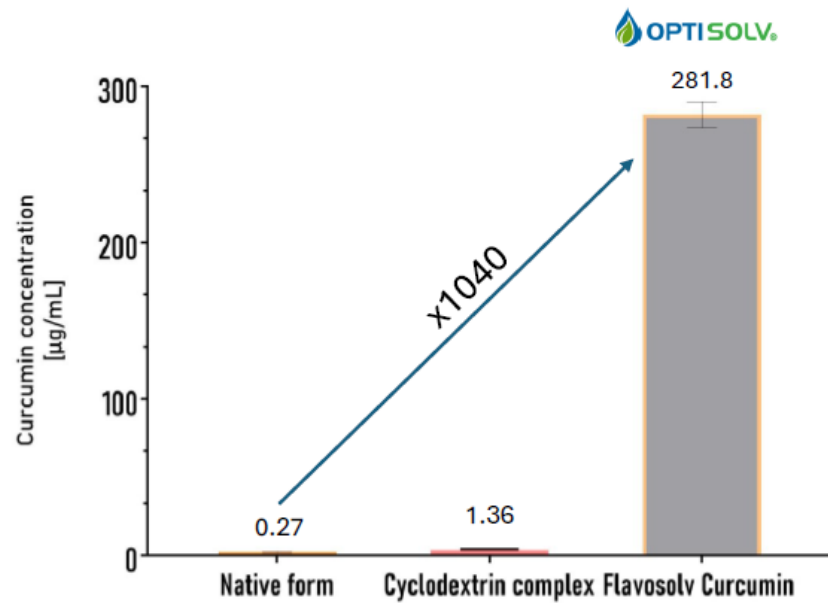
CAVACURMIN® Info Sheet – Scientific Evidence of Superior Bioavailability



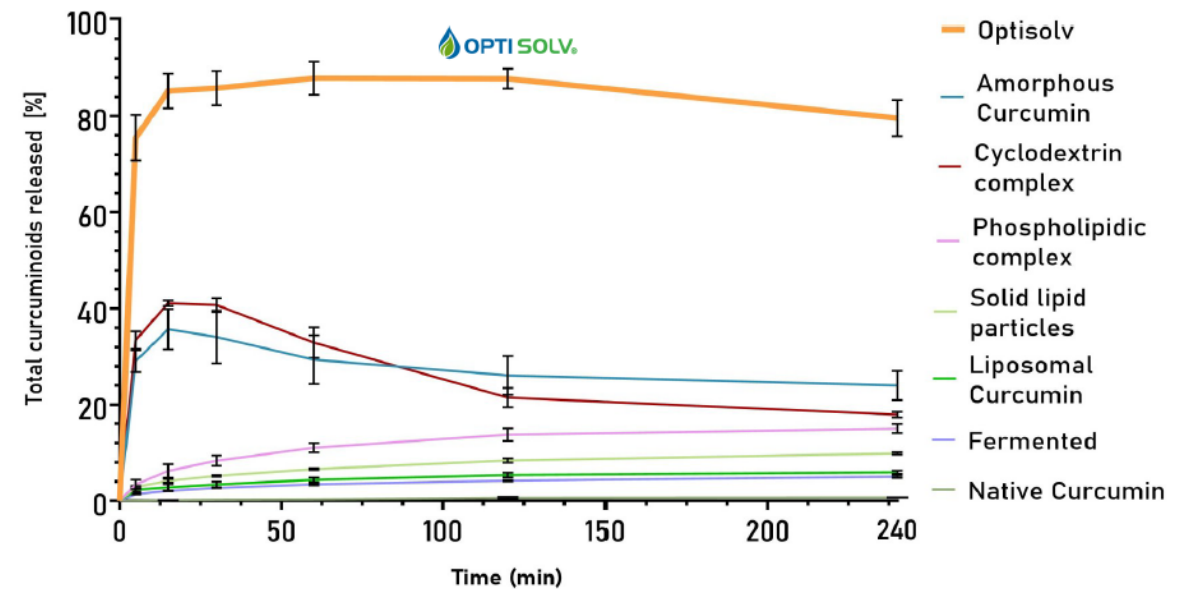
Various formulation technologies - Optisolv

Comparison of the release of different commercial carrier systems compared to OPTISOLV in biorelevant intestinal medium

Saturation solubility Curcumin in water 25°C



Release graph (0-100%)

