

# CAVACURMIN® – DISPERSIBLE CURCUMIN WITH SUPERIOR BIOAVAILABILITY

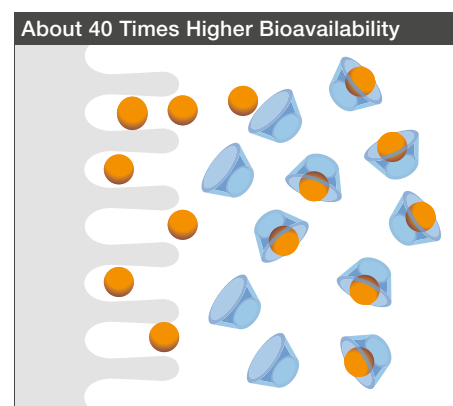
Curcumin and its derivatives, demethoxy-curcumin and bis-demethoxy-curcumin, commonly called curcuminoids, are the main active ingredients of the turmeric rhizome. Turmeric (botanical name: “*Curcuma longa*”) has been widely used for centuries in the traditional Ayurvedic approach to nutrition. Modern science has provided a solid basis for such uses and current clinical trials make curcumin one of the best investigated natural compounds to date. Supplying the body with beneficial amounts of curcumin can be difficult, as it is insoluble in water and thus poorly bioavailable. CAVACURMIN® eliminates these problems.

The extensive pharmacological activities of curcumin are related to its ability to regulate various cellular processes and to act as a free-radical scavenger. While the bioavailability of diet-derived polyphenols varies greatly, curcumin is known to show very poor uptake efficiency. Translating the physiological activities of curcumin into clear benefits has thus proven difficult. Poor absorption in the digestive tract and rapid metabolism are the two main reasons for the lack of systemic availability. These circumstances limit curcumin's ability to reach its targets and exert its beneficial action.

Although it is a helpful strategy to use curcumin in dietary supplements to provide larger amounts of curcuminoids, many products that are available on the market cannot ensure adequate bioavailability.



Turmeric extract's molecules are hydrophobic and therefore agglomerate in the human body. As a result, only a few molecules are absorbed in the gut.

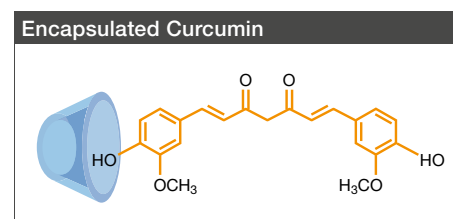


By creating a molecular dispersion through encapsulation of curcumin in gamma-cyclodextrin, much larger numbers of curcumin molecules are transported to the epithelial cell membrane.

## The Solution: CAVACURMIN®

By complexation with the naturally occurring vegetarian oligosaccharide CAVAMAX® W8 gamma-cyclodextrin, which has GRAS approval and is recognized as a novel food ingredient, WACKER offers an excellent solution for increasing the bioavailability of hydrophobic health-promoting ingredients like curcumin. The special feature of this oligosaccharide is its donut-shaped, three-dimensional structure: it creates an inner hydrophobic cavity capable of accommodating a lipophilic molecule like curcumin as a “guest.” The hydrophilic exterior, on the other hand, ensures compatibility in aqueous systems.

In the presence of water, CAVAMAX® W8 gamma-cyclodextrin leads to molecular dispersions, greatly enhancing the bioavailability of the hydrophobic curcumin.



Gamma-cyclodextrin functions as the hydrophilic carrier for hydrophobic curcumin, which is bound by the inner cavity of the gamma-cyclodextrin.

Formulations with CAVAMAX® W8 gamma-cyclodextrins are based on simple van der Waals bonds and do not change the nutritional value or functionality of the ingredient. Thanks to CAVACURMIN®, WACKER now offers a highly bioavailable curcumin powder.

