WHITE PAPER:

CLINOPTILOLITE ZEOLITE IN A COLLOIDAL SUSPENSION & THE SCIENCE AND RESEARCH OF PURE BODY EXTRA STRENGTH

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?

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.

Along with quartz and feldspar minerals, zeolites are three-dimensional frameworks of silicate (SiO4) tetrahedra in which all four corner oxygen's of each tetrahedron are shared with adjacent tetrahedra. If each tetrahedron in the framework contains silicon as its central atom, the overall structure is electrically neutral, as is quartz $(SiO)^2$.

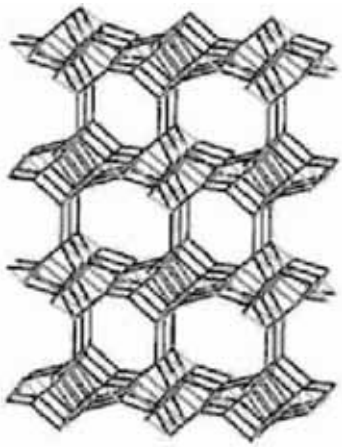

Fig. 1. Crystal structure of the zeolite clinoptilolite with its 8-ring and 10-ring channels.

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 (Ca2+), and magnesium (Mg2+), elsewhere in the structure.

The empirical formula of a zeolite is of the type:
M2/nO • Al2O3 • xSiO2 • yH2O, where M is any alkali or alkaline earth atom, n is the charge on that atom, x is a number from 2 to 10, and y is a number from 2 to 7. The chemical formula for clinoptilolite, a common natural zeolite is: (Na3K3)(Al6Si40)O96 • 24H2O

How do zeolites work?

For clinoptilolite, atoms or cations (charged metal atoms) within the second set of parentheses (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.

Those within the first set of parentheses (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.

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 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 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, 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 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 antigen-binding 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 10^5 to 10^6 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 clinoptilolite provoked a significantly higher allogeneic graft-versus-host reaction than did lymphocytes in control mice. After the mice were administered clinoptilolite intraperitoneally, the number of peritoneal macrophages increased significantly, as did their superoxide anion production. [109]

The ability of Clinoptilolite to attract and trap positively-charged toxins

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, 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. 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 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.

The zeolite will not be drawn to compounds in an effort to ‘rip’ metals away from them. In other words, the zeolite will not pull metals that are sequestered inside tissue or bone. If, on the other hand, the tissue has already released free metals into the system, the zeolite will have the ability to trap and remove it. Organics (Non Volatile and Volatile) are also removed by 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 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 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.

How effective is Clinoptilolite in Cation Exchange?

A mole of an atom or cation is its molecular or atomic weight written in terms of grains (gram-molecular weight); thus, a mole of sodium (Na) weighs 22.99 grams, and a mole of calcium (Ca) weights 40.08 g.

Expressing CEC in terms of equivalents (or milliequivalents) allows us to calculate exchange regardless of the charge of the cation. To calculate equivalent weight (or gram-equivalent weight) of a given cation, the gram-molecular weight (mole) must be divided by the charge on the cation.

Thus, the gram-equivalent weight of calcium (Ca^{2+}) is 40.08/2 = 20.04, half the gram-molecular weight. Hence, one mole of Ca^{2+} (40.08 g) would equal two equivalents of Ca^{2+}(20.04 g), but one mole of Na^{+} (22.99 g) would still be equal to one equivalent of Na^{+} (22.99 g).

To calculate the CEC of a given zeolite, one must know the chemical formula of the zeolite. Using the formula of clinoptilolite referenced earlier, for each formula unit, 3 Na + 3 K are exchangeable or that 6 equivalents of cations are exchangeable for each formula unit.

The weight of a formula unit can be calculated by adding up the atomic weights of the constituent atoms. For the above formula, this amounts to 2774.37 g. Thus, this particular clinoptilolite would have a cation-exchange capacity of 6 equivalents per 2774.37 gram, or, recalculating, 0.00216 equivalents per gram, or 2.16 milliequivalents (meq) per gram per zeolite molecule. If we were to exchange the singly-charged Na and K in this formula with doubly-charged Ca, the resultant formula would be written:

$(Ca_3)(Al_8Si_{40})O_{96} \cdot 24H_2O$.

Note that only half as many double-charged calcium ions are needed to balance the number of singly charged sodium and potassium ions. Calculating the CEC of the Ca-exchanged clinoptilolite yields the same value in terms of meq/g (actually very slightly more because the molecular weight of 4 calcium's is slightly less than the molecular weight of 4 sodium's + 4 potassium.)

Using CEC expressed in terms of milliequivalents (mcci) per gram (or 100 g) makes it easier to compare how much of any cation can be exchanged by a particular zeolite, without having to worry about the charge on the cation involved.

The calculated CECs of Clinoptilolite, based on theoretical formulae is:

Clinoptilolite $(NaK_3)(Al_6Si_{40}O_{96}) \cdot 24H_2O$ [2.16 meq/g]

It is often desirable to express cation-exchange capacity in terms of weight percent (e.g., how many grams of ammonium ion (NH_4^+) could be exchanged onto 1 gram of clinoptilolite). If the CEC of the zeolite (or zeolitic ore, for that matter) is known (in terms of meq/g), this is readily accomplished.

The number of milliequivalents of the given cation (i.e., NH_4^+ or Cu^{2+}) must be converted to grams by multiplying by the gram-equivalent weight of the cation. For singly-charged cations, this is the same as multiplying by the gram-molecular weight, but for double charged cations (e.g., Cu^{2+}), the number of meq/g must be multiplied by half the gram-molecular weight (i.e., converting gram-equivalent weight to gram-molecular weight).