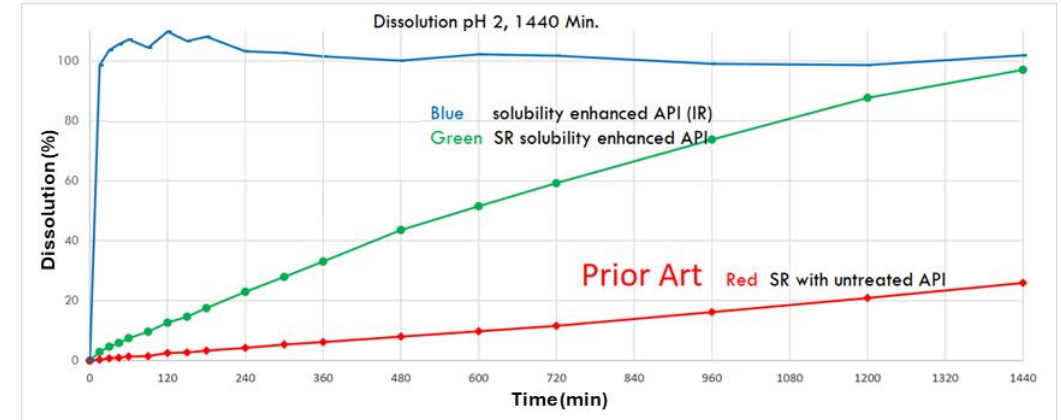




Various formulation technologies – sustained release

Dosage form preparation techniques:

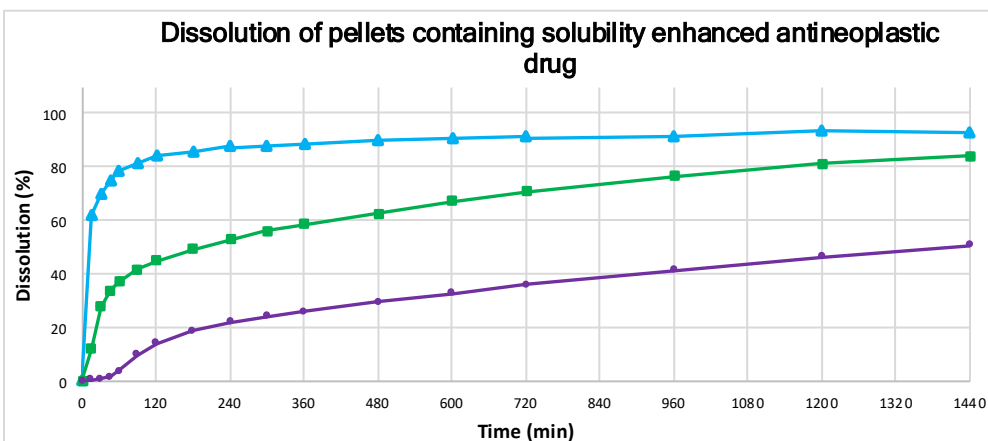
- Physical mixture
- Direct compression
- Wet-granulation
- Extrusion/melt granulation
- Dry granulation
- Fluid bed coating



Red: neither cyclodextrin, nor matrix material

Blue: API-cyclodextrin complex, without matrix material (only Step 1)

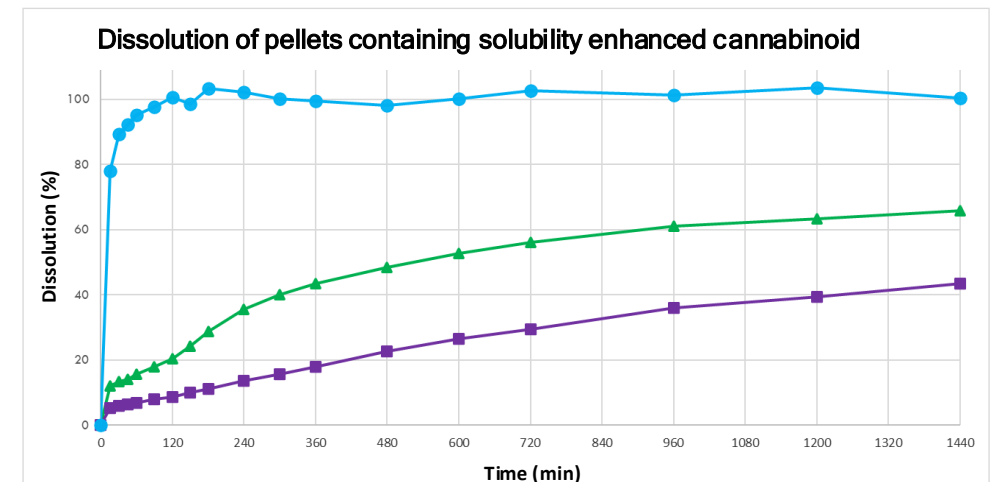
Green: API-cyclodextrin and matrix material added (both Step 1 and Step 2)