## Human Clinical Study Results

The European Journal of Nutrition published the peer-reviewed study on the exceptional bioavailability of CAVACURMIN® in February 2017. Download the full-length paper at [www.wacker.com/cavacurmin](http://www.wacker.com/cavacurmin)



**Enhanced Bioavailability – How?**

The increased bioavailability seems to correlate with an enlarged surface of curcumin molecules. Pure turmeric extract agglomerates in the human body. Only a few curcumin molecules from the small surface area of the agglomerates will be absorbed, while most are excreted without being absorbed. Creating a molecular dispersion through encapsulation of curcumin with CAVAMAX® W8 gamma-cyclodextrin allows much larger numbers

of these molecules to be transported into the upper intestinal tract, where only the curcumin molecules are absorbed into the body. This is why our human bioavailability study found absorption of CAVACURMIN® to be about 40 times higher (please see additional information sheet).

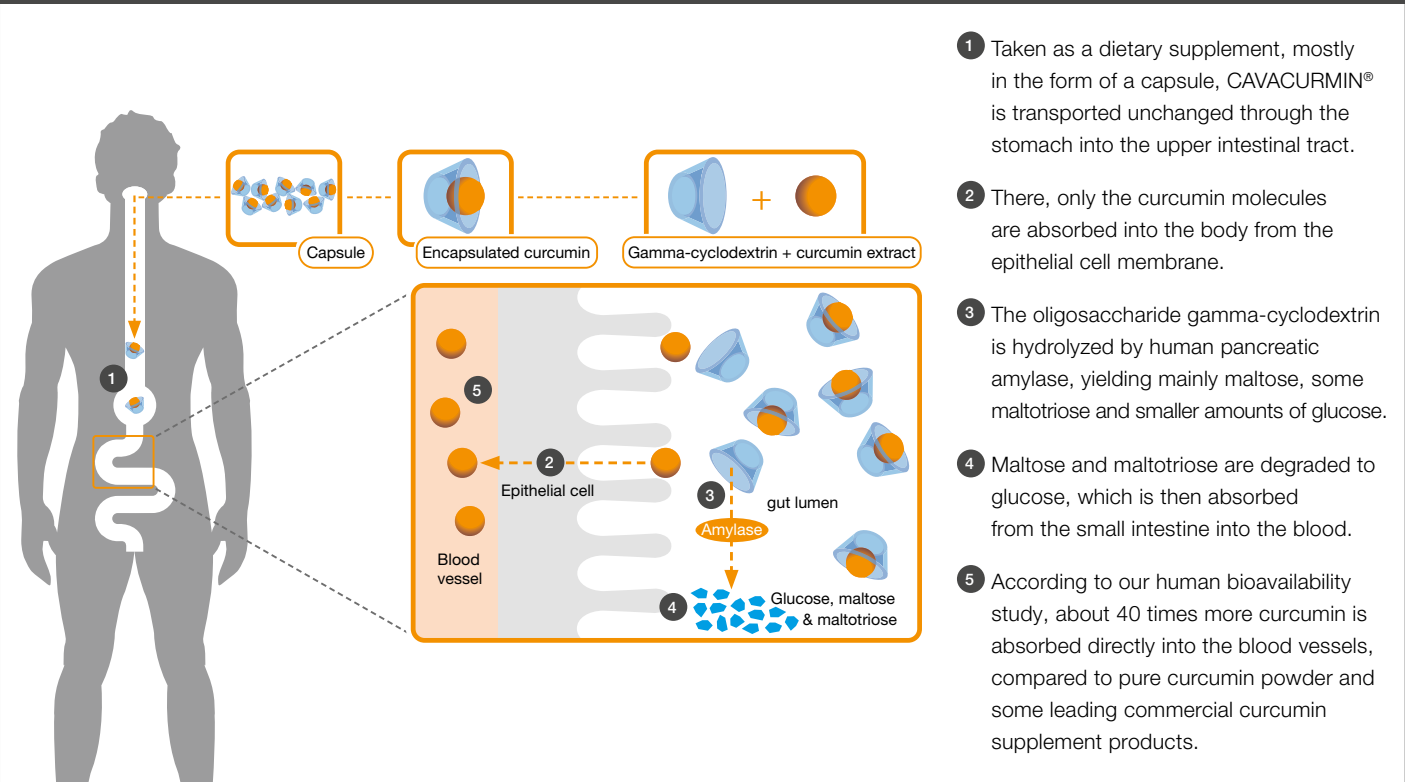
**For a Variety of Applications**

CAVACURMIN® comes as a dry, free-flowing powder. It is thus especially well suited for use in dry or powdery dietary

