

## **CURCUMIN STUDIES**

### **Chemical studies on antioxidant mechanism of curcuminoid: analysis of radical reaction products from curcumin.**

J Agric Food Chem. 1999 Jan; 47(1): 71-7.

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In the course of studies on the antioxidant mechanism of curcumin, its radical reaction was investigated. Curcumin was reacted with radical species, which were generated from the pyrolysis of 2, 2'-azobis(isobutyronitrile) under an oxygen atmosphere, and the reaction products from curcumin were followed by HPLC. The reaction at 70 degrees C gave several products, three of which were structurally identified to be vanillin, ferulic acid, and a dimer of curcumin after their isolation. The dimer was a newly identified compound bearing a dihydrofuran moiety, and its chemical structure was elucidated using spectroscopic analyses, especially 2D NMR techniques. A mechanism for the dimer production is proposed and its relation to curcumin's antioxidant activity discussed. The time course and gel permeation chromatography studies of the reaction were also investigated, and the results indicate that the dimer is a radical-terminated product in the initial stage.

REASON TO TAKE CURCUMIN W. 5 HTP:

### **Protection of radiation-induced protein damage by curcumin.**

Biophys Chem. 2001 Aug 30; 92(1-2): 119-26.

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Free radical reactions of lysozyme (Lz), tryptophan and disulfides were studied with curcumin, a lipid-soluble antioxidant from turmeric, in aqueous solution using a pulse radiolysis technique. The binding of curcumin with lysozyme was confirmed using absorption, fluorescence and stopped-flow techniques. The free radicals of curcumin generated after repairing radicals of disulfides, lysozyme and tryptophan absorb at 500-510 nm. Implication of this in evaluating the antioxidant behavior of curcumin in protecting proteins is discussed.

### **Theoretical elucidation on the antioxidant mechanism of curcumin: a DFT study.**

Org Lett. 2002 Aug 22; 4(17): 2909-11

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[reaction: see text] Bond dissociation enthalpies (BDEs) for the curcumin-related compounds have been calculated using density functional theory (DFT) methods. It was found that the antioxidant mechanism of curcumin was a H-atom abstraction from the phenolic group, not from the central CH<sub>2</sub> group in the heptadienone link. Curcumin, methylcurcumin, and half-curcumin had similar O-H BDEs, indicating that the two phenolic groups in curcumin were independent of each other.

### **Structural identification of new curcumin dimers and their contribution to the antioxidant mechanism of curcumin.**

J Agric Food Chem. 2002 Apr 24; 50(9): 2524-30.

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As a part of the research project on the elucidation of the chain-breaking antioxidant mechanism of natural phenolics against the oxidation of food components, curcumin, a main turmeric pigment, was investigated. A relatively high concentration of curcumin gave three dimers as radical termination products in addition to the coupling products with curcumin and the lipid hydroperoxide. The structural analysis of these dimers and quantitative analysis of their production rates revealed that radical-radical termination mainly occurred at the 2-position of curcumin. The contribution of the pathway for production of these dimers to the antioxidant mechanism of curcumin was estimated from the concentration-dependent data of the antioxidant activity and formation rates of these termination products. The A-A termination (dimer formation) was estimated to contribute at least about 40% of the entire antioxidant process against ethyl linoleate oxidation.

Zhonghua Er Ke Za Zhi. 2003 Dec; 41(12): 940-4

### **Protective effect and mechanism of pretreatment with curcumin on infectious brain edema in rats**

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Curcumin is a natural compound extracted from the spice tumeric, possessing both anti-inflammatory antioxidant, and anti-carcinogenic effect, is a potent stimulator of the stress-induced expression of heat shock protein 70 kd (HSP70). OBJECTIVES: To study the protective effect of pretreatment with curcumin against infectious brain edema in rats, and investigate its mechanism by assessing the free radical, cytokine and HSP70 expression of the brain. METHODS: An animal model of infectious brain edema induced by injecting pertussis bacilli (PB) through carotid artery was used. SD rats were randomly divided into five groups: (1) Normal control group (NS group, n = 9); (2) Infectious brain

edema group (PB group, n = 12); (3) DMSO control group (DMSO group, n = 9); (4) HS pretreatment group (HS group, n = 9); (5) Curcumin pretreatment group (CUR group, n = 13). The water content (WC), Na(+) and K(+) content in brain tissue were measured. The content of malondialdehyde (MDA) and super oxide dismutase (SOD) were assessed by chemical colorimetry. The levels of tumor necrosis factor alpha (TNF-alpha) and interleukin-1beta (IL-1beta) were detected by ELISA. The HSP70 expression was examined by Western blot analysis. RESULTS: (1) The WC and Na(+), MDA, TNF-alpha and IL-1beta were increased in PB group compared with NS group ( $P < 0.01$ ); they were decreased in HS and CUR groups compared with PB group ( $P < 0.01$  or  $P < 0.05$ ). (2) The content of SOD was decreased in PB group than in NS group ( $P < 0.05$ ), and was increased in HS and CUR group Compared with PB group, ( $P < 0.05$ ). (3) Western blot analysis showed that the band density areas of HS, CUR and PB groups were higher than those in NS and DMSO groups, especially in CUR group ( $P < 0.01$ ). **CONCLUSION: Pretreatment with curcumin showed a protective effect against infectious brain edema in rats. The effect might be associated with antioxidant, inhibition of the activity of cytokines and inducing expression of HSP70 by cur**