Blue: Immediate release-pellets with cyclodextrins

Green: SR-pellets (lower % coating)

Purple: SR-Pellets (higher % coating)



Blue: Immediate release-pellets with cyclodextrins

Green: Sustained release-pellets (2.5% coating)

Purple: Sustained release-Pellets (5.0% coating)

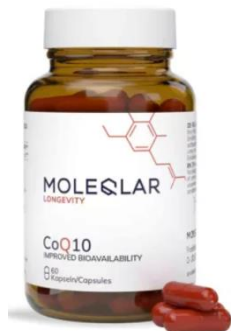


CD-Containing Dietary Supplement

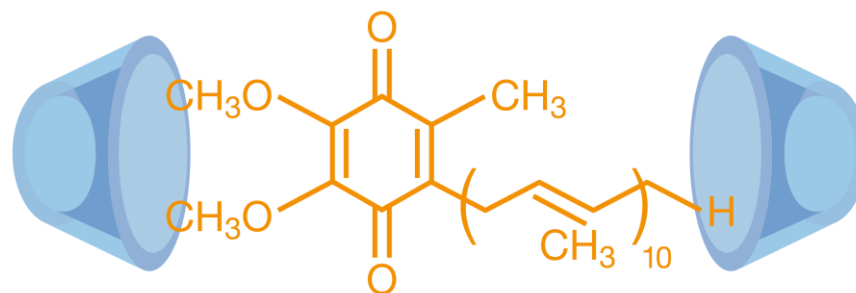
Coenzyme Q10 (CoQ10) containing products

Cyclodextrins can encapsulate CoQ10 molecules, enhancing their solubility in water-based solutions and potentially improving absorption.

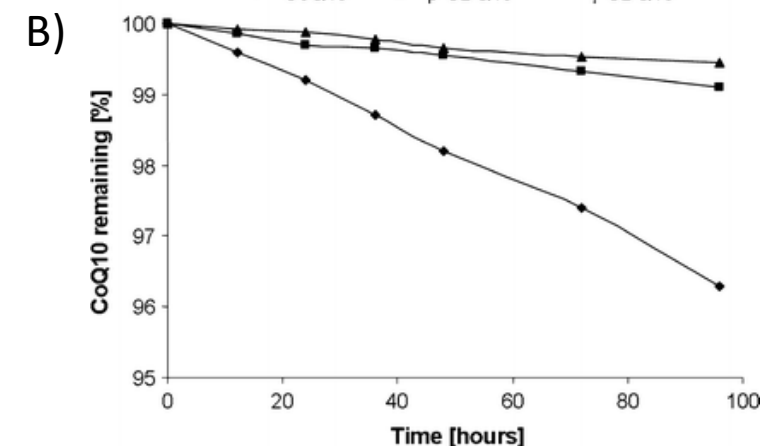
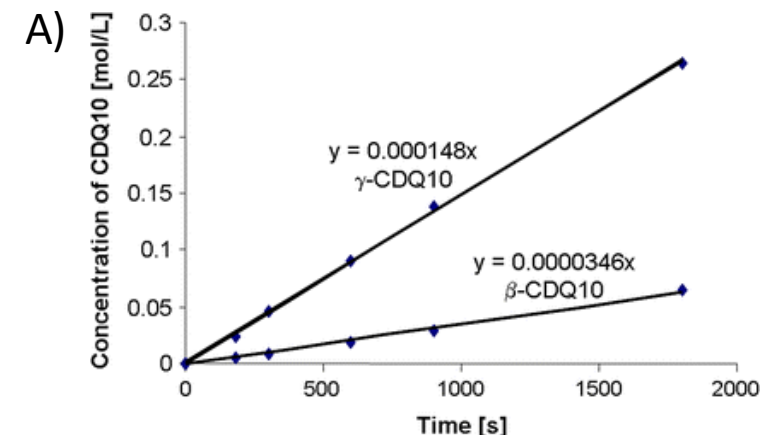
Cyclodextrins can protect CoQ10 from degradation, thereby increasing its stability and shelf life.



Product containing
Q10Vital® (BCD-content)



CoQ10 encapsulated by GCD



Increased solubility (A) and stability (B)
of CoQ10 by CDs¹

¹Fir, M.M. et al. Studies of CoQ10 and cyclodextrin complexes: solubility, thermo- and photo-stability. J Incl Phenom Macrocycl Chem 64, 225-232 (2009). <https://doi.org/10.1007/s10847-009-9555-4>

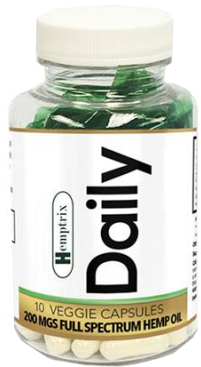


CD-Containing Dietary Supplement

Solubilized cannabinoids – cannabidiol (CBD)

Improved solubility and bioavailability of CBD.