supplement products, such as tablets, capsules and nutritional bars. Since it disperses easily in aqueous systems, it is also suitable for use in beverages. CAVACURMIN® is produced using a naturally occurring oligosaccharide (not chemically produced) as a hydrophilic carrier: CAVAMAX® W8 gamma-cyclodextrin.

Our experts look forward to partnering with you to help you create the healthy, bioavailable products of tomorrow.

**Mechanism of CAVACURMIN® Absorption**



Wacker Chemie AG, 81671 Munich, Germany, [www.wacker.com/contact](http://www.wacker.com/contact), [www.wacker.com/cavacurmin](http://www.wacker.com/cavacurmin)

Follow us on:

The information provided is addressed to an expert audience only and is available worldwide. It may contain statements that do not apply to your country. As claims do not refer to finished products, but solely to ingredients, they may not conform to Regulation (EC) No. 1924/2006. It is up to the marketer of any finished product to ensure that the finished product containing such ingredients and the claims associated there with are lawful and are in compliance with all valid legislation and regulations of the country or countries where said product is to be sold. The data presented in this medium are in accordance with the present state of our knowledge but do not absolve the user from carefully checking all supplies immediately on receipt. We reserve the right to alter product constants within the scope of technical progress or new developments. The recommendations made in this medium should be checked by preliminary trials because of conditions during processing over which we have no control, especially where other companies' raw materials are also being used. The information provided by us does not absolve the user from the obligation of investigating the possibility of infringement of third parties' rights and, if necessary, clarifying the position. Recommendations for use do not constitute a warranty, either express or implied, of the fitness or suitability of the product for a particular purpose.

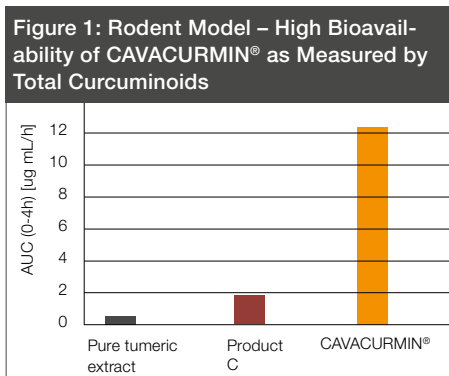
# CAVACURMIN® – SCIENTIFIC EVIDENCE OF SUPERIOR BIOAVAILABILITY

Supplying the body with beneficial amounts of curcumin can be difficult, as it is poorly bioavailable. CAVACURMIN® eliminates these problems.

While the bioavailability of diet-derived polyphenols varies greatly, curcumin is known to show very poor uptake efficiency. Poor absorption in the digestive tract and rapid metabolism limit curcumin's ability to reach targets that are distant from the intestines and exert its beneficial action. Providing larger amounts of curcuminoids through the intake of additional curcumin in dietary supplements may seem helpful, but adequate bioavailability is still an issue.

### The Solution: CAVACURMIN®

WACKER has successfully enhanced the bioavailability of curcumin and now offers the cyclodextrin-based curcumin formulation CAVACURMIN®. Various scientific studies conducted by WACKER have demonstrated high bioavailability by comparing CAVACURMIN® to pure turmeric extract as well as to different commercial curcumin products (A: with turmeric oil, B: phospholipid complex, C: with piperine).



