Selenium can be divided into 2 categories: organic and inorganic. The organic forms contain carbon, while the inorganic forms do not. The primary inorganic forms of selenium are selenite ($\text{SeO}_3$) and selenate ($\text{SeO}_4$). Selenite and selenate are not commonly found alone in nature; they are usually complexed with sodium to form sodium selenite ($\text{Na}_2\text{SeO}_3$) and sodium selenate ($\text{Na}_2\text{SeO}_4$).\(^1\)

The most common organic form of selenium is selenomethionine. The structure of selenomethionine is shown above the structure of the amino acid methionine in the figure below.

\[
\begin{align*}
\text{Selenomethionine} & : & \text{Selenocysteine} & : & \text{Methylselenocysteine} \\
\text{Methionine} & : & \text{Cysteine} \\
\end{align*}
\]

Figure 8.71 Structures of organic forms of selenium & similar sulfur-containing amino acids

In comparing the structures of selenomethionine or methionine, you can see that the only difference is that selenium has been substituted for the sulfur (S) atom in methionine. Selenocysteine is considered the 21st amino acid by some, because there is a codon that directs its insertion into selenoproteins. Like selenomethionine vs. methionine, the only difference between selenocysteine and cysteine is the substitution of selenium for sulfur. The last organic form is methylselenocysteine (aka Se-methylselenocysteine). Notice that its structure is like selenocysteine, but with a methyl group added (like the name suggests).

The selenium content of plants is dependent on the soil where they are grown. As shown below, soil selenium levels vary greatly throughout the United States, meaning that the selenium content of plant foods also greatly
Inorganic forms of selenium are commonly used in supplements. Selenomethionine is the most common organic form of selenium in supplements and food. It is found in cereal grains such as wheat, corn, and rice as well as soy. Yeast are typically used to produce selenomethionine for supplements.

It should be noted that selenomethionine accumulates at much higher levels in the body than other forms of selenium. This is because it can be nonspecifically incorporated into body proteins in place of methionine. However, despite accumulating at higher levels, selenomethionine is less effective than the methylselenocysteine in decreasing cancer incidence or growth in animal models. However, it is not common to find methylselenocysteine as selenomethionine, because methylselenocysteine is a form that plants accumulate to prevent selenium from becoming toxic to themselves.

Subsections:

8.71 Selenoproteins
8.72 Selenium Absorption, Excretion, Toxicity & Its Questionable Deficiency
References & Links

Links