Manufactured Clinoptilolite Zeolite in a Colloidal Suspension

About The White Paper:

The information presented in this paper is intended for professional education and is sourced from published research, articles, and books. This paper is not intended to serve as the basis for health advice, and should not be considered to replace the care of a licensed health professional.

What is Zeolite?

In simplistic terms, zeolites are microporous aluminosilicate minerals that have the ability to act like molecular sieves. Zeolites have the natural ability to sort molecules based on size as well as molecular charge. (Molecules typically carry a positive or negative charge).

Technically, Zeolites are crystalline, hydrated aluminosilicates of alkali and alkaline earth metals, having infinite, three-dimensional atomic structures. They are further characterized by the ability to lose and gain water reversibly and to exchange certain constituent atoms, also without major change of atomic structure.

In zeolite structures, some of the quadri-charged silicon is replaced by triply-charged aluminum, giving rise to a deficiency of positive charge. The charge is balanced by the presence of singly-and doubly-charged atoms, such as sodium (Na^+), potassium (K^+), calcium (Ca^{2+}), and magnesium (Mg^{2+}), elsewhere in the structure.

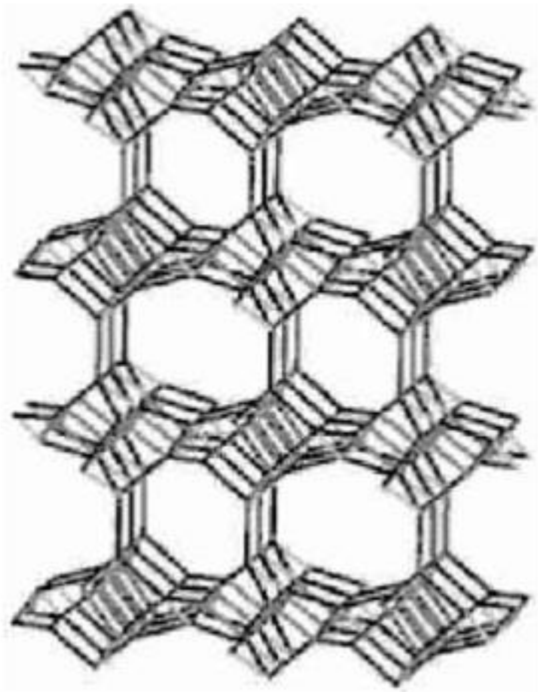
How do zeolites work?

Zeolites are completely inert, or does not react or release in the body in any way. With manufactured clinoptilolite (one of the many forms of zeolite), the crystal structure forms a cage of 8-ring and 10-ring structures that have the natural ability to attract positively charged ions (such as heavy metals) and absorb them.

For manufactured clinoptilolite, atoms or cations (charged metal atoms) aluminum and silicon are known as structural atoms, because with oxygen they make up the rigid framework of the structure. This is why the form of aluminum in zeolites is completely inert and does not react or release in the body in any way. Sodium and potassium are known as exchangeable ions, because they can be replaced (exchanged) more or less easily with other cations in aqueous solution, without affecting the aluminosilicate framework. This phenomenon is known as ion exchange, or more commonly cation exchange. The exchange process involves replacing one singly-charged exchangeable atom in the zeolite by one singly-charged atom in a solution or replacing two singly-charged exchangeable atoms in the zeolite by one doubly-charged atom in a solution.

The magnitude of such cation exchange in a given zeolite is known as its cation-exchange capacity (CEC) and is commonly measured in terms of moles of exchangeable cation per gram (or 100 grams) of zeolite or in terms of equivalents of exchangeable cations per gram (or 100 grams) of zeolite. While the ratio of exchange for ions is fixed, the effectiveness of cation exchange is directly related to the particle size of the zeolite. The smaller the zeolite particle is, the greater the available negatively-charged surface area. A large surface area provides a greater ability to attract positively-charged ions for cation exchange.