**Total curcuminoids:** sum of free curcumin, curcumin sulfates and curcumin glucuronides.

### In Vivo Bioavailability in a Rodent Model (2009)

#### Setup:

Total concentrations of curcuminoids in the blood plasma (0-4 hours) of Sprague Dawley rats were recorded after one oral gavage (500 mg/kg bw) of three curcumin preparations: pure turmeric extract, a commercial product (Product C) and CAVACURMIN®. Plasma was analyzed for free curcumin and curcumin metabolites (curcumin sulfates and curcumin glucuronides) by HPLC (0-4 hours).

#### Results:

Animals that received CAVACURMIN® had 8 to 20 times more total curcuminoids in their blood plasma (expressed as the sum of free curcumin and its metabolites) than animals that received a commercial product or pure curcumin powder.

#### Conclusion:

This huge difference in HPLC-measured curcumin metabolites indicates that the maximum amount of curcumin was delivered to the blood stream of the rats, which can only be explained by the presence of very highly bioavailable CAVACURMIN® (see Figure 1).

### In Vitro Bioavailability in a Human Caco-2 Model (2011)

#### Setup:

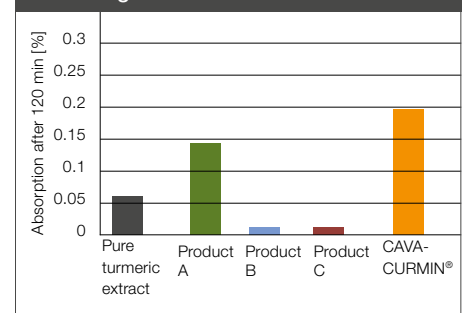
This study investigated the dissolution profile of five curcumin preparations (pure turmeric extract, CAVACURMIN® and three leading commercial curcumin products A, B, C) in simulated intestinal fluid (SIF, 0.5% SDS) followed by the uptake of Caco-2 cells (human intestinal cell model).

#### Results:

CAVACURMIN® dissolved up to five times more efficiently than leading commercial curcumin supplement products or curcumin powder itself.

The following uptake study with human Caco-2 cells also demonstrates the superior performance of CAVACURMIN®. Here uptake was up to 10 times higher than was the case for other leading commercial curcumin formulations or for curcumin powder itself (see Figure 2).

**Figure 2: Caco-2 Model – Absorption of CAVACURMIN® in Comparison to Leading Commercial Products**



#### Conclusion:

These results clearly underscore the significant increase in bioavailability of curcumin in a cyclodextrin-based formulation.

### Human Clinical Study Results

The European Journal of Nutrition published the peer-reviewed study on the exceptional bioavailability of CAVACURMIN® in February 2017. Please see the back page for the summary or download the full-length paper at [www.wacker.com/cavacurmin](http://www.wacker.com/cavacurmin)



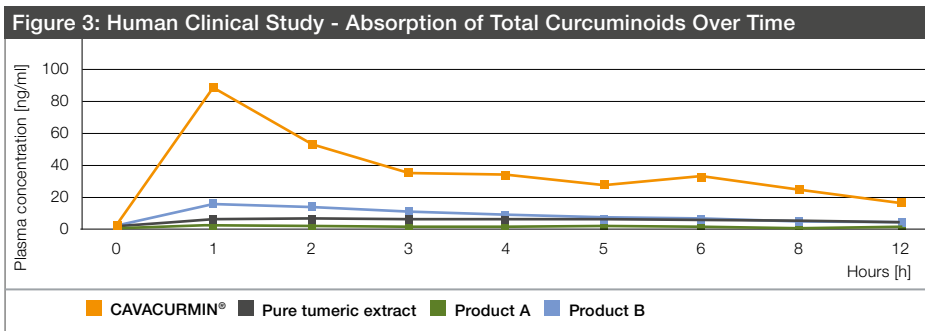
**Human Bioavailability in a Clinical Study (2013)**