Hence, 1 g of a sample of clinoptilolite-rich ore having a measured CEC of 2.00 meq/g could load (exchange) 3.67 wt. % (g/100 g) NH_4^+. The calculation is simple; merely multiply the known CEC of the zeolitic material by the milliequivalent weight (i.e., 1/1000 of the equivalent weight) of the atomic species involved. The following table lists the number of grams of various atoms taken up by one gram of zeolitic materials having the indicated CECs.

This information and these tables were prepared by F.A. Mumpton, Chairman of the International Committee on Natural Zeolites.

CEC (meg/g)	wt.(g)	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00
NH4+	.0187	0.028	0.033	0.037	0.042	0.047	0.051	0.056	0.061	0.065	0.070	0.075
Cs+4	.0329	0.049	0.058	0.066	0.074	0.082	0.091	0.099	0.107	0.115	0.123	0.132
Cu2+	.0318	0.048	0.056	0.064	0.071	0.079	0.087	0.095	0.103	0.111	0.119	0.127
Pb2+	.1036	0.155	0.181	0.207	0.233	0.259	0.285	0.311	0.337	0.363	0.389	0.414
Sr2+	.0438	0.066	0.077	0.088	0.099	0.110	0.120	0.131	0.143	0.153	0.164	0.175

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 Pure Body?

Pure Body is a liquid suspension of zeolite clinoptilolite in pure water. Pure Body is sized to 0.3 Micrometers (microns) mean average in size, to allow for detoxification benefits on a systemic level (through absorption in the small intestine), and detoxification in the large intestine.*

Third-party independent chemical analyses, x-ray diffraction analysis and particle size analysis all attest to the efficacy of Pure Body to support the body's ability to detoxify heavy metals and other toxins, assist in balancing the body's pH and supporting the immune system.*

At 0.3 mean microns, the particle size is still too large to remain in suspension in pure water. This means there are areas Pure Body cannot access in the body since it relies on absorption via villi in the small intestine and cannot use water as its transportation medium throughout the body.

A colloidal suspension allows for particles sized so small they can remain suspended inside water molecules, providing a delivery mechanism for clinoptilolite zeolite throughout the body with increased surface area, hence, delivering an effective, extra strength version of Pure Body.*

*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?

Chemistry

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 above definition is useful to understand the differences between the current Pure Body product and the colloidal Pure Body Extra Strength. It is simply a matter of size. To translate the sizes above, a colloid is between 1 nanometer and 100 Micrometers in size.

Pure Body is sized to 0.3 Micrometers (microns) mean average in size. The colloidal suspension of Pure Body Extra Strength is sized in the nanometer range which forms a very stable suspension and is a true colloidal. In effect, the zeolite particles are small enough to fit inside the water molecules, creating a suspension that is colorless, odorless and tasteless.*

Imagine for a moment the standard Pure Body particle size of 0.3 micron mean average being the equivalent to a NBA basketball (9.5 inches in diameter). In contrast, the colloidal Pure Body Extra Strength would be equivalent to a small pearl (9.65 mm).

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 the current zeolite 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.*

Now think of surface area. Imagine how many pearls you could fit inside that basketball. The combined surface area of those pearls would greatly surpass the surface area of the single basketball. With a nanometer size range, it takes many more particles to fill the space of a single particle at .3 microns, creating a greater area of negatively-charged points for positively-charged toxins to be trapped and attach to the zeolite.*

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 Touchstone Essentials 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.

*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.

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

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

- The proprietary processing for Pure Body Extra Strength removes any existing environmental pollutants from the zeolite cages, and fills the cage-like structures with the exchangeable ions calcium, magnesium, potassium and sodium, which in effect, means Pure Body will always swap out one of its beneficial ions in exchange for positively-charged heavy metals and toxins.

- The Clinoptilolite zeolite in Pure Body Extra Strength is mined from a well-known US mine with documented safety protocols.

- 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 Pure Body Extra Strength, increasing water intake is suggested to facilitate the body's ability to remove toxins.

- The manufacturing and bottling facilities for Pure Body Extra Strength all follow cGMP (Good Manufacturing Practices) in the handling of both the raw materials and the finished product.

- Touchstone Essentials uses an independent laboratory to test every batch of Pure Body Extra Strength. Chemical analysis is conducted for everything from heavy metals, to organic compounds, to microbial assays. Each independent lab result is published and available on the Touchstone Essentials website.

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.

- Pure Body Extra Strength undergoes proprietary processing to reduce the zeolite particle size to the nanometer range.

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

In addition to cation exchange, at this particle size range, new forces are in effect, and can greatly increase the detoxification potential of the zeolite. This new force is known as the van der Waals force (or van der Waals interaction) in physical chemistry.

Named after Dutch scientist Johannes Diderik van der Waals, is the sum of the attractive or repulsive forces between molecules (or between parts of the same molecule) other than those due to covalent bonds, the hydrogen bonds, or the electrostatic interaction of ions with one another or with neutral molecules. The term includes:

- The force between two permanent dipoles (Keesom force)
- The force between a permanent dipole and a corresponding induced dipole (Debye force)
- The force between two instantaneously induced dipoles (London dispersion force).

It is also sometimes used loosely as a synonym for the totality of intermolecular forces. Van der Waals forces are relatively weak compared to covalent bonds, but play a fundamental role in fields as diverse as supramolecular chemistry, structural biology, polymer science, nanotechnology, surface science, and condensed matter physics. Van der Waals forces define many properties of organic compounds, including their solubility in polar and non-polar media.

