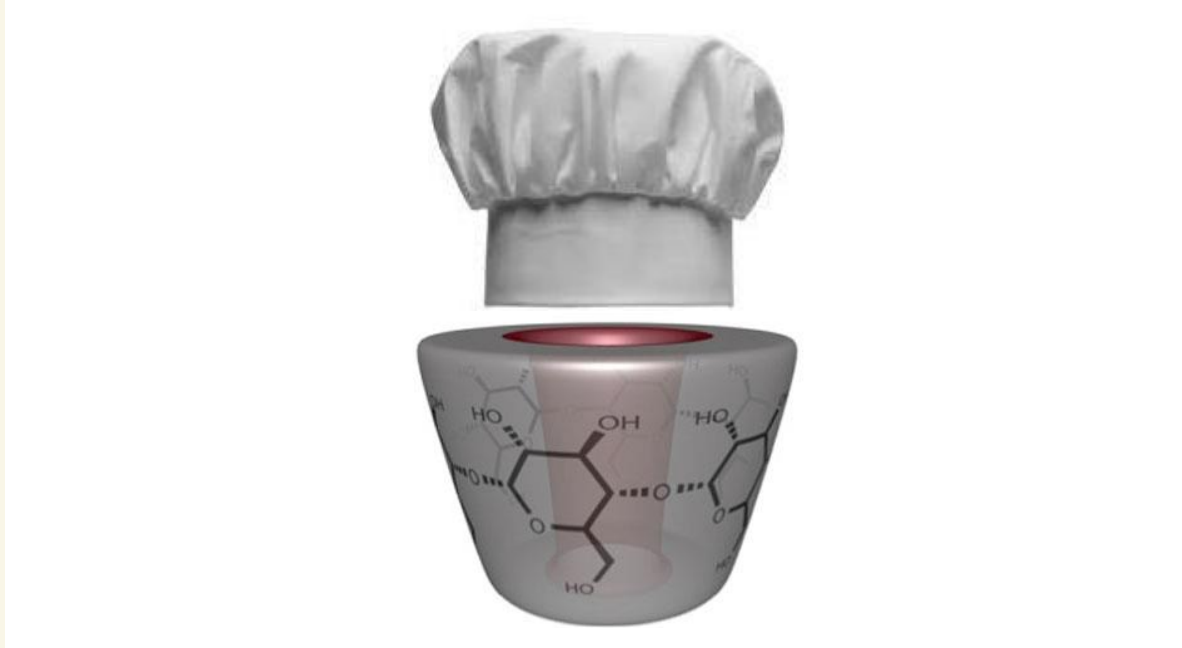




Application of CDs in Food



Puskás István

„Important Applications of Cyclodextrins” Workshop, CyclonHit

7 May 2015

Scope of present lecture is FOOD:
any substance consumed to provide
nutritional support for the body.

Food supplements:
concentrated sources
of nutrients

Meals: eating occasion

Drinks



Outline



1. CDs in food supplements



2. CDs in meals and drinks



3. Foodstuffs processed by CDs



4. CDs in food packagings

CDs have been present in some consumables ever since...

Beer is a fermentation product of starch...

CD is also a fermentation product of starch....

L. Szente, J. Harangi, M. Greiner, F. Mandel: **Cyclodextrins found in enzyme- and heat-processed starch-containing foods.**

Chemistry & Biodiversity, Vol 3(9), pp.1004–1014, (2006)



The history of CD containing food dates back to the neolithic age (9500 BC) when beer was discovered....

Major benefits of using CDs in food

- Improvement of the **stability** of flavours, colourants and unsaturated fats, etc.
(physical and chemical sense)
- Extended product **shelf-life**
- **Pulverizing** liquid, pasty substances
- Improved **taste** (masking)
- Improved **bioavailability** (nutrients in food supplements)

Ref.: Prof. Thorsteinn Loftsson: „Cyclodextrin pharmacokinetics, toxicology and regulatory”, CyclonHit Training e-Class, Lecture #2

Current Regulatory Status

	Food Approval		
	US	Europe	Japan
α CD	GRAS	Novel food ingredient	Yes
β CD	GRAS	Food Additive E-459*	Yes
γ CD	GRAS	Novel food ingredient	Yes

* ADI (acceptable daily intake) of 5 mg/kg/day

GRAS (Generally Recognized as Safe) there is a scientific consensus that the ingredient is **safe at the levels consumed** (i.e. under the conditions of its intended use).



1.



Cyclodextrin containing food supplements



A New-Zealand honey formulation prepared with alpha CD



Increased **antimicrobial** strength.