ACD is also listed for its benefits as a dietary supplement, as being able to lower cholesterol and blood-fat levels, while also feeding the gut microbiome.



Spectrum of products containing CD solubilized CBD



Capsules containing a micelle preparation of water-soluble full-spectrum hemp oil powder.

SUPPLEMENT FACTS

SERVING SIZE: 1 CAPSULE

SERVINGS PER CONTAINER: 10

AMOUNT PER SERVING		% DAILY VALUE
Cyclodextrin Prebiotics	475 mgs	**
Cannabidiol (CBD) *	25 mg	**
(Derived from 200mgs full spectrum, whole plant hemp oil including all natural Cannabinoids and Terpenes.)		



CD-Containing Dietary Supplement

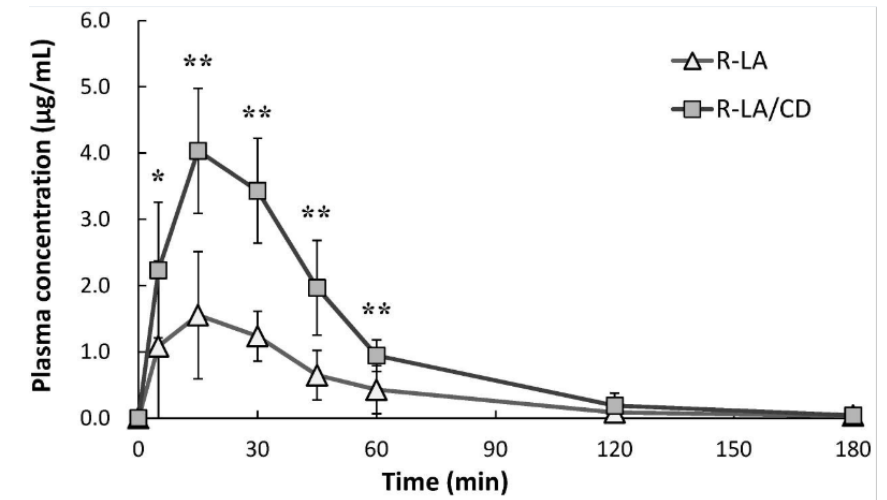
Solubility increase of R- α -lipoic acid

Lipoic acid is a powerful antioxidant that helps protect cells from oxidative stress, supports mitochondrial energy production, and may improve insulin sensitivity.

After complexation of R- α -lipoic acid with CD, the bioavailability and stability of active compound is claimed to be increased which is inline with the findings of Ikuta et al.¹



R-ALA Cyclodextrin Powder



Increased bioavailability of R- α -lipoic acid-GCD complex compared to R- α -lipoic acid¹



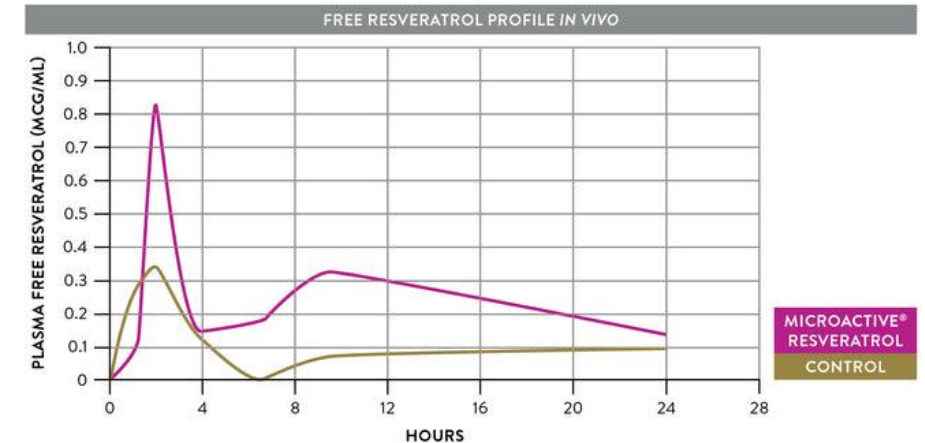
CD-Containing Dietary Supplement

MicroActive® Resveratrol for sustained release

Resveratrol is a natural polyphenol found in red grapes, berries, peanuts, and red wine. It has attracted great interest, due to the “French paradox”; despite fat-rich diets, mortality from coronary heart disease is lower in France than in other countries due to the moderate consumption of red wine.