Van der Waals forces include attractions and repulsions between atoms, molecules, and surfaces, as well as other intermolecular forces. They differ from covalent and ionic bonding in that they are caused by correlations in the fluctuating polarizations of nearby particles (a consequence of quantum dynamics). Intermolecular forces have several major contributions:

- Attractive or repulsive electrostatic interactions between permanent charges (in the case of molecular ions)
- Dipoles (in the case of molecules without inversion center)
- Quadrupoles (all molecules with symmetry lower than cubic), and in general between permanent multipoles. The electrostatic interaction is sometimes called the Keesom interaction or Keesom force after Willem Hendrik Keesom
- Induction (also known as polarization), which is the attractive interaction between a permanent multipole on one molecule with an induced multipole on another. This interaction is sometimes called Debye force after Peter J.W. Debye
- Dispersion (usually named after Fritz London), which is the attractive interaction between any pair of molecules, including non-polar atoms, arising from the interactions of instantaneous multipoles

This force, along with the Zeta potential, explains the increased effectiveness even though the particle is smaller. What does all of this mean?

At this particle size, it is more than just cation-exchange with the zeolite. These forces allow for the colloidal zeolite to attract and hold much larger particles, which has particular relevance for Volatile Organic Compounds.

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

While not a replacement for Pure Body, the Pure Body Extra Strength is a more effective way to aid the body in detoxification due to its particle size, and access to the van de Waals force, creating a product capable of reaching cellular structures normally not available to standard sized zeolite.

Who can benefit from Pure Body Extra Strength?

In a word, everyone. The colloidal Pure Body Extra Strength works differently than the standard Pure Body product, which was designed to have a mean average size of 0.3 microns to ensure that about half of the amount enters the colon and half of the amount enters the bloodstream. This allows zeolite supplementation to provide detoxification benefits to the colon and to the overall health and well-being of the person. For this reason, Pure Body can be taken in addition to Pure Body Extra Strength.*

With Pure Body Extra Strength, 100 percent of the zeolite will enter the bloodstream. While this will offer detoxification benefits to everyone, two groups can derive the greatest benefit:

1. Those with a concern regarding exposure to heavy metals and environmental pollutants.

2. Individuals who perform a high degree of athletic training, such as a semi-professional or professional athletes due to the high rate of metabolic activity and added stress to the body.

Because Pure Body Extra Strength may enter the bloodstream easily, it may better be able to enter the cells[1,21,22,23,26,61, 84] to remove toxins safely. Again, zeolite is not stored in the body and the elimination cycle is still in the 4 to 6 hour range to process through the kidneys.

Common signs of a body that is detoxifying can include tiredness, increased thirst, sweating, headaches and other aches and discomfort. This is a completely temporary, natural response to the body eliminating toxins and can be easily resolved by reducing the number of servings and gradually increasing servings over the course of a few days.

Summary

1. 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 Clinoptilolite is proven safe through its years of safe usage as a supplement for the general population including children.

3. Pure Body Extra Strength is bringing to the market the very best that technology and nature can produce, with a natural mineral sized to access the body on a cellular level.*

4. Safety and effectiveness of Pure Body Extra Strength 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. Touchstone Essentials uses only independent third-party laboratories to conduct thorough testing on the zeolite.

6. Along with Pure Body, Pure Body Extra Strength may result in a more complete removal of heavy metal and environmental toxins from the body.*

7. Pure Body represents a safe, natural and effective means to aid the body in detoxification.*

*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.

References

1. Zeolite/polymer composite hollow microspheres containing antibiotics and the in vitro drug release. *Zhang Y, Xu C, He Y, Wang X, Xing F, Qiu H, Liu Y, Ma D, Lin T, Gao J. J Biomater Sci Polym Ed. 2011;22(4-6):809-22. Epub 2010 Jun 21. PMID: 20566060 [PubMed - indexed for MEDLINE]*

2. Ruthenium(II)-tris-bipyridine/titanium dioxide codoped zeolite Y photocatalysts: II. Photocatalyzed degradation of the model pollutant 2,4-xylidine, evidence for percolation behavior. *Bossmann SH, Jockusch S, Schwarz P, Baumeister B, Göb S, Schnabel C, Payawan L Jr, Pokhrel MR, Wörner M, Braun AM, Turro NJ. Photochem Photobiol Sci. 2003 May;2(5):477-86. PMID: 12803069 [PubMed] Related citations*

3. Controlled nanozeolite-assembled electrode: remarkable enzyme-immobilization ability and high sensitivity as biosensor. *Yu T, Zhang Y, You C, Zhuang J, Wang B, Liu B, Kang Y, Tang Y. Chemistry. 2006 Jan 23;12(4):1137-43. PMID: 16250058 [PubMed - indexed for MEDLINE]*

4. Zeolite Linde Type L as micro-solid phase extraction sorbent for the high performance liquid chromatography determination of ochratoxin A in coffee and cereal. *Lee TP, Saad B, Ng EP, Salleh B. J Chromatogr A. 2012 May 11;1237:46-54. Epub 2012 Mar 17. PMID: 22444432 [PubMed - indexed for MEDLINE]*

5. Synthesis design and structure of a multipore zeolite with interconnected 12- and 10-MR channels. *Moliner M, Willhammar T, Wan W, González J, Rey F, Jorda JL, Zou X, Corma A. J Am Chem Soc. 2012 Apr 11;134(14):6473-8. Epub 2012 Apr 2. PMID: 22440136 [PubMed - in process]*

6. Well-organized zeolite nanocrystal aggregates with interconnected hierarchically micro-meso-macropore systems showing enhanced catalytic performance. *Yang XY, Tian G, Chen LH, Li Y, Rooke JC, Wei YX, Liu ZM, Deng Z, Van Tendeloo G, Su BL. Chemistry. 2011 Dec 23;17(52):14987-95. doi: 10.1002/chem.201101594. Epub 2011 Nov 23. PMID: 22113715 [PubMed]*