Sustained-release for enhanced delivery in the body.

Lowers the **Glycaemic Index** making it suitable for pre-diabetics and people with reduced insulin sensitivity.

Travel-friendly capsules and chewable tablets to get the benefits on the go.

Has a **pre-biotic effect** in the lower gut

Cyclodextrins may help to make you „sporty”



Supplement Facts

Serving Size : 1.6ml
Servings Per Container : 112

Amount Per Serving	%DV
Anti-Aromatase Complex:	105mg
2-phenyl-benzo{h}-chromen-4-one	*
Hydroxy-beta-propyl-cyclodextrin	*
Estrocontrol Complex	60mg
Stinging Nettle Root Extract (root)	*
90%+ Trans-Resveratrol (resveratrol)	*
*Daily Value Not Established	



Supplement Facts

Serving Size: 1 Tablet
Servings Per Container: 75

Proprietary Blend
E-911 complex
Caffeine
Geranium oil extract # 105-41-9
Cyclodextrin
Synephrine HCL
Hordinine
Lecithin
Chitosan
Acacia seed extract

*Daily Value not established.



Supplement Facts

Serving Size 1 Capsule

Amount Per Serving	% Daily Value
MicroActive® CoQ10 Complex	400 mg †
(as β-Cyclodextrin and CoQ10)	
(standardized to contain 100 mg of CoQ10)	

† Daily Value not established.

Other Ingredients: Rice Flour, Vegetable Magnesium Stearate, Silicon Dioxide, Vegetable Cellulose (capsule).



Nutrient Qty %DV

Zinc (as Mono-Methionine and Aspartate)	30 mg	200%
Magnesium (as Magnesium Aspartate)	450 mg	113%
Proprietary Testobolic Blend	205 mg	
Cyclosomes (Hydroxypropyl-Beta-Cyclodextrin and Liposomes)	150 mg	
Vitamin B-6 (Pyridoxine HCl)	11 mg	525%

Cyclodextrins are said to make you thinner



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.

The producer claims:

Calorease is a dietary supplement containing the primary ingredient 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.



2.



Cyclodextrin containing meals and drinks

10 Ways to Use Cyclodextrin (Recipe Book) (eBook)

by [Delcie Howerton, Sam Enrico](#) (Author)



[Read Customer Reviews](#)

Sam Enrico

Ingredients & Recipes

Cyclodextrin

**10 Different
Ways to Prepare**



This publication will teach you how to use Cyclodextrin in 10 different dishes. With step by step guides and instructions, you will not only learn how to prepare fantastic dishes, but enjoy wonderful meals using Cyclodextrin in 10 different dishes

Category: Cooking, Food & Wine Cooking, Food & Wine Cooking, Food & Wine

Released: January 8, 2015

[Free eBook Preview](#)

