



CARBOHYDE
REVOLUTION OF
CYCLODEXTRINS

Cyclodextrins

In Food and Nutrition



What are Cyclodextrins (CDs)?

Properties & applications

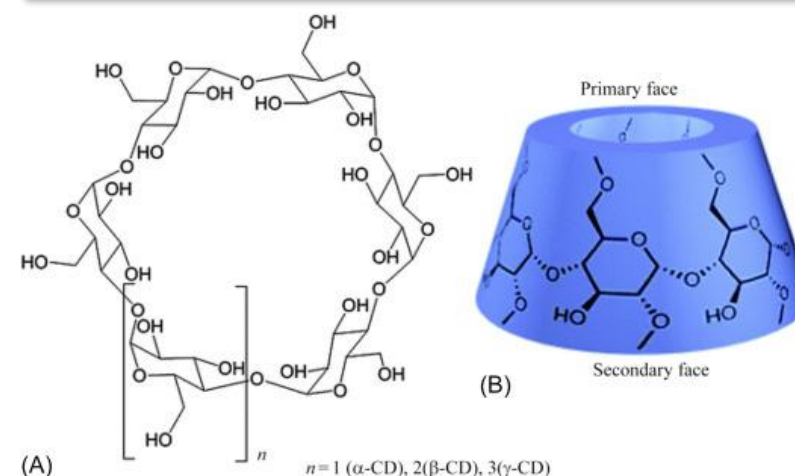
- Composed of sugars
- Naturally occurring cyclic molecules
- Used in food, pharmaceuticals, drug delivery, chemical industries, agriculture, etc.
- Sub-nanometer sized molecular containers with hydrophilic outer phase and hydrophobic interior properties
- Reversible inclusion complex formation

CDs with GRAS¹ status

- alfa-cyclodextrin
- beta-cyclodextrin
- gamma-cyclodextrin

¹Generally recognized as safe (GRAS)

Structure and application of CDs

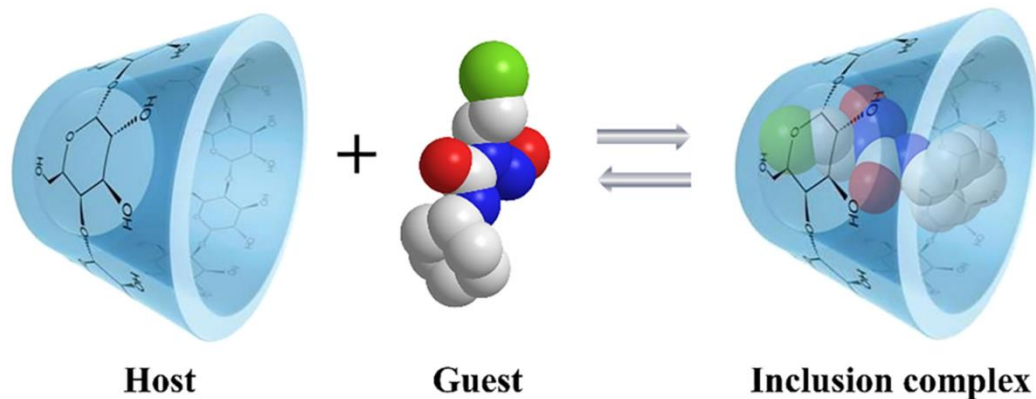




Utility of Cyclodextrins in Food

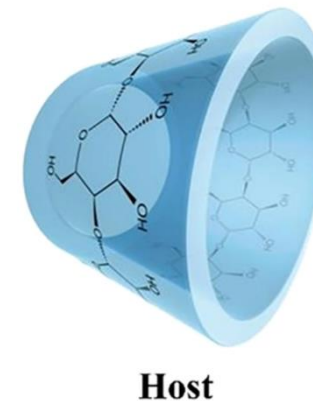
Encapsulation agents/additive

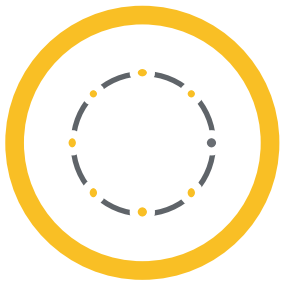
- **stabilization** of flavours, colorants, etc.
- **solubilization** purposes (beverages)
- **controlled-release** of food additives
- **improving food properties** (against hygroscopicity, improving powder properties, etc.)