7. Investigation of the cytotoxicity of nanozeolites A and Y. *Thomassen LC, Napierska D, Dinsdale D, Lievens N, Jammaer J, Lison D, Kirschhock CE, Hoet PH, Martens JA. Nanotoxicology. 2012 Aug;6:472-85. Epub 2011 Sep 27. PMID: 21950480 [PubMed - in process]*

8. Synthesis and application of colloidal nanocrystals of the MFI-type zeolites. *Watanabe R, Yokoi T, Tatsumi T. J Colloid Interface Sci. 2011 Apr 15;356(2):434-41. Epub 2011 Jan 15. PMID: 21310426 [PubMed]*

9. Structure and colloidal stability of nanosized zeolite beta precursors. *Hould ND, Kumar S, Tsapatsis M, Nikolakis V, Lobo RF. Langmuir. 2010 Jan 19;26(2):1260-70. PMID: 19725568 [PubMed*

10. Colloid stable sorbents for cesium removal: preparation and application of latex particles functionalized with transition metals ferrocyanides. *Avramenko V, Bratskaya S, Zheleznov V, Sheveleva I, Voitenko O, Sergienko V. J Hazard Mater. 2011 Feb 28;186(2-3):1343-50. Epub 2010 Dec 10. PMID: 21208744 [PubMed - indexed for MEDLINE]*

11. Lanthanide-organic cation frameworks with zeolite gismondine topology and large cavities from intersected channels templated by polyoxometalate counterions. *Li CH, Huang KL, Chi YN, Liu X, Han ZG, Shen L, Hu CW. Inorg Chem. 2009 Mar 2;48(5):2010-7. PMID: 19235962 [PubMed]*

12. Silica nanoarchitectures with tailored pores based on the hybrid three- and four-membered rings. *Zhang D, Zhang RQ. J Phys Chem B. 2006 Aug 10;110(31):15269-74. PMID: 16884244 [PubMed]*

13. In situ observation of homogeneous nucleation of nanosized zeolite A. *Fan W, O'Brien M, Ogura M, Sanchez-Sanchez M, Martin C, Meneau F, Kurumada K, Sankar G, Okubo T. Phys Chem Chem Phys. 2006 Mar 21;8(11):1335-9. Epub 2006 Feb 10.*

14. Nanosized gismondine grown in colloidal precursor solutions. *Kecht J, Mihailova B, Karaghiosoff K, Mintova S, Bein T. Langmuir. 2004 Jun 22;20(13):5271-6. PMID: 15986662 [PubMed]*

15. Structure of extremely nanosized and confined In-O species in ordered porous materials. *Ramallo-López JM, Rentería M, Miró EE, Requejo FG, Traverse A. Phys Rev Lett. 2003 Sep 5;91(10):108304. Epub 2003 Sep 5. PMID: 14525517 [PubMed]*

16. Confined space synthesis. A novel route to nanosized zeolites. *Schmidt I, Madsen C, Jacobsen CJ. Inorg Chem. 2000 May 29;39(11):2279-83. PMID: 12526485 [PubMed]*

17. A correlative approach at characterizing nanoparticle mobility and interactions after cellular uptake. *Schumann C, Schübbe S, Cavelius C, Kraegeloh A. J Biophotonics. 2012 Feb;5(2):117-27. doi: 10.1002/jbio.201100064. Epub 2011 Oct 11. PMID: 21987351 [PubMed - indexed for MEDLINE]*

18. In vivo toxicity of nano-alumina on mice neurobehavioral profiles and the potential mechanisms. *Zhang QL, Li MQ, Ji JW, Gao FP, Bai R, Chen CY, Wang ZW, Zhang C, Niu Q. Int J Immunopathol Pharmacol. 2011 Jan-Mar;24(1 Suppl):23S-29S. PMID: 21329562 [PubMed - indexed for MEDLINE]*

19. Need for safety of nanoparticles used in food industry. *Das M, Ansari KM, Tripathi A, Dwivedi PD. J Biomed Nanotechnol. 2011 Feb;7(1):13-4. PMID: 21485778 [PubMed - indexed for MEDLINE]*

20. Nanoparticles: small and mighty. *Wiesenthal A, Hunter L, Wang S, Wickliffe J, Wilkerson M. Int J Dermatol. 2011 Mar;50(3):247-54. doi: 10.1111/j.1365-4632.2010.04815.x. Review.*

21. Nanoparticles and their interactions with the dermal barrier. *Schneider M, Stracke F, Hansen S, Schaefer UF. Dermatoendocrinol. 2009 Jul;1(4):197-206. PMID: 20592791 [PubMed] Free PMC Article*

22. Development of a novel viral DNA vaccine against human papillomavirus: AcHERV-HP16L1. *Lee HJ, Park N, Cho HJ, Yoon JK, Van ND, Oh YK, Kim YB Vaccine. 2010 Feb 10;28(6):1613-9. Epub 2009 Dec 2. PMID: 19961961 [PubMed - indexed for MEDLINE]*

23. Safety aspect of inorganic layered nanoparticles: size-dependency in vitro and in vivo. *Choi SJ, Oh JM, Choy JH. J Nanosci Nanotechnol. 2008 Oct;8(10):5297-301. PMID: 19198442 [PubMed - indexed for MEDLINE]*

24. Nanotechnology: the challenge of regulating known unknowns. *Wilson RF. J Law Med Ethics. 2006 Winter;34(4):704-13. PMID: 17199812 [PubMed - indexed for MEDLINE]*

25. Development of a preliminary framework for informing the risk analysis and risk management of nanoparticles. *Morgan K. Risk Anal. 2005 Dec;25(6):1621-35. Erratum in: Risk Anal. 2006 Feb;26(1):287. PMID: 16506988 [PubMed - indexed for MEDLINE]*