**Setup:**

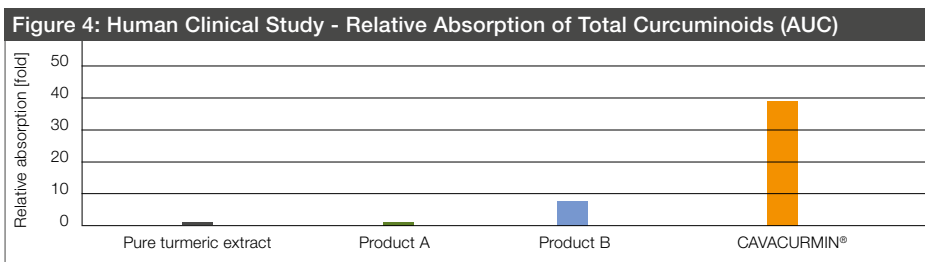
The relative absorption of CAVACURMIN® was compared to a standard 95% turmeric extract and to two leading commercial products (A and B) claiming to have enhanced bioavailability in a clinical setting. In this double-blind, crossover study, 12 individuals (fasted overnight) were given ~ 376 mg of curcuminoids in capsules (5x more of pure turmeric extract to ensure a measurable intake, which was taken into consideration when calculating the results) with a one-week washout period in between the four formulations. After product intake, blood was drawn hourly for 12 hours and analyzed (spiked plasma samples). Blood concentration and the relative absorption of curcumin and its derivatives were determined.

**Results:**

CAVACURMIN® was about 40 times more efficiently absorbed than leading commercial curcumin supplement products or curcumin powder itself. The highly superior performance of CAVACURMIN® was demonstrated by the fact that curcumin uptake was at least 4.6 times higher than the next-best commercial curcumin formulation in this clinical study (see Figures 3 and 4).



Already 1 hour after ingestion of CAVACURMIN® the curcuminoids concentration in the blood was significantly higher than for all other commercial formulations and remained elevated for 12 hours.



CAVACURMIN® is ~ 40 times more bioavailable than pure turmeric extract. This enables a smaller dosage for the same effect.

**Conclusion:**

These results clearly corroborate the significant increase in bioavailability of curcumin in a cyclodextrin-based formulation. Furthermore, these data suggest that CAVACURMIN® can provide the benefits of the powerful antioxidant curcumin to a much greater extent than existing commercial products.

suited for use in dry or powdery dietary supplement products, such as tablets, capsules and nutritional bars. Since it disperses easily in aqueous systems, it is also suitable for use in beverages. CAVACURMIN® is produced using a naturally occurring oligosaccharide (not chemically produced) as a hydrophilic carrier: CAVAMAX® W8 gamma-cyclodextrin.

**For a Variety of Applications**

CAVACURMIN® comes as a dry, free-flowing powder. It is thus especially well

Our experts look forward to partnering with you to help you create the healthy, bioavailable products of tomorrow.



[www.wacker.com/contact](http://www.wacker.com/contact)



Wacker Chemie AG, 81737 Munich, Germany, [www.wacker.com/contact](http://www.wacker.com/contact), [www.wacker.com/cavacurmin](http://www.wacker.com/cavacurmin)

Follow us on:

The information provided is addressed to an expert audience only and is available worldwide. It may contain statements that do not apply to your country. As claims do not refer to finished products, but solely to ingredients, they may not conform to Regulation (EC) No. 1924/2006. It is up to the marketer of any finished product to ensure that the finished product containing such ingredients and the claims associated therewith are lawful and are in compliance with all valid legislation and regulations of the country or countries where said product is to be sold. The data presented in this medium are in accordance with the present state of our knowledge but do not absolve the user from carefully checking all supplies immediately on receipt. We reserve the right to alter product constants within the scope of technical progress or new developments. The recommendations made in this medium should be checked by preliminary trials because of conditions during processing over which we have no control, especially where other companies' raw materials are also being used. The information provided by us does not absolve the user from the obligation of investigating the possibility of infringement of third parties' rights and, if necessary, clarifying the position. Recommendations for use do not constitute a warranty, either express or implied, of the fitness or suitability of the product for a particular purpose.