

Insight of mineral water

The variety of mineral and spring waters out there is mind boggling! Each mineral or spring water has its own geological origin and therefore its own unique mineralization.

This series, compiled in cooperation with Doemens Academy, aims to give the interested reader from the beverage trade, catering industry or source company an overview of the diverse nutritional effects, tastes and nutritional value of mineral and spring water as a companion to food and drinks.



Silicon-rich mineral waters

Geology

Silicon, an element with the chemical symbol "Si," is the second most common element – behind oxygen – in the earth's crust. It is found in the structures of many living organisms such as diatoms or sea sponges and also provides structure for many plants. Silicon never occurs alone in nature, but is always surrounded by oxygen and often other elements.

The most common manifestation is silicates, which are compounds of silicon and oxygen (SiO_2 = quartz) to form feldspar, mica and countless other minerals. Sand also consists mainly of the nearly insoluble SiO_2 . Quartz is only soluble under the influence of carbonic acid, high pressure and high temperature.

In the ocean and other bodies of water, silicon occurs in its dissolved form: silicic acid. It is estimated that almost 600 million tonnes of silicic acid are dumped into the world's oceans by the flow of rivers every year. Since silicic acid is "built into" marine organisms, silicon accumulates on the sea floor after the death of these organisms.

A distinction must be made between "meta-silicic acid" (H_2SiO_3) and "ortho-silicic acid" (H_4SiO_4).

On mineral water and medicinal water labels, silicon content is usually indicated as meta-silicic acid (H_2SiO_3). If the information is given as silicon (Si), silicon dioxide (SiO_2) or orthosilicic acid (H_4SiO_4), conversion can be calculated as follows:

$$1 \text{ mg Si} = 2.14 \text{ SiO}_2 = 2.70 \text{ mg H}_2\text{SiO}_3 = 3.43 \text{ mg H}_4\text{SiO}_4$$

Nutritional-physiological significance

Silicon accounts for about 20 mg per kg body weight of the human body's structure and this proportion decreases with age. It is therefore the third most common trace element in the human body. It is mainly found in bones and connective tissue,

but also in hair, skin and nails, and is therefore often referred to as a "beauty mineral." It also increases the strength of ligaments and tendons.

Silicon is believed to improve the stability and elasticity of artery walls. Recent studies suggest that silicon can protect against dementia and even prevent Alzheimer's disease. One possible reason is that aluminum toxicity is reduced by the forming of aluminum silicates.*

An official daily silicon requirement has not yet been established. Foods rich in silicon include beans, cereals, spinach and potatoes. However, absorption from solid foods is very low due to poor solubility. Availability from liquids is much better, so beverages (such as water, coffee and beer) provide more than 50 percent of the daily requirement of silicon. Mineral and medicinal waters in particular can contribute significantly to silicon absorption, as concentrations of this essential mineral can be as high as 150 mg/l (calculated as meta-silicic acid) and the silicates are already present in dissolved and thus readily available form.

Sensory assessment

Silicic acid is not directly perceptible in mineral water from a sensory point of view because other elements such as sodium and magnesium are more dominant and silicic acid has no appreciable taste of its own. Nevertheless, mineral waters with a higher content of silicic acid are usually described as "soft." Mouthfeel sometimes appears almost oily to creamy and flatteringly viscous, an impression that is mainly perceptible at first sip up to the swallow, giving full body to the mineral water overall.

This velvety soft impression is particularly noticeable in mineral and medicinal waters with low quantities of other minerals. If total mineral content is very high overall, silicic acid is less evident from a sensory point of view, but it can steer the overall impression in the background in a creamier direction and thus round off "hard edges."



Recommendations

Thanks to its “softness,” silicic acid-containing mineral water goes well with creamy desserts, for example, and paired with less spicy main dishes. If mineral waters containing silicic acid are used in food preparation of creams or mousses, they can even increase the viscosity of the food slightly. Silicic acid influence as a mixer with certain wines remains undocumented, as other minerals present themselves as more dominant in this context.

International market overview (without guarantee and not exhaustive):

Mineral waters with high silicon content	Country	Meta-silicic acid [mg/l]
Rogaska, Donat-Quelle	SLO	156
Nürburg Quelle Classic	GER	120
Dreiser Sprudel / Medium	GER	111
NOQ Neue Otto Quelle	GER	103
Hirschquelle Vital	GER	101
Ferrarelle	ITA	85
Magnesia Extra	CZE	82
Rhätzünser	SUI	64
Tönissteiner Naturell	GER	50
Kondrauer	GER	47

Low mineralized mineral waters

Certification

In the past, in Germany and in Eastern European countries, only waters with at least 1,000 mg/l total mineralization could obtain official designation as natural mineral water. After the Member States of the European Community in 1980 (in the form of a European Mineral Water Directive) coordinated their certification processes, this requirement was dropped. Since then, natural mineral waters have been labeled “low in minerals” if the concentration of minerals does not exceed 500 mg/l and even “very low in minerals” if the concentration of minerals does not exceed 50 mg/l.

Geology

Low mineralized mineral waters mostly originate from glacial sand and gravel deposits. Almost no minerals can be dissolved from these rocks. Natural carbon dioxide is also very rarely found in these deposits, so that solubility of carbonic acid remains very low.

Nutritional-physiological significance

In balneology, the science of therapeutic use and healing effects of water, waters low in minerals are recommended for their diuretic effect (excretion of larger quantities of fluid than supplied), among other things as a cure for gout and for gout prevention. In naturopathy, there is also the view that forced diuresis increases the body's detoxification capacity. According to this doctrine, low mineralized waters are ideal for “purification cures.” These waters are an excellent solvent for removing deposits from the body. For this reason, very low mineralized waters are commonly seen on health food supplier's shelves.

Sensory assessment

You might think that the lower the mineral content, the more neutral the taste. Even when we're not eating or drinking, our saliva, which has a mineral concentration of several hundred milligrams per liter, still flows through the mouth. We experience this substance as “neutral,” so that even waters with a similar total mineralization have a mostly neutral taste. In contrast, extremely low mineralized water ($\leq 50 \text{ mg/l}$) causes a haptic sensation in the oral cavity, which most people describe as slightly bitter. If low mineralized waters are carbonated, they show a distinctly refreshing, strongly acidic note, as the low mineralization offers no buffering effect.

Recommendations

These waters are best paired with lighter foods, such as fresh summer salads or steamed fish, as the fine aromas from these dishes can develop to their fullest. Low mineralized waters are also ideal for mixers with fruit juices. When preparing spritzers, the acids from the fruit can unfold fully, so that the unadulterated character of the juice is always present. They can also be perfectly paired with the sweeter white wines, as the limited acidity of the mineral water helps form an optimal sweet-acidic balance. □

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Reference: *) From: DER MINERALBRUNNEN 05/2015;
Dr Johannes Naumann “Can silicic acid in mineral water prevent Alzheimer's disease?”