„Empty” non-complexed CDs

- **tastes and odor masking** agents
- **dietary fibers**, affecting human microflora
- human **lipid status-altering** agents
- **glycemic response** affecting agents





Utility of Cyclodextrins in Food

Solubilizing in foods

CD-complexation **improves the solubility** of lipophiles

Example: prevention of precipitation, aggregation in canned juices, Citrus beverages (hesperidin, naringin, etc.), food lipids: fats, sterols, carotenes





Cyclodextrin-Enabled Packaging Materials

Absorber and emitter functions



CD complexed volatiles: in emitting sachets and bags to provide released volatile antimicrobials, repellents etc. (moisture-activated!)

Empty CDs: in adsorbent pads and bags (collecting, fixing and immobilizing odours and to prevent loss of volatiles)



CD Additive to Improve the Quality of Starchy Food

CDs in rice, noodles and other starchy foods

- Dietary fiber
- Improved taste
- Anti-aging effect (reduced retrogradation of starch)
- Improved palatability
- Longer shelf-life
- Reduced glycemic index
- Lower insulinemic effect



EFSA recommendation: to consume at least 5 g of α -CD to each 50 g of starch to achieve considerable reduction of post-prandial glycemic responses



Cholesterol Removing and Egg-Free Baking

Cholesterol-removal process from eggs

- Step 1 yolks and whites are separated
- Step 2 beta-CD is mixed with the yolks and then products are removed, along with the crystalline cholesterol-BCD complex by centrifugal force
- Step 3 yolks and whites rejoined
- Step 4 the mixture is pasteurized



Egg-free baking

- Alpha-CD can create oil-in-water **emulsions** that remain **stable, even at high temperatures**
- replace up to 100% of eggs in ready-to-use powder mixes.
- plant-based soluble dietary fiber
- vegan, kosher & halal
- free of all major allergens
- easy to process (powder mixes)



Enables producers to utilize a streamlined HACCP approach while also offering a safeguard against fluctuations in seasonal egg prices.



CD-Containing Dietary Supplement

Solubilized cannabinoids – cannabidiol (CBD)

Contains 25 mg CBD per capsule

475 mg α -cyclodextrin.

Improved solubility and bioavailability.

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

Spectrum of products containing CD solubilized CBD.



SUPPLEMENT FACTS

SERVING SIZE: 1 CAPSULE

SERVINGS PER CONTAINER: 10

AMOUNT PER SERVING	% DAILY VALUE
--------------------	---------------

Cyclodextrin Prebiotics	475 mg	**
-------------------------	--------	----

Cannabidiol (CBD) *	25 mg	**
---------------------	-------	----

(Derived from 200mg full spectrum, whole plant hemp oil including all natural Cannabinoids and Terpenes.)

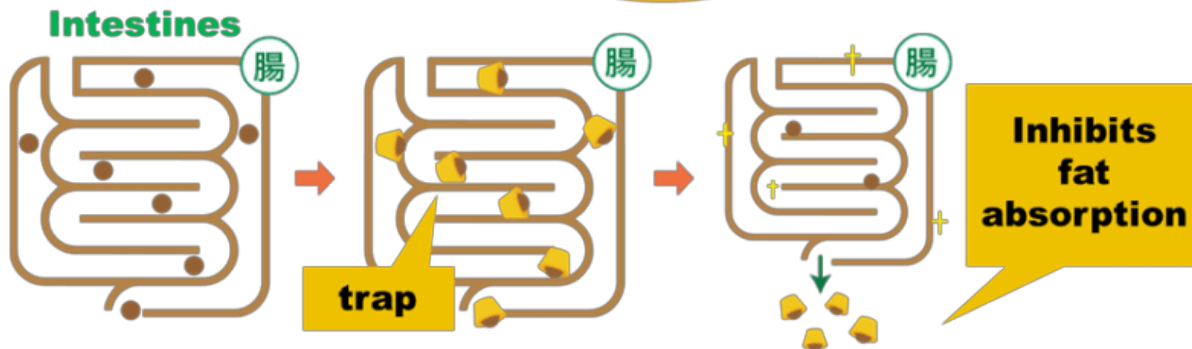


New Seasoning Concept

Designed to improve not the "taste" but your "body"

- Tasteless and odorless
- Simple to use, just sprinkle it on food
- CD efficiently captures excess fats and inhibits their absorption
- Improve both health and flavours