26. Bio-functional inorganic materials: an attractive branch of gene-based nano-medicine delivery for 21st century. *Chowdhury EH, Akaike T. Curr Gene Ther. 2005 Dec;5(6):669-76. Review. PMID: 16457655 [PubMed - indexed for MEDLINE]*

27. Research strategies for safety evaluation of nanomaterials. Part VI. Characterization of nanoscale particles for toxicological evaluation. *Powers KW, Brown SC, Krishna VB, Wasdo SC, Moudgil BM, Roberts SM. Toxicol Sci. 2006 Apr;90(2):296-303. Epub 2006 Jan 11.*

28. Small is beautiful: microparticle and nanoparticle technology in medical devices. *Williams D. Med Device Technol. 1999 Apr;10(3):6, 8-9. PMID: 10387629 [PubMed - indexed for MEDLINE]*

29. Exploitation of unique properties of zeolites in the development of gas sensors. *Zheng Y, Li X, Dutta PK. Sensors (Basel). 2012;12(4):5170-94. Epub 2012 Apr 20. PMID: 22666081 [PubMed - in process] Free PMC Article*

30. Structure and catalytic properties of the most complex intergrown zeolite ITQ-39 determined by electron crystallography. *Willhammar T, Sun J, Wan W, Oleynikov P, Zhang D, Zou X, Moliner M, Gonzalez J, Martínez C, Rey F, Corma A. Nat Chem. 2012 Jan 29;4(3):188-94. doi: 10.1038/nchem.1253. PMID: 22354432 [PubMed]*

31. Synthesis of nano-zeolite from coal fly ash and its potential for nutrient sequestration from anaerobically digested swine wastewater. *Chen X, Wendell K, Zhu J, Li J, Yu X, Zhang Z. Bioresour Technol. 2012 Apr;110:79-85. Epub 2012 Jan 28. PMID: 22330598 [PubMed - indexed for MEDLINE]*

32. Optimization of hydrothermal synthesis of pure phase zeolite Na-P1 from South African coal fly ashes. *Musyoka NM, Petrik LF, Gitari WM, Balfour G, Hums E. J Environ Sci Health A Tox Hazard Subst Environ Eng. 2012;47(3):337-50. PMID: 22320685 [PubMed - indexed for MEDLINE]*

33. Synthesis of hydroxy sodalite from coal fly ash using waste industrial brine solution. *Musyoka NM, Petrik LF, Balfour G, Gitari WM, Hums E. J Environ Sci Health A Tox Hazard Subst Environ Eng. 2011 Dec;46(14):1699-707. PMID: 22175873 [PubMed - indexed for MEDLINE]*

34. Synthesis of active carbon-based catalysts by chemical vapor infiltration for nitrogen oxide conversion. *Busch M, Bergmann U, Sager U, Schmidt W, Schmidt F, Notthoff C, Atakan B, Winterer M. J Nanosci Nanotechnol. 2011 Sep;11(9):7956-61.*

35. Photovoltaic effects of CdS and PbS quantum dots encapsulated in zeolite Y. *Kim HS, Jeong NC, Yoon KB. Langmuir. 2011 Dec 6;27(23):14678-88. Epub 2011 Nov 3.*

36. Production of biofuel from waste cooking palm oil using nanocrystalline zeolite as catalyst: process optimization studies. *Taufiqurrahmi N, Mohamed AR, Bhatia S. Bioresour Technol. 2011 Nov;102(22):10686-94. Epub 2011 Aug 24. PMID: 21924606 [PubMed - indexed for MEDLINE]*

37. Hierarchised luminescent organic architectures: design, synthesis, self-assembly, self-organisation and functions. *Maggini L, Bonifazi D. Chem Soc Rev. 2012 Jan 7;41(1):211-41. Epub 2011 Jul 12. Review. PMID: 21748186 [PubMed - indexed for MEDLINE]*

38. Mesoporous MFI zeolites by microwave induced assembly between sulfonic acid functionalized MFI zeolite nanoparticles and alkyltrimethylammonium cationic surfactants. *Jin H, Ansari MB, Park SE. Chem Commun (Camb). 2011 Jul 14;47(26):7482-4. Epub 2011 May 31. PMID: 21629918 [PubMed]*

39. Photoluminescence of ZnO in metal ion exchanged zeolite Y. *So SJ, Kim HJ, Cha du H, Han CS. J Nanosci Nanotechnol. 2011 Jan;11(1):847-50. PMID: 21446559 [PubMed]*

40. Ultrasensitive chemical sensors based on whispering gallery modes in a microsphere coated with zeolite. *Lin N, Jiang L, Wang S, Yuan L, Xiao H, Lu Y, Tsai H. Appl Opt. 2010 Nov 20;49(33):6463-71. doi: 10.1364/AO.49.006463. PMID: 21102672 [PubMed - indexed for MEDLINE]*

41. On the zinc sorption by the Serbian natural clinoptilolite and the disinfecting ability and phosphate affinity of the exhausted sorbent. *Stojakovic D, Hrenovic J, Mazaj M, Rajic N. J Hazard Mater. 2011 Jan 15;185(1):408-15. Epub 2010 Sep 22.*

42. Dynamic and reversible organization of zeolite L crystals induced by holographic optical tweezers. *Woerdemann M, Gläsener S, Hörner F, Devaux A, De Cola L, Denz C. Adv Mater. 2010 Oct 1;22(37):4176-9.*

43. Asymmetric printing of molecules and zeolites on self assembled monolayers. *Kehr NS, Schäfer A, Ravoo BJ, De Cola L. Nanoscale. 2010 Apr;2(4):601-5. Epub 2010 Jan 28. PMID: 20644765 [PubMed - indexed for MEDLINE]*