Fig. 1. Crystal structure of the zeolite manufactured clinoptilolite with its 8-ring and 10-ring channels.



Health Benefits and Uses of Zeolite:

Zeolites have been investigated in a broad spectrum of uses. Several of these applications take advantage of the adsorption and ion exchange properties of zeolites.

- The property of manufactured clinoptilolite to remove heavy metals has been documented extensively.104, 109

- Recently, two clinical studies involving healthy volunteers and patients suffering from malignant disease and diabetes demonstrated that orally administered natural manufactured clinoptilolite is a potent antioxidant.98

- When applied externally in powder form, zeolite has also been found to quicken the healing of wounds and surgical incisions; in Cuba, manufactured clinoptilolite is commonly used to treat topical wounds in horses and livestock.

- As proven bactericides and fungicides, zeolites have been used to control urinary tract infection and dental plaque formation.99-101

• It is well known that silica particles prevent almost completely the onset of spontaneous diabetes in young BB rats and the destruction of β cells in non-obese mice given cyclophosphamide.102-103

• In mice with alloxan-induced diabetes, natural manufactured clinoptilolite has been shown to avert or diminish some late sequelae of the disorder, such as polyneuropathy.90

• Accumulating evidence has suggested that zeolites may significantly affect the regulation of the immune system. Ueki et al have reported that silica, silicates, and aluminosilicates may act as nonspecific immunostimulators in a manner similar to that of the superantigens (SAgs),104,105 a class of powerful, immunostimulatory bacterial and viral toxins. Unlike conventional antigens, SAgs bind as unprocessed proteins to particular motifs of the variable region of the β chain (Vβ) of the T-cell receptor (TcR) outside the antigenbinding groove and to invariant regions of major histocompatibility complex (MHC) class II molecules on the surface of antigen-presenting cells (APCs). As a consequence, SAgs, in nanogram to picogram concentrations, stimulate up to 10% to 30% of the host T-cell repertoire, whereas in conventional antigenic peptide- TcR binding, only 1 in 105 to 106 T cells (0.01%-0.0001%) is activated. **106** in accordance with this theory, proinflammatory macrophages, which belong to MHC class II APCs, are activated by fibrogenic silicate particles,107,108 and the removal of MHC class II DP/DR+ cells results in a lack of macrophage stimulation by the silicate chrysotile. 104

More recently, Pavelic et al have demonstrated that the lymphocytes from lymph nodes of mice that were fed for 28 days with micronized zeolite manufactured clinoptilolite provoked a significantly higher allogeneic graft-versus-host reaction than did lymphocytes in control mice. After the mice were administered manufactured clinoptilolite intraperitoneally, the number of peritoneal macrophages increased significantly, as did their superoxide anion production. 109

The ability of manufactured clinoptilolite to attract and trap positively-charged toxins:

Manufactured clinoptilolite has a cage-like structure, with pores and channels running through the crystal. The cage and surrounding mineral carries a net negative charge, making it one of the few negatively charged minerals found in nature. Because of its cage-like structure and negative charge, manufactured clinoptilolite has the ability to draw and trap within and on itself **98, 107** positively charged heavy metals and other toxic substances **90,92,97,99,101,106,108,111,121,122.**

