

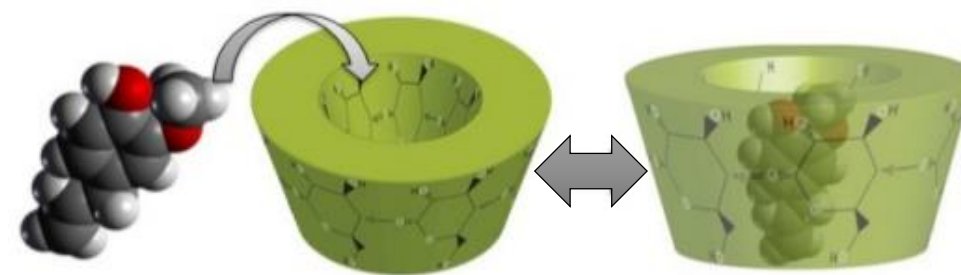
GETTING THE BEST OUT OF CYCLODEXTRINS

Cyclodextrins in Food
and Nutrition



What are cyclodextrins?

- Composed of sugars
- Cyclic molecules
- Naturally occurring compounds
- 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



Cyclodextrins on the GRAS list

Alpha-, beta- and gamma-cyclodextrin

Between 1975-2000 CDs have been used as encapsulation agents/additives:

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

Since 2000 more emphasis is put on use of „empty” non-complexed CDs as:

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

Utilization of CDs in food solubilization

Solubilizing in Foods

CD-complexation improves solubility of lipophiles

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



Around **40 products** marketed in Japan and Korea

Cyclodextrins to control body mass by affecting fat absorption



Supplement Facts	
Serving Size 2 Tablets	
Servings per container 90	
Amount Per Serving	
	% Daily Value
FBCx Alpha-cyclodextrin 2000 mg	*
**Daily Value Not Established.	
PRIMARY INGREDIENT:	
FBCx™ IS A NATURALLY SOURCED SOLUBLE DIETARY FIBER FROM CORN. EACH SERVING BINDS UP TO 18 GRAMS (162 CALORIES) OF DIETARY FAT.	

Calorease™ is a dietary supplement containing α CD/FBCx. FBCx is a patented, naturally sourced **dietary plant fiber with a fat-binding capacity**. It has the ability to bind up to 9 times its own weight of dietary fat, passing the fat out of the body.

A New-Zealand honey formulation prepared with alpha CD (food supplement product)



Increased antimicrobial potency

Sustained-release for enhanced delivery in the body

Lowers the Glycaemic Index, suitable for pre-diabetics and people with reduced insulin sensitivity

Has a pre-biotic effect in the lower gut



Plant fats derived milk powders supplemented with CDs (Real Food Inc.)




Ingredients:

Vegan Coconut Milk Powder, Organic Matcha Green Tea Powder (Ceremonial Grade), Organic Baobab Powder
Vegan Coconut Milk powder contains Coconut Milk, Maltodextrin (from Corn), Tapioca Syrup (<1%), **Cyclodextrin** (dietary fibre <1%)



CD-containing dietary supplement by Vitasome Labs, Inc. CA



Supplement Facts
 Serving size 1 sachet: 0.11 Oz. (3 g)
 Servings Per Container: 30

	Amount Per Serving	% DV
Calories	5	-
Vitamin C (as L-Ascorbic- Acid)	250 mg	417%
L-Glutathione (Setria®)	250 mg	▲
Citrus Bioflavonoids	12.5 mg	▲
Phosphatidylcholine	125 mg	▲
Pterostilbene	50 mg	▲
Piperic Acid	1.5 mg	▲

▲ (Daily Value not established).
 * (Percent Daily Values are based on a 2,000 calorie diet).
Other Ingredients: Sunflower lecithin, Citric Acid, Cyclodextrin, Acacia (Gum Arabic), Natural Flavors, Stevia.

Vitasome Labs, Inc.
 Placentia, 92870
 California, U.S.A
 Support: 888-669-VITA (8482)

Setria® is a registered trademark of KYOWA HAKKO BIO CO., LTD.
 Vitasome® is a registered trademark of Vitasome Labs, Inc.
 Glutasome® is a registered trademark of Vitasome Labs, Inc.



Promotes healthy skin, helps diminish signs of aging, defends against environmental toxins

CD-containing dietary supplement solubilized cannabinoids - CBD

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.)

Protency Test Results: Contains < 0.3% THC

**Daily Value not established

*CBD is a natural component of hemp (stalk & stem extract)

Other Ingredients: Gelatin Capsule

Suggested Use: As a supplement, take 1-2 capsules daily as needed.

CAUTION: Do not exceed recommended dose. Pregnant or nursing mothers, children under the age of 18 and individuals with a known medical condition should consult a physician before using this or any dietary supplement.

KEEP OUT OF REACH OF CHILDREN. DO NOT USE IF SAFETY SEAL IS DAMAGED OR MISSING. STORE IN A COOL, DRY PLACE.