44. A bio-metal-organic framework for highly selective CO(2) capture: A molecular simulation study. *Chen Y, Jiang J. ChemSusChem. 2010 Aug 23;3(8):982-8. PMID: 20623727 [PubMed - indexed for MEDLINE]*

45. MgO encapsulated mesoporous zeolite for the side chain alkylation of toluene with methanol. *Jiang N, Jin H, Jeong EY, Park SE. J Nanosci Nanotechnol. 2010 Jan;10(1):227-32. PMID: 20352838 [PubMed - indexed for MEDLINE]*

46. Enhanced catalytic performance of copper-exchanged SAPO-34 molecular sieve in methanol-to-olefin reaction. *Kim SJ, Park JW, Lee KY, Seo G, Song MK, Jeong SY. J Nanosci Nanotechnol. 2010 Jan;10(1):147-57. PMID: 20352825 [PubMed - indexed for MEDLINE]*

47. Toward white light emission through efficient two-step energy transfer in hybrid nanofibers. *Vohra V, Calzaferri G, Destri S, Pasini M, Porzio W, Botta C. ACS Nano. 2010 Mar 23;4(3):1409-16. PMID: 20131877 [PubMed - indexed for MEDLINE]*

48. New insights into ETS-10 and titanate quantum wire: a comprehensive characterization. *Jeong NC, Lee YJ, Park JH, Lim H, Shin CH, Cheong H, Yoon KB. J Am Chem Soc. 2009 Sep 16;131(36):13080-92.*

49. Removal of trimethylamine by adsorption over zeolite catalysts and deodorization of fish oil. *Chung KH, Lee KY. J Hazard Mater. 2009 Dec 30;172(2-3):922-7. Epub 2009 Jul 28.*

50. The beta-zeolite synthesized by dry-gel conversion method without the use of sodium hydroxide: characterization and catalytic behaviors. *J Nanosci Nanotechnol. 2009 Jan;9(1):475-83. Sakthivel A, Iida A, Komura K, Sugi Y. Department of Materials Science and Technology, Faculty of Engineering, Gifu University, Gifu 501-1193, Japan.*

51. Superbroadband near-IR nano-optical source based on bismuth-doped high-silica nanocrystalline zeolites. *Sun HT, Miwa Y, Shimaoka F, Fujii M, Hosokawa A, Mizuhata M, Hayashi S, Deki S. Opt Lett. 2009 Apr 15;34(8):1219-21. PMID: 19370123 [PubMed]*

52. Significantly enhanced superbroadband near infrared emission in bismuth/aluminum doped high-silica zeolite derived nanoparticles. *Sun HT, Hasegawa T, Fujii M, Shimaoka F, Bai Z, Mizuhata M, Hayashi S, Deki S. Opt Express. 2009 Apr 13;17(8):6239-44. PMID: 19365448 [PubMed - indexed for MEDLINE]*

53. The application of silicalite-1/fly ash cenosphere (S/FAC) zeolite composite for the adsorption of methyl tert-butyl ether (MTBE). *Lu J, Xu F, Wang D, Huang J, Cai W. J Hazard Mater. 2009 Jun 15;165(1-3):120-5. Epub 2008 Sep 30. PMID: 19036514 [PubMed - indexed for MEDLINE]*

54. Removal of free fatty acid in waste frying oil by esterification with methanol on zeolite catalysts. *Chung KH, Chang DR, Park BG. Bioresour Technol. 2008 Nov;99(16):7438-43. Epub 2008 Apr 1. PMID: 18387298 [PubMed - indexed for MEDLINE]*

55. On the acidity of saponite materials: a combined HRTEM, FTIR, and solid-state NMR study. *Bisio C, Gatti G, Boccaleri E, Marchese L, Bertinetti L, Coluccia S. Langmuir. 2008 Mar 18;24(6):2808-19. Epub 2008 Feb 6.*

56. Analysis of the temperature and pressure dependence of the 129Xe NMR chemical shift and signal intensity for the derivation of basic parameters of adsorption as applied to zeolite ZSM-5. *Kawata Y, Adachi Y, Haga S, Fukutomi J, Imai H, Kimura A, Fujiwara H. Anal Sci. 2007 Dec;23(12):1397-402.*

57. Investigation of potential alternative hydrogen carrier, Mg supported zeolite with temperature programmed desorption of NH3. *Cho SJ, Kim TH, Jang YB, Lee J. J Nanosci Nanotechnol. 2007 Nov;7(11):4041-4.*

58. Novel microporous carbon material with flower like structure templated by MCM-22. *Srinivasu P, Vinu A, Gokulakrishnan N, Anandan S, Asthana A, Mori T, Ariga K. J Nanosci Nanotechnol. 2007 Aug;7(8):2913-6. PMID: 17685317 [PubMed - indexed for MEDLINE]*

59. Structural and zeolitic features of a series of heterometallic supramolecular porous architectures based on tetrahedral {M(C2O4)4}4- primary building units. *Imaz I, Bravic G, Sutter JP. Dalton Trans. 2005 Aug 21;(16):2681-7. Epub 2005 Jul 15. PMID: 16075106 [PubMed - indexed for MEDLINE]*

60. Highly effective sulfated zirconia nanocatalysts grown out of colloidal silica at high temperature. *Zhu G, Wang C, Zhang Y, Guo N, Zhao Y, Wang R, Qiu S, Wei Y, Baughman RH. Chemistry. 2004 Oct 4;10(19):4750-4. PMID: 15372651 [PubMed]*

61. Biochemical evolution III: polymerization on organophilic silica-rich surfaces, crystal-chemical modeling, formation of first cells, and geological clues. *Smith JV, Arnold FP Jr, Parsons I, Lee MR. Proc Natl Acad Sci U S A. 1999 Mar 30;96(7):3479-85. Review. PMID: 10097060 [PubMed - indexed for MEDLINE] Free PMC Article*

62. Zeolite-confined Nano-RuO(2): A green, selective, and efficient catalyst for aerobic alcohol oxidation. *Zhan BZ, White MA, Sham TK, Pincock JA, Doucet RJ, Rao KV, Robertson KN, Cameron TS. J Am Chem Soc. 2003 Feb 26;125(8):2195-9. PMID: 12590547 [PubMed]*

63. Direct synthesis of hierarchical LTA zeolite via a low crystallization and growth rate technique in presence of cetyltrimethylammonium bromide.