The negative charges of the AlO4 units are balanced by the presence of four-exchangeable, positively charged metals known as cations. These cations usually consist of calcium, magnesium, sodium and potassium. These ions are only loosely held and can be readily displaced by other substances, such as toxic heavy metals or other organics. This phenomenon is known as cationic exchange, and it is the very high cationic exchange capacity of zeolites, which provides for many of their useful properties. Another special aspect of this structure is that the pore and channel sizes are nearly uniform, allowing the crystal to act as a molecular sieve. Manufactured clinoptilolite seems to be highly specific for the heavy metals. Research has shown that the smaller the diameter of the metal and the higher the charge of the metal, the greater the affinity it has for the zeolite. Higher charges simply increase the strength of binding with higher binding characteristics. The small size allows for deeper access into the zeolite pores with more points of coordination. As an example of this phenomenon, arsenic has a charge of +3 and an atomic radius of approximately 1.8 angstroms, while potassium has a charge of only +1 and an atomic radius of approximately 2.8 angstroms. The arsenic binds with very high affinity for the zeolite while the potassium has no affinity whatsoever. The manufactured clinoptilolite binds a variety of toxins. This includes heavy metals (Lead, Cadmium, Mercury, etc.), nitrosamines, and others. Cationic exchange is an entirely passive process—when the zeolite is in close proximity to these high-affinity compounds, they will be drawn to the zeolite and either absorbed into the cage or adsorbed onto the surface of the zeolite. There is no chemical activity in this process.

Organics (Non Volatile and Volatile) are also removed by manufactured clinoptilolite**.** **91,92,93,97,99,105,106,108,121**, Organics are not trapped or exchanged in or onto the surface as in heavy metals, but rather are absorbed into and onto the manufactured clinoptilolite using a combination of ionic attraction rather than exchange. This attraction is based on the overall charge of the organic compound with preference given to positive charge points on the molecule itself. Thus, a large molecule such as ammonium citrate will still be removed even though its size is much larger than the particle of zeolite. There are many studies ongoing today to take advantage of this effect. See references 123 to 130 below. While manufactured clinoptilolite is mostly known for heavy metal removal, the ability to, positively affect, the removal of potentially toxic organic compounds at the same time cannot be ignored.

Human Exposure to Environmental Chemicals

In our increasingly industrialized world, the issue of toxic environmental exposure is coming to the forefront as an issue of public health and safety. In the 2009 the "Fourth National Report on Human

Exposure to Environmental Chemicals" (prepared jointly by the Department of Health and Human Services, Centers for Disease Control and Prevention and the National Center for Environmental Health updated 2011) gives a comprehensive look at what the human exposure is in a cross section of Americans. To understand the depth and severity of what the average American is exposed to on a daily basis you can read the full report here: www.cdc.gov/exposurereport/, including updated tables for 2012.

Why a Colloidal form of Advanced TRS?

Advanced TRS is a liquid suspension of manufactured clinoptilolite zeolite in pure water. Advanced TRS is sized to 0.9 Nanometers mean average in size, to allow for detoxification benefits on a systemic level through absorption in all cellular systems. At 0.9 mean nanometers, the particle size is easily able to remain in suspension in pure water. This means there are no areas Advanced TRS cannot access in the body.

A colloidal suspension allows for particles sized so small they can remain suspended inside water molecules, providing a delivery mechanism for manufactured clinoptilolite zeolite throughout the body with increased surface area. *

* These statements have not been evaluated by the Food and Drug Administration. Our products are not intended to diagnose, treat, cure or prevent any disease.

What is a Colloid?

a. A system in which finely divided particles, which are approximately 10 to 10,000 angstroms in size, are dispersed within a continuous medium in a manner that prevents them from being filtered easily or settled rapidly.

b. (Chemistry) Also called colloidal solution, suspension a mixture having particles of one component, with diameters between 10-7 and 10-9 meters, suspended in a continuous phase of another component.

The mixture has properties between those of a solution and a fine suspension.

The American Heritage® Dictionary of the English Language, Fourth Edition

The above definition is useful to understand what exactly Advanced TRS is. It is simply a matter of size. To translate the sizes above, a colloid is between 1 nanometer and 100 Micrometers in size. Advanced TRS is sized to 0.9 nanometers mean average in size. The colloidal suspension of Advanced TRS is sized to form a very stable suspension and is a true colloidal suspension. In effect, the zeolite particles are small enough to fit inside the water molecules, creating a suspension that is colorless, odorless and tasteless.