“Hydro Hemp”

Contains 25 mg CBD per capsule

Contains 475 mg α -cyclodextrin

Improved solubility and bioavailability, although no aqueous liquid forms on the market

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

Powdered alcohol

The History of Powdered Alcohol

1970s: Japanese company Sato Foods begins selling powdered alcohol as an additive to help preserve meat and fish.

1974: The first American application for a powdered alcohol patent is filed.

2005: German company Subyou introduces powdered alcohol for creating beverages.

2007: Students in the Netherlands invent Booz2Go, a powdered alcohol for creating beverages marketed at young people.

April, 2014: US Company Palcohol (owned by Lipsmark) seeks approval for distribution of powdered alcohol.

April 8, 2014: The Alcohol and Tobacco Trade and Tax Bureau in the US (ATTTB) approved Palcohol packaging labels.

April 18, 2014: ATTTB informs the associated press that approvals were issued in error.

March, 2015: Several US states including: Alaska, Louisiana, South Carolina, Vermont and Virginia, prohibit the distribution of Palcohol.

March 21, 2015: Palcohol confirms that the plan is to bring Palcohol to Australia in the next few months.



Powdered Alcohol Approved For Sale In The U.S. in March 2015

„Powdered alcohol lets you turn water into wine or vodka”

(Mark Phillips, CEO Palcohol)

Low cholesterol dairy products and egg



Cholesterol removal from milk before processing into butter and cheese:
Beta-CD is added and the crystalline cholesterol complex is removed by centrifugation

Solvent-free cholesterol-removal process for eggs:

Step 1 yolks and whites are separated,

Step 2 beta-CD is mixed with the yolks and then removed, along with the crystalline cholesterol-BCD complex by centrifugal force

Step 3 yolks and whites and rejoined

Step 4 the mixture is pasteurized



Michael Foods / Simply eggs products

Pioneers of egg cholesterol removal:

Bayol et al: EP 326469 A1 2 Aug 1989

Cully, J. et al EP 454099 A1 30 Oct 1991

Sidhu-Oakenfull: 6th Intl. CD Symp. Chicago (1992) DEXOLVE™



CD as thickener

Cyclodextrin in ice creams can improve the texture, stabilize the flavors and pigments and can also serve as probiotic (soluble fiber). Ice cream powders from various manufacturers containing CD can be purchased



Protein-free, fat-free and fat-reduced sandwich creams and spreads can be produced with alpha-CD