65. Capturing ultrasmall EMT zeolite from template-free systems. *Ng EP, Chateigner D, Bein T, Valtchev V, Mintova S. Science. 2012 Jan 6;335(6064):70-3. Epub 2011 Dec 8. PMID: 22157080 [PubMed]*

66. Templated nanoscale porous carbons. *Xia Y, Yang Z, Mokaya R. Nanoscale. 2010 May;2(5):639-59. Epub 2010 Feb 26. Review. PMID: 20648305 [PubMed - indexed for MEDLINE]*

67. Mercaptosilane-assisted synthesis of metal clusters within zeolites and catalytic consequences of encapsulation. *Choi M, Wu Z, Iglesia E. J Am Chem Soc. 2010 Jul 7;132(26):9129-37.*

68. Removing cadmium ions from water via nanoparticle-enhanced ultrafiltration. *Jawor A, Hoek EM. Environ Sci Technol. 2010 Apr 1;44(7):2570-6.*

69. Water confined in cement pastes as a probe of cement microstructure evolution. *Ridi F, Luciani P, Fratini E, Baglioni P. J Phys Chem B. 2009 Mar 12;113(10):3080-7.*

70. Activity of double wash-coat monolith catalyst with noble metals and zeolites in selective catalytic reduction of NO(x) with C3H6. *Lee JD, Kim KJ, Kim YH, Jeon GS, Choi YK, Ahn HG. J Nanosci Nanotechnol. 2008 Oct;8(10):5306*-10. PMID: 19198444 [PubMed]

71. Characterization of nanoparticles in diluted clear solutions for Silicalite-1 zeolite synthesis using liquid 29Si NMR, SAXS and DLS. *Follens LR, Aerts A, Haouas M, Caremans TP, Loppinet B, Goderis B, Vermant J, Taulelle F, Martens JA, Kirschhock CE. Phys Chem Chem Phys. 2008 Sep 28;10(36):5574-83. Epub 2008 Jul 23. PMID: 18956092 [PubMed - indexed for MEDLINE]*

72. Assembly of nanozeolite monolayers on the gold substrates of piezoelectric sensors. *Biemmi E, Bein T. Langmuir. 2008 Oct 7;24(19):11196-202. Epub 2008 Aug 27. PMID: 18729483 [PubMed]*

73. Exceptionally small colloidal zeolites templated by Pd and Pt amines. *Kecht J, Mintova S, Bein T. Langmuir. 2008 Apr 15;24(8):4310-5. Epub 2008 Mar 1. PMID: 18312007 [PubMed]*

74. Ultrasonic attenuation by nanoporous particles. Part II: experimental. *Rowlands WN, Beattie JK, Djerdjev AM, O'Brien RW. Phys Chem Chem Phys. 2006 Nov 21;8(43):5124-30. Epub 2006 Sep 5. PMID: 17091163 [PubMed - indexed for MEDLINE]*

75. Photocatalytic paper from colloidal TiO(2)--fact or fantasy. *Pelton R, Geng X, Brook M. Adv Colloid Interface Sci. 2006 Nov 23;127(1):43-53. Epub 2006 Oct 6. PMID: 17027532 [PubMed - indexed for MEDLINE]*

76. Nanoparticle formation and zeolite growth in TEOS/Organocation/water solutions. *Cheng CH, Shantz DF. J Phys Chem B. 2005 Apr 21;109(15):7266-74. PMID: 16851831 [PubMed]*

77. Interlayer stacking disorder in zeolite beta family: a Raman spectroscopic study. *Mihailova B, Valtchev V, Mintova S, Faust AC, Petkov N, Bein T. Phys Chem Chem Phys. 2005 Jul 21;7(14):2756-63. Epub 2005 Jun 15. PMID: 16189590 [PubMed - indexed for MEDLINE]*

78. Binding of chemicals to melanins re-examined: adsorption of some drugs to the surface of melanin particles. *Bridelli MG, Ciati A, Crippa PR. Biophys Chem. 2006 Jan 20;119(2):137-45. Epub 2005 Sep 1. PMID: 16139945 [PubMed - indexed for MEDLINE]*

79. The role of aqueous iron(II) and manganese(II) in sub-aqueous active barrier systems containing natural clinoptilolite. *Jacobs PH, Waite TD. Chemosphere. 2004 Jan;54(3):313-24. PMID: 14575744 [PubMed - indexed for MEDLINE]*

80. n-Alkane hydroconversion on Zeogrid and colloidal ZSM-5 assembled from aluminosilicate nanoslabs of MFI framework type. *Aerts A, Huybrechts W, Kremer SP, Kirschhock CE, Theunissen E, Van Isacker A, Denayer JF, Baron GV, Thybaut JW, Marin GB, Jacobs PA, Martens JA. Chem Commun (Camb). 2003 Aug 7;(15):1888-9. PMID: 12932017 [PubMed - indexed for MEDLINE]*

81. Mechanism of zeolite A nanocrystal growth from colloids at room temperature. *Mintova S, Olson NH, Valtchev V, Bein T. Science. 1999 Feb 12;283(5404):958-60. PMID: 9974382 [PubMed - indexed for MEDLINE] Free Article*

