



## Technical Report

# Allergies to Sulfur Compounds?

## The Confusion between Sulfates, Sulfites, and Sulfa Drugs

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## **Allergies to Sulfur Compounds?**

### **The confusion between Sulfates, Sulfites and Sulfa drugs**

*Consumers who are allergic to sulfa drugs or have had reactions to sulfites in foods are often concerned about potential reactions when using dietary supplements containing sulfates or sulfur (i.e., glucosamine sulfate, chondroitin sulfate, MSM etc.). This practical report will help clear up some of the confusion between these similar compounds, while dispelling the notion that someone can be allergic to sulfates or sulfur in general. Simply put, sulfur in the form of sulfate is a necessary component to life and will not result in adverse reactions, while sulfa drugs and sulfites are sulfur derivatives with potentially harmful reactions in sensitive individuals. The following information will provide reference to and help distinguish these sulfur compounds.*

#### **Elemental Sulfur**

Sulfur is the common denominator in these compounds, although it is not inherently harmful. Sulfur is naturally contained in a number of minerals and is the eighth most common element found in our body. For us to receive this necessary nutrient, we obtain organic sulfur complexes through our food. Particularly rich sources include garlic, sunflower seeds, soybeans, lentils, and yogurt. Every living cell in our body contains vital sulfur molecules. A number of these molecules are the proteinogenic amino acids, methionine and cysteine. Additional sulfur compounds include heparin, chondroitin sulfate, keratin, thiamin, biotin, lipoic acid and coenzyme A, to name a few.

#### **Sulfate: An Important Dietary Compound**

Sulfate, a compound of sulfur and oxygen (SO<sub>4</sub>) is crucial to several metabolic pathways. It is used in conjunction with enzymes and as an important electrolyte. Inorganic sulfate serves as an anion required for sulfate conjugation reactions which is important in the detoxification of xenobiotics, catecholamines, steroids, and bile acids. Sulfate is also key to tissue and membrane synthesis (1). Dietary supplements such as glucosamine sulfate, vanadyl sulfate and berberine sulfate are examples of compounds in which the sulfate acts as a stabilizing anion. These compounds are not consumed for their sulfate content per se; however, they may result in a significant sulfur intake by certain individuals. While some people may display an inherent intolerance to one or more of these compounds, such reactions would not be due to the sulfate portion.

#### **Sulfur Associated Concerns**

##### **Sulfites**

Sulfur compounds known as sulfites (SO<sub>3</sub>) have produced reactions in 1%-2% of the Population (2). Commonly found in association with potassium or sodium, sulfites are used primarily as food preservatives. The table below lists the more common sulfiting agents which are applied to a wide variety of foods as antimicrobials and color stabilizers.

**Table 1**

Sodium sulfite	Na <sub>2</sub> SO <sub>3</sub>
Sodium bisulfite	Na HSO <sub>3</sub>
Sodium metabisulfite	Na <sub>2</sub> S <sub>2</sub> O <sub>5</sub>
Potassium bisulfite	KHSO <sub>3</sub>
Potassium metabisulfite	K <sub>2</sub> S <sub>2</sub> O <sub>5</sub>
Sulfur dioxide	SO <sub>2</sub>

There are two postulates which account for reactions to sulfites: One, is that sulfur dioxide vapors given off of sulfited food is thought to be responsible for the associated sensitivities a few individuals exhibit. In this postulate, sulfur dioxide produces a cholinergic reflex when tracheobronchial receptors are triggered. Sulfur dioxide is a known inhalation irritant and may be the reason for sulfite associated asthma attacks since asthmatics are particularly sensitive to sulfiting agents (3). In the second postulate, it is thought that sulfites may accumulate in the bodies of those who are sulfite-oxidase or molybdenum deficient, eventually exhibiting a strong sulfite reaction. Normally sulfites are oxidized into harmless sulfates with the help of sulfite oxidase enzymes and molybdenum, a necessary trace element; then are either synthesized into other useful sulfate compounds or excreted via urine. A lack of sulfite oxidase causes reactions as mild as a headache or as severe as an asthma attack or anaphylactic shock (4). Because of the number of adverse reactions reported to FDA prior to 1985, food labels must now disclose information on any product containing more than 10ppm of a sulfiting agent (3).

#### Sulfa drugs (sulfonamide)

Sulfonamides, or better known as sulfa drugs, were once important antimicrobials now generally replaced by penicillin and its counterparts. Sulfa, short for paraaminobenzenesulfonamide, is any organic compound containing SO<sub>2</sub>NH<sub>2</sub>. Still used in treating urinary tract infections and some fungal diseases it has also been known to cause an allergic reaction in a small portion of the population. Because sulfa drugs are rarely used today, many people may not be aware they may react to sulfa drugs. The reason for a sulfa drug reaction is due to a dysfunctional acetylation pathway which uses the conjugation of acetyl-coA to detoxify the drug. It's the inability of the body to convert the aromatic amine which is first oxidized from sulfamethoxazole into sulfamethoxazolehydroxylamine; typically an unreactive metabolite. From this metabolite it further oxidizes into a nitroso metabolite which is reactive and is in most cases detoxified through acetylation. In a few individuals the nitroso metabolites bind to proteins causing uninhibited production of TNF (Tumor Necrosis Factor), and a suppression of the T-lymphocytes, leading to apoptosis, and resulting in an adverse reaction. In the case of sulfonamides it is the hydroxylamine not the sulfur that poses a toxic threat.<sup>5</sup>

### References

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2 HealthLink web site (<http://www.healthlink.mcw.edu>) copyright Medical College of Wisconsin 2003.

3 Warner Charles R. PhD, et al. Food Testing & Analysis Aug/Sept 2000 "Sulfites: An Important Food Safety Issue."

4 Pizzorno Jr. Joseph and Murray Michael Textbook of Natural Medicine Vol.1; 2nd Ed.1999

5 Knowles Sandra, et al. Drug Safety 2001 "Should Celecoxib Be Contraindicated in Patients Who Are Allergic to Sulfonamides?" issue 24 (4); 239-247.