CD additive to improve the quality of starchy food



Reduced retrogradation of starch

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

CDs in rice, noodles and other starchy foods

Dietary fiber

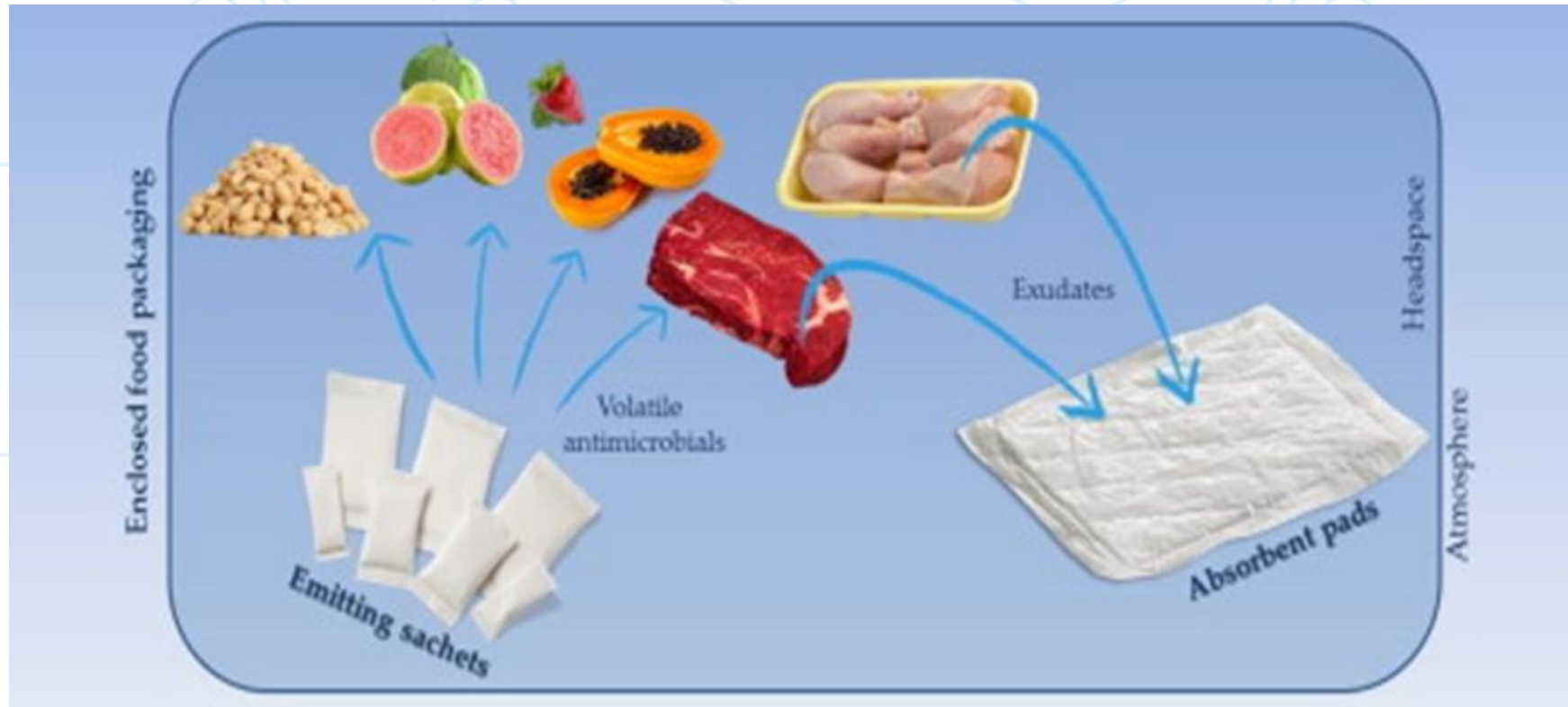
Improved taste

Anti-aging effect (reduced retrogradation of starch)

Improved palatability



Cyclodextrin-enabled packaging materials: adsorber 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 immobilising odours and to prevent loss of volatiles)

I-REMOVE: a cyclodextrin-containing body weight management product

I-REMOVE is a weight-loss supplement containing a patented fiber complex of fat-binding properties supplemented with gamma-cyclodextrin. When taken after a meal, I-REMOVE binds to a portion of the fat molecules in food, forming fat-fiber complexes that are too large to be absorbed by the intestine.

Gamma cyclodextrin intensifies the fat binding property of the fiber components (Opuntia ficus indica powder and gum arabic)



Who are we at CycloLab?



The world's only all-round **CYCLODEXTRIN** company with over

40-year experience of CD-technology

in pharmaceutical-, cosmetics-, food-, environmental- and analytical applications

Experience

Over 490 technical/scientific papers and 950 technical reports to customers

200 different cyclodextrin derivatives

130 patents/applications

40 products on the market

Drug Master Files (USA type IV) and eCTD

Over 20,000 citations to CYCLOLAB's papers

Expertise & Technology

Custom synthesis

Drug solubilization, and stabilization

Further industrial applications

Cyclodextrin-related analytics,

Stability testing

GMP-conform manufacturing

Feasibility studies



CycloLab service portfolio related services – R&D



Early phase drug development

Customization of CD enabled formulations

Investigation of changes in physico-chemical properties

Life cycle management

IP services and consultation

30 years of experience in compilation of CD related patents (synthesis, application, etc.), patent claim analysis, consultancy in CD related projects

Over 62.000 CD related papers

Custom cyclodextrin synthesis

Exclusive manufacture, unique synthetic routes

self-tailored products and characteristics

In vitro bioequivalence studies

Design and performance of in vitro studies to support bioequivalence of a CD enabled formulation.

Analytical services

Method development, validation; cGMP release testing of pharma grade CDs

HPLC, GC, CE, UV, MS, NMR, IR, Micro and BET content methods

Stability studies

CD-guest interaction studies

CD-based chiral separations

Assay, impurity tests

Bioanalytical investigations



CycloLab service portfolio

Feasibility study

Running a short feasibility study with your molecule free of charge

Proof of concept to consider CD based formulations



CycloLab Grant

CycloLab offers a unique possibility to collaborate on creating novel and interesting cyclodextrins under the terms of the CycloLab Grant

The proposal after application is thoroughly evaluated by CycloLab

If the application is approved, the cyclodextrin is provided free of charge for the beneficiary

Cyclodextrins in Food and Nutrition

COMPANY CONTACTS

CYCLOLAB CYCLODEXTRIN RESEARCH & DEVELOPMENT LABORATORY LTD.

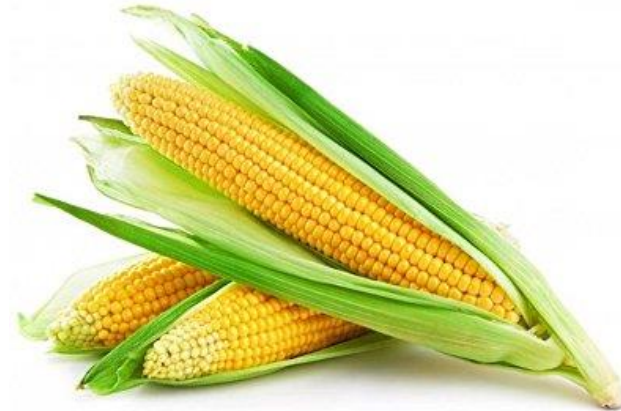
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DEXOLVE™