

*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.*



## Mineral waters that contain sulfate

### Geology

The most common manifestation of sulfate ( $\text{SO}_4^{2-}$ ) is gypsum, or water-containing calcium sulfate ( $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ ), found as a translucent to whitish crystal in caves. Gypsum, especially when combined with other minerals, accumulates over large areas when seawater evaporates, creating whole deserts of gypsum.

Gypsum deposits are common in Southern Germany and Switzerland. More than 200 million years ago, seawater was forced back out of this region, leaving deposits of calcium sulfate in the prevailing warm and dry climate, which were covered by layers of other minerals to form the familiar rock found in this geologic zone. Mineral waters supplied from this region quite naturally contain a higher level of sulfates.

### Market overview (neither guaranteed nor complete)

Mineral and spring waters with a high proportion of sulfates	$\text{SO}_4^{2-}$ [mg/l]	Country
Rogaska Donat Mg	2100	Slowenia
Hepar Mg	1530	France
Bella Fontanis	1490	Germany
Ensinger Sport	1463	Germany
Eptinger	1445	Switzerland
Aqua Römer	1382	Germany
Steinsieker	1360	Germany
Residenzquelle	1280	Germany
Adelbodner Mineral	1268	Switzerland
Adello	1127	Switzerland
Contrex	1121	France

In addition to pairing with calcium, sulfate also combines well with magnesium as the rarer kieserite ( $\text{MgSO}_4 \cdot \text{H}_2\text{O}$ ), and in conjunction with sodium it becomes the well-known "Glauber's salt" ( $\text{Na}_2\text{SO}_4$ ). Both can usually be found closer to the sea, as they are formed via water evaporation, thus called "evaporites."

### Nutritional-physiological importance

When mineral water contains more than 200 mg/l of sulfate, it is designated as "sulfate-containing" according to the European Mineral Water Directive 2009/54/EC. Sulfate is essential for the body, yet it can not produce the substance itself.

The bioavailability of sulfate from food and especially from mineral water is very high, so that deficiencies are rare. Sulfate is important for the firmness of skin and hair, is a component of important metabolic enzymes and proteins and supports fat metabolism in liver and bile.

However, sulfate's most important role is in the digestive tract – depending on the concentration it has a mild to severe laxative effect. Thus, sulfate-containing mineral and spring waters from 1,200 mg/l are often used to prepare for a period of fasting and to help combat digestive problems.

Water that is used for the preparation of baby food may therefore not contain more than 240 mg/l of sulfate (legal requirement in Germany).

### Sensory assessment

Sulfate-containing waters show a slightly bitter note at high concentrations. However, the same applies here as with the other anions (such as chloride ( $\text{Cl}^-$ ) and bicarbonate ( $\text{HCO}_3^-$ )), namely that the sensory



impression is dominated by positively charged counterions.

In conjunction with sodium, sulfate causes a pleasantly salty impression. As calcium sulfate, it gives the water an intense mouthfeel with an almost grainy sensation. And in combination with magnesium, sulfate unveils a bittersweet taste, colloquially referred to as “Epsom salts.”

### **Recommendations**

Sulfate-rich mineral waters are the companion of choice for heavier meals. Due to their complex taste, they go well with grilled and roasted meats and vegetables, but also add a spicy touch to salads.

Sulfate-containing mineral waters are also suitable as a digestive. Since alcohol has no influence on the digestive effect (some studies even show that the alcohol inhibits digestion), feel free to reach for this alcohol-free alternative. Due to the mild laxative effect of sulfate, food is digested more completely. People who eat fatty foods often reach for a “digestive schnapps”, yet a carbonated, sulfate-rich mineral water makes more sense because carbonic acid emulsifies fats better, which helps make fatty foods much easier to digest. □

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