Application of CDs in Food

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„Important Applications of Cyclodextrins” Workshop, CyclonHit

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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…


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**

<table>
<thead>
<tr>
<th>Food Approval</th>
<th>US</th>
<th>Europe</th>
<th>Japan</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>α CD</strong></td>
<td>GRAS</td>
<td>Novel food ingredient</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>β CD</strong></td>
<td>GRAS</td>
<td>Food Additive E-459*</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>γ CD</strong></td>
<td>GRAS</td>
<td>Novel food ingredient</td>
<td>Yes</td>
</tr>
</tbody>
</table>

* 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“
Cyclodextrins are said to make you thinner

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.
Cyclodextrin containing meals and drinks
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

Released: January 8, 2015
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. ”

Subyou (German), Booz2Go (Dutch): no longer available;
Some products sold in Japan containing cyclodextrins or „Highly Branched Cyclic Dextrin”
Let us loose some weight by a pinch of $\alpha$-CD!

Wacker’s $\alpha$-CD as consumable product on the grocery store shelf
Spice it up with CD!

Special Japanese onion spice stabilized with CD
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 and 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*
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