# Extraction efficiency and effective utilization in Quercetin

## ～Effectively use waste～

○Rei Yamazaki[1], ○Kan Furumido[1], Motohiko Ukiya[2]

Abstract: Quercetin has an ultraviolet absorbing effect and an antioxidant effect, and if it does not exceed the fixed amount, it has a good effect on the human body. Therefore, we conducted an experiment to extract quercetin efficiently and investigated the extraction efficiency.

Quercetin is a type of polyphenol. Polyphenols have UV absorption, anti-aging, blood pressure increase, and antioxidant properties. In it, we focused on the antioxidant activity of quercetin.

First, we thought about the efficient extraction of quercetin, and conducted an experiment on the extraction efficiency.

The solvents used were ethyl acetate and diethyl ether. The reason for using them is that they are known as common organic solvents, are also available in school drug stores, are easily available, and have been used in previous studies.

Next, we will explain the experimental method. Soak 6.0 g of onion rind in 80.0 ml of a mixed solvent of ethyl acetate and diethyl ether and reflux at 40 ° C for 30 minutes. And, the solution produced in this process is suction filtered to separate the onion rind. Use an evaporator to concentrate. The filtrate is then concentrated using an evaporator. Finally, the precipitated crude crystals of quercetin are subjected to column chromatography and their mass is measured. This time, we conducted experiments while changing the ratio of the two solvents, and investigated which ratio had the highest extraction efficiency.

Results and considerations. From the table and graph, it was found that the highest amount of quercetin could be extracted when ethyl acetate and diethyl ether were 4: 6. In addition, when the purity of the precipitated crude crystals was analyzed using NMR, the results are as shown in the figure. From this figure, it was found that the crude crystals we precipitated were very pure.

From this, we thought that the closer the ratio of both solvents was, the more could be extracted. Also, in the previous experiment, ethyl acetate and ethanol were used as the solvents, but the result was also the most extracted at 4: 6, so we have a ratio of 4: 6 and it is easy to extract. I wondered if it had something to do with it. Therefore, I would like to conduct similar experiments on other solvents such as methanol to investigate the relationship. That concludes the explanation of quercetin extraction.

We said before, quercetin has many actions. For instance, UV absorption effect, gene expression inhibitory effect, anti-aging effect, blood pressure increase inhibitory, blood sugar level increase inhibitory effect, antioxidant effect, and so on. These are common to polyphenols. However, quercetin itself has a very strong antioxidant power, so it is easy to participate.

Accumulation of active oxygen that is harmful to the human body causes cancer, arteriosclerosis, heart disease, and stroke. Since the electronic state of oxygen is unstable, they have a strong ability to extract electrons from surrounding substances. By the attack of active oxygen, fat is transformed into peroxide, protein is denatured, enzyme is inactivated, nucleic acid is structurally damaged, and active oxygen is produced everywhere in the body. This causes the illness I mentioned earlier. Antioxidants prevent them. Antioxidants include polyphenols, vitamins and carotenoids. Antioxidants have the power to reduce active oxygen to make it harmless and at the same time oxidize itself. This is called antioxidant activity.

The radicals that appear in this equation are explained. Radicals are atoms, molecules, or ions that have unpaired electrons in active oxygen. One of the radicals is hydroxyl radical, which is the most reactive of active oxygen. It abstracts hydrogen from the sugar portion of DNA and radicalizes it to cleave the DNA strand and also acts on the DNA base portion to produce oxidative damage to the DNA base. In this way, the oxidation reaction takes place. Finally, biological components are converted into S•. It is a radical initiation reaction, Next, S• and oxygen combine to form S-OO•. Then, S-OO • reacts with biological components to form S-OOH and S•. This is the oxidation reaction. Then, S-OO • and AH (antioxidant) react to produce S-OOH and A •. Eventually, the radical termination reaction causes A • to stabilize. It is a radical initiation reaction, and reactions 2 to 4 are radical growth reactions. This is how the antioxidant reaction takes place.

---

1: Sapporo Nihon University High School　2: Department of Materials and Applied Chemistry, CST., Nihon-U.

It changes to the biological component S •. This is the radical initiation reaction. Next, S • and oxygen combine to produce S-OO •. Then, S-OO • reacts with the biological component to form S-OOH • and S •. This is the oxidation reaction. Then, S-OO • and AH (antioxidant) react to produce S-OOH and A •. This is the radical growth reaction. Eventually, the radical termination reaction causes A • to stabilize. This is how the antioxidant reaction takes place.

Therefore, the five phenol groups found in the structure of quercetin are deeply involved in the antioxidant effect.

As a result, we were able to extract high-purity quercetin, and when the ratio of the two solvents was close, we were able to extract the most. We also focused on the antioxidant activity of quercetin and conducted research.

The ultimate goal of this study is to find the types and proportions of quercetin that can be efficiently extracted, to discover why this is so, and to elucidate the mechanism by which functional groups involved in antioxidant activity work is.