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Stereoselective Oxidative Addition of Benzenethiol to Idene in the Presence of Ovoalbumin

Short Communication

Jaime Baeza*, Juanita Freer, and **Graciela Palma**

Departamento de Química, Universidad de Concepción, Concepción, Chile

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The oxidative addition of benzenethiol to indene in the presence of ovoalbumin produces only one isomer on the surface of the protein, *trans-anti*-2-phenylsulfinyl-1-indanol. This reaction may be considered as a biomimetic model of detoxification of certain hydrocarbons by the liver.

(Keywords: Cooxidation reaction; Biomimetic reaction; Ovoalbumin)

Stereoselektive oxydative Anlagerung von Thiophenol an Inden in Gegenwart von Ovoalbumin (Kurze Mitteilung)

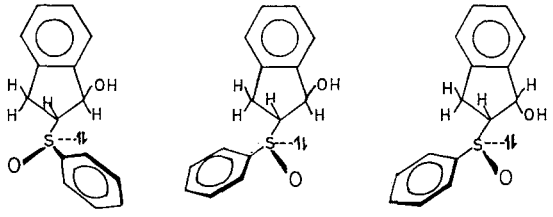
Durch die oxydative Anlagerung von Thiophenol an Inden in Gegenwart von Ovoalbumin bildet sich nur ein Isomer an der Oberfläche des Proteins, das *trans-anti*-2-Phenylsulfinyl-1-Indanol. Diese Reaktion kann als ein biomimetisches Modell der Entgiftung von gewissen Kohlenwasserstoffen durch die Leber betrachtet werden.

The oxidative addition (cooxidation) of benzenethiol to indene produces a mixture of the isomeric 2-phenylsulfinyl indanols: *trans-syn* (**1**), *trans-anti* (**2**), and *cis-anti* (**3**)[1]. When this reaction was carried out in presence of ovoalbumin (*OVA*), pure **2** was exclusively isolated from the surface of the protein.

Equimolar amounts ($2.2 \cdot 10^{-2}$ mol), of freshly distilled thiophenol and indene were added to a heterogeneous mixture of *OVA* in hexane (60 ml). After stirring this mixture at room temperature for two days and continously bubbling of oxygen the solid phase was separated from the solution and washed with chloroform. Both, the hexane and $CHCl_3$ solutions, were successively washed with a 10% solution of $Na_2S_2O_3$, a dil. NaOH aq. solution, and water. The hexane solution was dried over

drierite and the solvent was evaporated. The residue thus obtained corresponds to a typical mixture of cooxidation products. On the other hand, the chloroform phase, which was worked up in the same way, yielded only, as shown by TLC on silica plate ($R_f = 0.55$ using 10% ethyl acetate − 90% hexane), *trans-anti*-2-phenylsulfinyl-1-indanol (*2*), m. p. 101° (lit.[1] 101°).

^{1}H-NMR ($CDCl_3$) δ (ppm): 2.53 (s, 1 H, OH, identified by exchange with D_2O); 2.76 (dd, 1 H, H-3, $J_{2-3} = 3.8$ Hz, $J_{3-3} = 8{,}5$ Hz); 3.45 (dd, 1 H, H-3′, $J_{2-3'} = 3.8$ Hz, $J_{3-3'} = 8.5$ Hz); 3.72 (m, 1 H, H-2); 5.03 (d, 1 H, H-1, $J = 2.8$); 7 −7.7 (m, 9 H, aromatics). [Hydrogens 1, 2 and 3 were identified by displacement with Eu(*DPM*)$_3$]. IR (KBr): 3 250 (OH) 1 060 (S=O) cm^{-1}. MS (70 eV, 80 °C), m/*z* (%): 242 $[M-O]^{+\cdot}$ (24), 224 (12), 133 (69), 132 (93), 115 (100), 110 (70), 109 (45), 91 (36), 77 (84), 65 (50).



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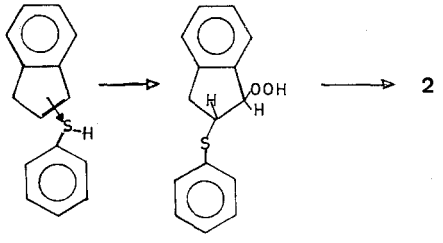

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In order to disregard the possibility that the compound **2** was selectively binding to the protein another reaction was run in the absence of *OVA*. After 48 hours the bubbling oxygen was stopped, 27 g of *OVA* was added and the mixture was stirred for several hours. From the hexane and $CHCl_3$ solutions the same typical mixtures of cooxidation products were isolated.

The influence of the amount of *OVA* in the yield of formation of **2** was also examined. When the *OVA* content was increased from 9 to 27 g the

percentage of **2** isolated from the protein increased 2.3 times (from 18 to 41%).

The cooxidation reaction has been extensively studied[2]. It has been postulated that the formation of the *trans* isomers goes via a "bridged" sulfur radical, while the "open" radical originates both, the *trans* and the *cis* isomers. However, in the presence of *OVA,* the protein furnishes an environment in its binding domain and the adduct **4** will end in the *trans* hydroperoxide **5**. In the absence of a reducing agent the formation of the hydroxisulfide is not possible and the final product is the hydroxysulfoxide, but on the surface of the protein only the isomer **2** is formed. This result is in agreement with others published elsewhere, in which an asymmetric oxidation of sulfides has been found in the presence of a protein[3].

This reaction may be considered as a model of the detoxification mechanism of aromatic, unsaturated and halogenated hydrocarbons by the liver of a number of animals. In this reaction the glutathione-S-transferases catalyze the hydrocarbon condensation with glutathione[4].

We are continuing our studies to provide some insights into the detailed reaction mechanism and to extend the present reaction to other systems.

Acknowledgement

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