MicroActive® Resveratrol containing products



MicroActive® Resveratrol contains BCD and is claimed to have 2.5-times greater bioavailability than pure resveratrol¹

¹[MicroActive Resveratrol - MicroActive® Ingredients](#)



CD-Containing Dietary Supplement

Manuka Honey - Cyclopower

Manuka honey is renowned for its potential health benefits, particularly its **antibacterial** and **wound-healing properties**.

When combined with ACD in the form of Manuka honey CycloPower, it is claimed that the **encapsulation enhances the bioavailability and efficacy** of the active compounds present in the honey.



Manuka Honey - Cyclopower

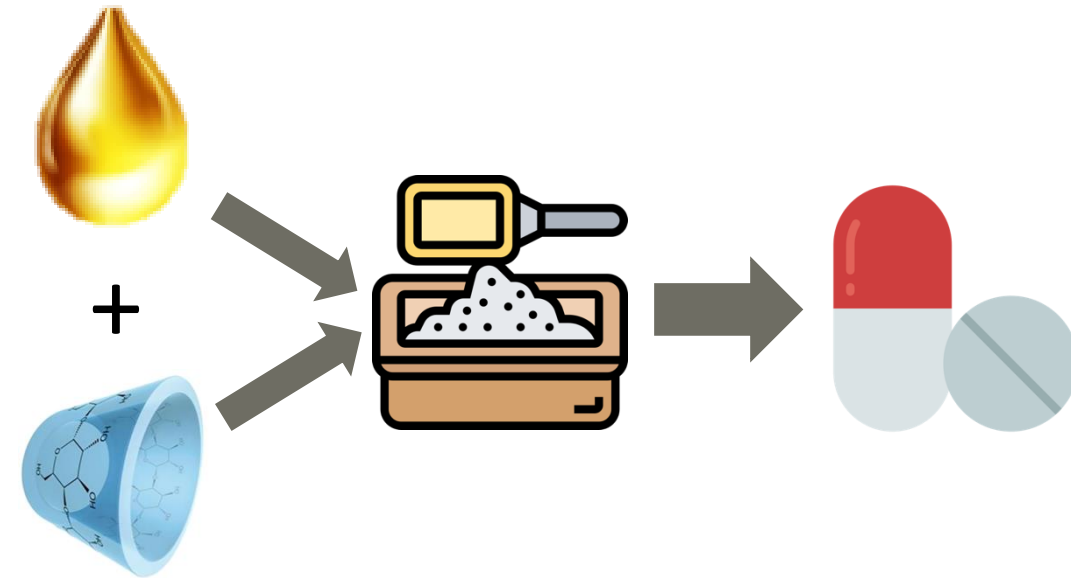


CD-Containing Dietary Supplement

Formulation of essential oils

Essential oils in nutraceuticals provide antioxidant, anti-inflammatory, antimicrobial, and digestive benefits, supporting overall health. They also enhance nutrient bioavailability, cognitive function, immune support, and metabolism, making them valuable in wellness formulations. However, due to their volatility and poor water solubility, they often require encapsulation (e.g., cyclodextrins, liposomes) for improved stability and bioavailability.

With cyclodextrins, essential oils be converted into powder form suitable for powders, granules, even capsules and tablets.

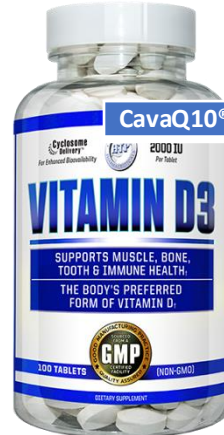
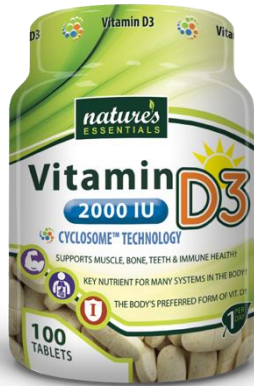




CD-Containing Dietary Supplement

Vitamin encapsulation

Encapsulating vitamins with cyclodextrins in nutraceutical products offers several advantages in terms of stability, solubility, and bioavailability.



Vitamin products utilizing the "Cyclosome™ Technology": a technology using hydrophobic compounds in CD complex in liposomes



Pregnancy vitamin manufactured by 3 Chênes Laboratoires.¹

¹Fish oil is complexed in this product with BCD.



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REVOLUTION OF
CYCLODEXTRINS

For any questions:

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