This offers two distinct advantages: smaller size and increased surface area. With the smaller particle size, it is a logical assumption that the smaller the particle the more efficient it is in getting in the more inaccessible parts of the cellular structure. This smaller size increases the effectiveness in being able to remove toxins from parts of the body that most current zeolites simply will not go due to size. This includes the more dense muscle tissues, parts of the lungs, and other organs that due to enzymatic barriers restrict larger particles of zeolite from entering. A colloidal suspension will have a greater impact for detoxification by being able to go where the finest capillaries flow at a true cellular level.

Well documented safety of colloidal minerals

References 1,5,7 9,13,17,18,19,21,22,23,24,25,26,27,68,71,73,84,86

The safety of colloidal minerals is well studied. Nature supplies colloidal minerals to us in our water supply and foods every day. The safety of colloidal zeolite in the size range Coseva is producing has been as well studied in vitro and in vivo (see above). All of the above references for the safety of colloidal zeolites come from www.pubmed.com and show the in-depth research that has gone into the safety studies for colloidal zeolites. The zeolite has been shown to be biologically inert even at the small size it takes to form a colloidal solution with zeolite. The main characteristics of zeolite are still in place. *

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• The manufactured clinoptilolite zeolite has been recognized as safe, having been granted GRAS status by the FDA (Generally Recognized as Safe).

• Additionally, Manufactured clinoptilolite zeolite has a documented affinity (or preference) for positively-charged heavy metals and toxins and will not remove beneficial nutrients.

• Manufactured clinoptilolite zeolite is not stored in the body, and is excreted via the kidneys within 4-6 hours of ingestion.

• Given the natural hydrophilic nature of zeolites and the increased surface area of Advanced TRS, increasing water intake is suggested to facilitate the body's ability to remove toxins.

• The manufacturing and bottling facilities for Advanced TRS all follow cGMP (Good Manufacturing Practices) in the handling of both the raw materials and the finished product.

The effectiveness of colloidal zeolite

References
2,4,6,140,20,21,22,26,28,31,34,35,36,39,40,41,44,45,46,49,53,54,55,56,61,62,68,78,79,82,85

In addition to the safety of colloidal zeolite, its effectiveness has also been well studied. This directly relates to the small size of the colloidal zeolite particles. The cationic exchange efficiency (CEC) is directly related to the number of aluminum interchanges and cages exposed. In other words, the smaller the zeolite particle is, the greater the number of cages available for heavy metal and toxin removal.

• While it is logical to assume the smaller particle is more effective, the research shows a marked increase in efficiency and amount of heavy metal removal with the reduction in particle size.

• Advanced TRS undergoes proprietary processing to reduce the zeolite particle size to an average of 0.9 nanometers in size.

• The small particle size creates a vast surface area in every serving, delivering an effective cellular detoxification with every spray.*

Organic Compounds.

With a true colloidal suspension, the manufactured clinoptilolite particle is literally inside the individual water molecule and thus suspended by that molecule. That is why the manufactured clinoptilolite will not "settle out" after even a long period of time and why the body accepts the colloidal suspension of manufactured clinoptilolite in areas where it currently will not accept standard sized zeolite. At this size, the charge of the manufactured clinoptilolite zeolite has a greater resonance and will attract and hold these organic compounds.

Summary

1. Manufactured clinoptilolite zeolite is safe and effective, proven in numerous trials involving both people and animals, and is granted GRAS (Generally Recognized as Safe) status with the FDA (Food and Drug Administration).

2. The zeolite Manufactured clinoptilolite is proven safe through its years of safe usage as a supplement for the general population including children.

3. Advanced TRS is bringing to the market the very best that technology and nature can produce, with a manufactured zeolite sized to access the body on a cellular level.*

4. Safety and effectiveness of Advanced TRS is instilled through the stringent protocols from testing the incoming raw material to knowing what is in every bottle of product that reaches the consumer.

5. Advanced TRS represents a safe, effective means to aid the body in detoxification.*

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