

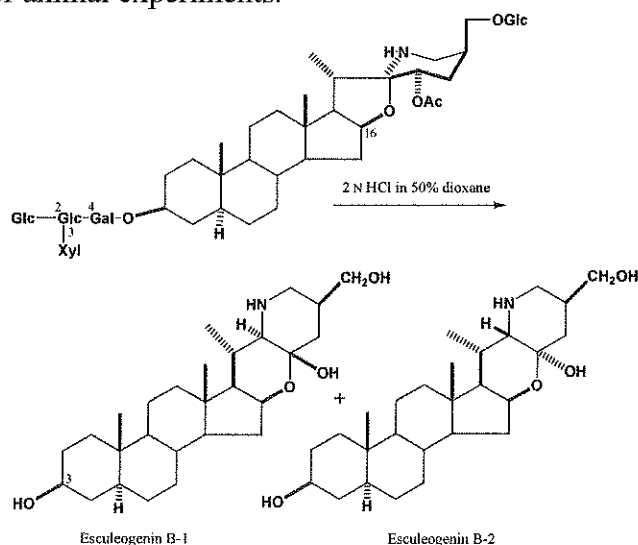
## Study on Tomato-Saponin and Onion Sulfide (Biotechnological Production of Natural Products)

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Belief in the medicinal power of foods is not a recent event but has been a widely accepted philosophy for generations. Hippocrates, the father of medicine stated almost 2,500 years ago, "Let food be thy medicine and medicine be thy food". Today, the belief in the health benefits of selected foods and their components appears to increase. The consumers are aware of the fact that a healthy diet is important and necessary for improving human health. An increasing number of scientific studies is supporting the knowledge that food is an important factor for preventing many of the chronic disorders and diseases. I have been interested in vegetables which are expected to have many biological activities. Among them, I have focused on the sciences of tomato (*Solanum lycopersicum* L.) and onion (*Allium cepa* L.).

Regarding to tomato, I have clarified a chemical interrelation between esculeoside A and esculeogenin B, which is a rare naturally occurring substance. A chemical conversion of spirosolane skeleton-type, esculeoside A, into solanocapsine-type skeleton, esculeogenin B, has successfully been attained by acid hydrolysis using 2 N HCl in a solution of dioxane and water (1:1) to yield two kinds of esculeogenin B. Its mechanism of conversion has been deduced. Now it has become possible to prepare esculeogenin B for animal experiments.



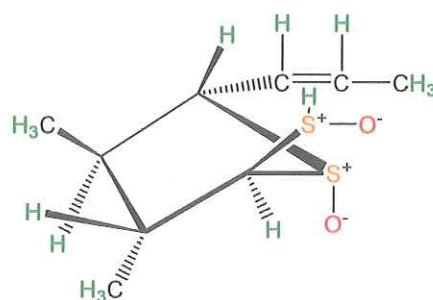
Acid Treatment of Esculeoside A (1) with 2 N HCl in Dioxane and Water (1:1)

Next, I have determined the content variations of tomato-saponin, esculeoside A in the fresh tomato, tomato boiled in water, tomato heated using a microwave oven, freeze-dried tomato, and commercially available tomato products contained in plastic bottles and cans in order to develop a health food. The yields of the tomato-saponin, esculeoside A, in the mini and midsize tomatoes were approximately four times that of

Momotaro tomato. The tomato-saponin was not decomposed or changed upon heating or upon heating under far-infrared light or using a microwave oven. In commercial juices and cans, tomato-saponin could not be found.

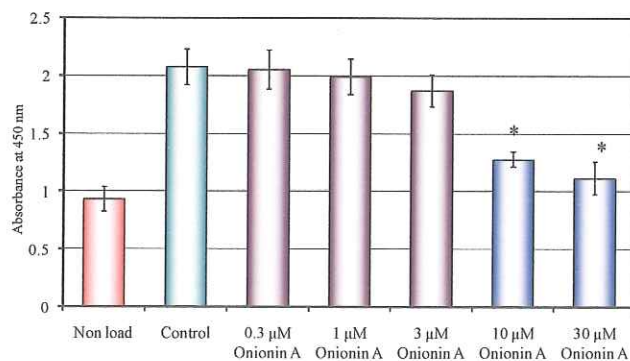
We have developed a tomato-health food with co-operation of a company (N.D.R. Co., Ltd.) and are trying to apply for persons suffering from high blood pressure, high blood sugar level, and atopic dermatitis to accumulate the data for future use.

Meanwhile, onion is the most widely used *Allium*. It is a rich source of organosulfur compounds, which are mainly responsible for many biological activities. I have isolated a compound onionin A from the acetone extracts of bulbs of onion. It is a novel, stable, sulfur-containing compound, and its structure has been characterized as 3,4-dimethyl-5-(1Z-propenyl)-tetrahydrothiophen-2-sulfoxide-S-oxide. The biosynthetic pathway for production of onionin A could be estimated.



Onionin A

Then, we have examined the inhibitory effect of onionin A on CD163 expression by cell-ELISA. We have found that onionin A significantly inhibited CD163 expression; this finding suggests that onionin A has a potential to suppress tumor cell proliferation by inhibition of M2 macrophage polarization.



Data are presented as the mean  $\pm$  SD. \*  $p < 0.001$  vs. control

Effect of Onionin A on CD163 Expression

For exhibiting maximum biological activities from tomato, tomato should be used as a fresh juice homogenized with water or freeze-dried. On the other hand, onion should be taken in raw (uncooked) since onion contains beneficial sulfur compounds which are destroyed by cooking.