List Price: \$5.99

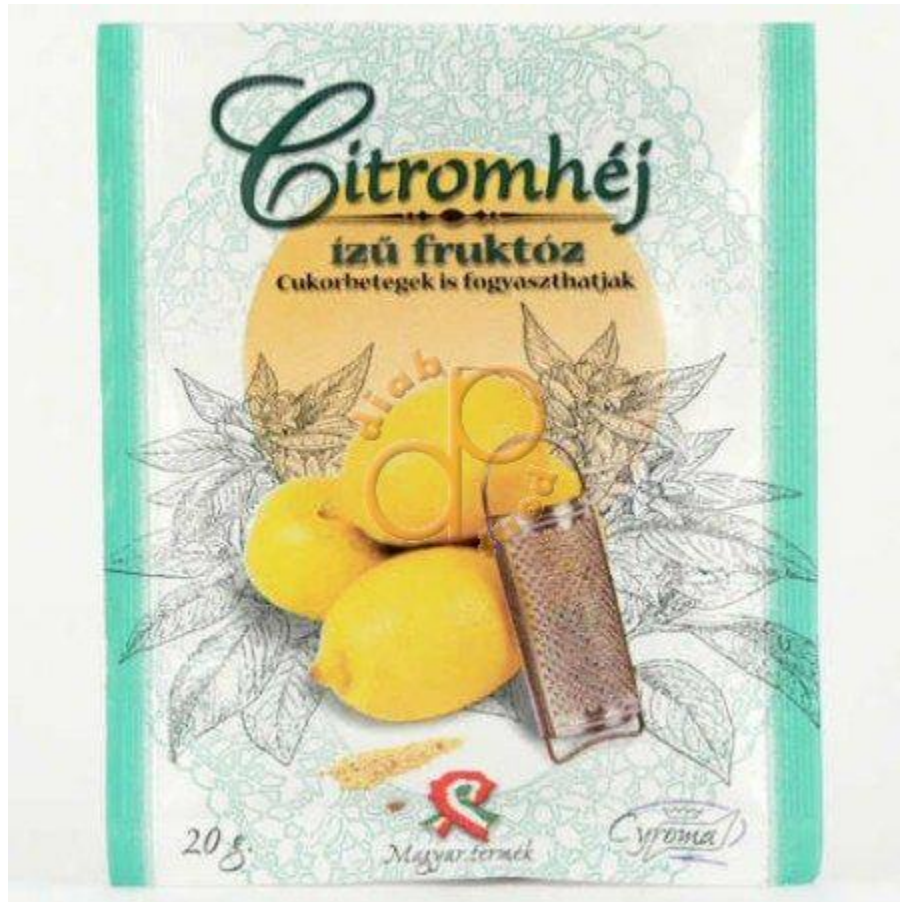
Our Price: **\$5.99**

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[Need multiple copies? Buy 10 Ways to Use Cyclodextrin \(Recipe Book\) eBook in Bulk](#)

Fructose containing lemon crust essential oil / BCD complex



Improved aroma stability

Hungarian product
developed by Cyclolab

Powdered alcohol by alpha-CD

Patented in early 1970's, marketized long ago in Japan
(Sato foods industries)

„enables us to easily use alcohol in solid and powdered foods that were previously difficult to add alcohol to, such as chocolate, candies, and powdered soups. ”



© Stiftung Warentest



Subyou (German), Booz2Go (Dutch): no longer available;
Palcohol: legalized in the US in 2015 March, available in summer 2015.

Some products sold in Japan containing cyclodextrins or „Highly Branched Cyclic Dextrin”



Let us loose some weight by a pinch of α -CD!



Wacker's α -CD as consumable product on the grocery store shelf

Spice it up with CD!