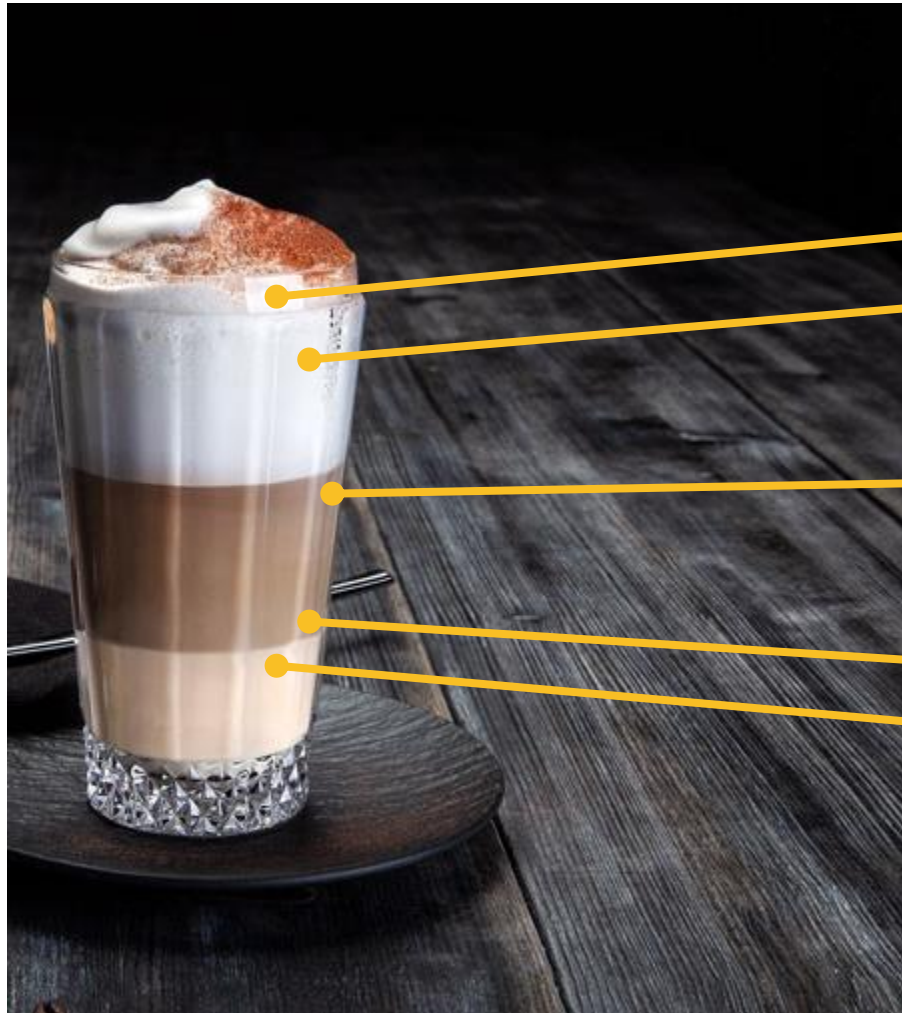
Cyclodextrin (CD) traps fats, and inhibits their absorption.



DON-MAIN salt, pepper and chili seasoning produced by CyDing Co., Ltd.



An Example for Cyclodextrin Utility in One Product



- Long-lasting, high volume foam
- Low fat milk
- Reduced coffee
- Reduction of bitterness of coffee
- Encapsulation of acids for enriching antioxidant capacity



Utility of Cyclodextrins in Food

The possibilities are...

- **Soft drinks and carbonated beverages**
(encapsulate flavorings, such as fruit flavors, to improve their stability and taste)
- **Bakery products**
(improve the texture and shelf life of baked goods, such as bread and cakes)
- **Dairy products**
(encapsulate vitamins, to improve their bioavailability in dairy products, such as yogurt and cheese)
- **Chewing gums**
(encapsulate flavorings and sweeteners, such as peppermint and aspartame, to improve their stability and taste)
- **Nutraceuticals and dietary supplements**
(improve the stability and bioavailability of vitamins, minerals, and other active ingredients in dietary supplements)
- **Sports drinks**
(encapsulate carbohydrates, such as glucose and fructose, to improve their stability and slow their absorption into the bloodstream, providing sustained energy during exercise)

...endless.



CARBOHYDE
REVOLUTION OF
CYCLODEXTRINS

For any questions:

info@carbohydride.com