Special Japanese onion
spice stabilized with CD

CDs for masking terrible taste of products



Fermented soybean
„soft drink” + γ -CD



„Diet” tea with crab
(chitosan), cowplant, brown
rice extracts

γ -CD against unpleasant breath

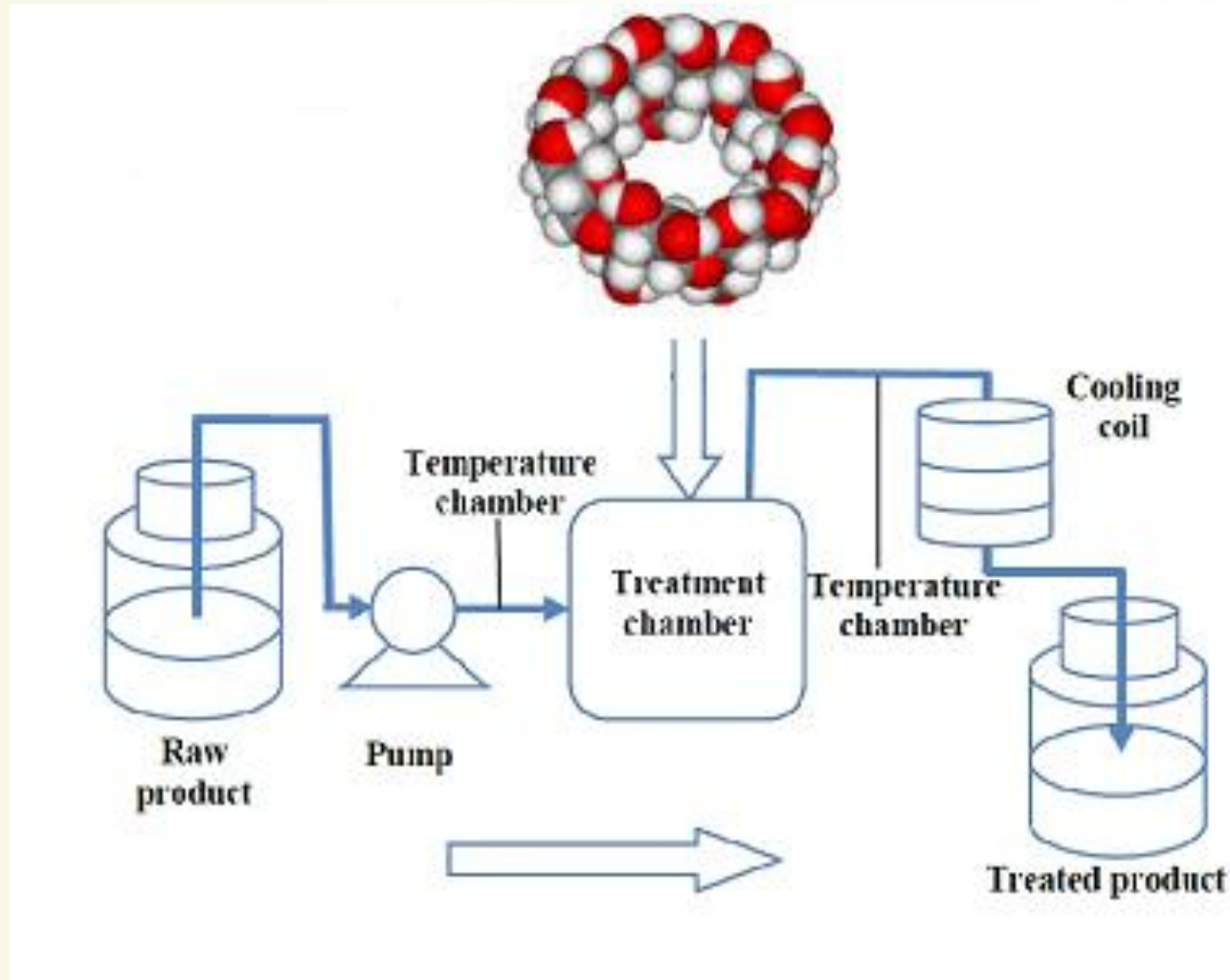


Contains catechin and γ -CD

Such product is classified as foodstuff in Japan



3.



Food products processed by CDs

Low cholesterol egg

In the cholesterol-removal process:

- 1.) yolks and whites are separated,
- 2.) beta cyclodextrin is mixed with the yolks and then removed, along with the cholesterol, by centrifugal force,
- 3.) yolks and whites are rejoined,
- 4.) the mixture is Pasteurized and packed.



Michael Foods / Simply eggs

Cholesterol removed from dairy products by CD:

BCD forms insoluble crystalline complex with cholesterol



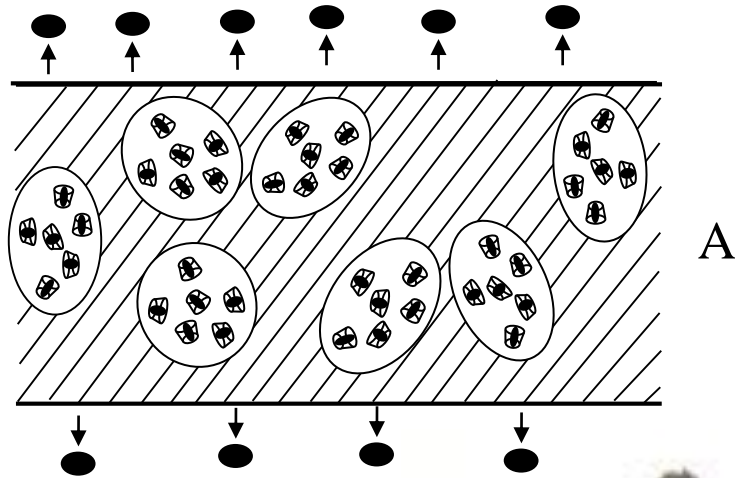


4.



CD containing food packagings

CD-containing foil (PE, PVC) activated by humidity



Unpackaged (1), packed in control PVC foil (2)
packed in 2.9% imazalil/BCD complex-loaded PVC foil (3)
bananas after 12 days of storage at 13°C



Finally....

a very special use of CDs in the food industry



FlavorActiv Flavour standards

Beer, cider:

Acetaldehyde (α -CD)

Bromophenol (β -CD)

„Catty” (p-menthane-8-thiol-3-one) (β -CD)

Freshly cut grass (cis-3-hexanol) (β -CD)

H₂S (α -CD)

Rotten vegetable (dimethyl disulphide) (β -CD)



FlavorActiv Flavour standards

Water



Cucumber (β -CD) <bacterial contamination>

Chlorophenol (β -CD) <chemical contamination>

Dimethyl trisulphide (β -CD) <swampy water>

Bell pepper flavour (β -CD) < bacterial contamination >

Conclusions

Cyclodextrins may be used in the food industry in various ways

- The use in food supplements is similar to that in pharmaceuticals (bioavailability, stability enhancement)
- Direct use in meals and drinks (weightloss products, taste masking)
- In food processing technologies (cholesterol removal)
- In food packaging materials