82. The potential of a microencapsulated urease-zeolite oral sorbent for the removal of urea in uremia. *Cattaneo MV, Chang TM. ASAIO Trans. 1991 Apr-Jun;37(2):80-7. PMID: 1649615 [PubMed - indexed for MEDLINE]*

83. Nanozeolites doped photopolymer layers with reduced shrinkage.*Moothanchery M, Naydenova I, Mintova S, Toal V. Opt Express. 2011 Dec 5;19(25):25786-91. doi: 10.1364/OE.19.025786. PMID: 22273971 [PubMed - indexed for MEDLINE]*

84. Effect of composition, morphology and size of nanozeolite on its in vitro cytotoxicity. *Kihara T, Zhang Y, Hu Y, Mao Q, Tang Y, Miyake J. J Biosci Bioeng. 2011 Jun;111(6):725-30. Epub 2011 Mar 9. PMID: 21393058[PubMed - indexed for MEDLINE]*

85. Ruthenium(0) nanoclusters stabilized by a Nanozeolite framework: isolable, reusable, and green catalyst for the hydrogenation of neat aromatics under mild conditions with the unprecedented catalytic activity and lifetime. *Zahmakiran M, Tonbul Y, Ozkar S. J Am Chem Soc. 2010 May 12;132(18):6541-9. Erratum in: J Am Chem Soc. 2010 Jul 28;132(29):10205. PMID: 20405831[PubMed]*

86. Electrochemistry of nanozeolite-immobilized cytochrome c in aqueous and nonaqueous solutions. *Guo K, Hu Y, Zhang Y, Liu B, Magner E. Langmuir. 2010 Jun 1;26(11):9076-81. PMID: 20373776 [PubMed - indexed for MEDLINE]*

87. (1)H relaxivity of water in aqueous suspensions of Gd(3+)-loaded NaY nanozeolites and AlTUD-1 mesoporous material: the influence of Si/Al ratio and pore size. *Norek M, Neves IC, Peters JA. Inorg Chem. 2007 Jul 23;46(15):6190-6. Epub 2007 Jun 23. PMID: 17589991[PubMed - indexed for MEDLINE]*

88. A new route for the synthesis of uniform nanozeolites with hydrophobic external surface in organic solvent medium.Vuong GT, Do TO. J Am Chem Soc. 2007 Apr 4;129(13):3810-1. Epub 2007 Mar 10. No abstract available. PMID:17348654 [PubMed]

89. La roca magica: uses of natural zeolites in agriculture and industry. *Mumpton FA. Proc Natl Acad Sci USA. 1999;96:3463-3470.*

90. Medical applications of zeolites. Pavelic K, Hadzija M. *In: Auerbach SM, Carrado KA, Dutta PK (eds). Handbook of Zeolite Science and Technology. New York: Dekker; 2003; pp 1143-1174.*

91. The potential of a microencapsulated urease-zeolite oral sorbent for the removal of urea in uremia. *Cattaneo MV, Chang TM. ASAIO Trans. 1991;37:80-87.*

92. Zeolitic ammonium ion exchange for portable hemodialysis dialysate regeneration. *Patzer JF II, Yao SJ, Wolfson SK Jr.ASAIO J. 1995;41:221-226.*

93. Effects of haemoperfusion on selected Indices of blood biochemistry in sheep. *Seidel H, Bartko P, Kovác G, Paulíková I, Nagy O.Acta vet Brno. 1997;66:213-218.*

94. Enterex-anti-diarrheic drug based on purified natural clinoptilolite. *Rodriguez-Fuentes G, Barrios MA, Iraizoz A, Perdomo I, Cedre B. Zeolites. 1997;19:441-448.*

95. Gadolinium zeolite as an oral contrast agent for magnetic resonance imaging. *Young SW, Qing F, Rubin D, et al.J Magn Reson Imaging. 1995;5:499-508.*

96. Zeolite A increases proliferation, differentiation, and transforming growth factor beta production in normal adult human osteoblast-like cells in vitro. *Keeting PE, Oursler MJ, Wiegand KE, Bonde SK, Spelsberg TC, Riggs BL. J Bone Miner Res. 1992;7:1281-1289.*

97. The effect of tribomechanically activated zeolite (TMAZ) on total antioxidant status of healthy individuals and patients with malignant disease. *Ivkovic S, Zabcic D.Free Radic Biol Med. 2002; 33(suppl 1):172.*

98. Antioxidative Therapy: nanotechnology product TMA-Zeolite reduces oxidative stress in cancer and diabetic patients. *Ivkovic S, Zabcic D.Free Radic Biol Med. 2002;33(suppl 2):331.*

99. Antifungal effect of zeolite-incorporated tissue conditioner against Candida albicans growth and/or acid production. *Nikawa H, Yamamoto T, Hamada T, Rahardjo MB, Murata H, Nakanoda S.J Oral Rehabil. 1997;24:350-357.*

100. Pilot study on the effect of a mouthrinse containing silver zeolite on plaque formation. *Morishita M, Miyagi M, Yamasaki Y, Tsuruda K, Kawahara K, Iwamoto Y. J Clin Dent. 1998;9:94-96.*

101. Adsorption characteristics of UO(2)(2+) and Th(4+) ions from simulated radioactive solutions onto chitosan/clinoptilolite sorbents. *J Hazard Mater. 2011 Jan 15;185(1):447-55. Epub 2010 Sep 22.*

102. Characterization of ZZ a Zn2+ clinoptilolite. *Humelnicu D, Dinu MV, Drăgan ES. Source Al I Cuza University of Iasi, Faculty of Chemistry, Bd. 11 Carol I, 700506 Iasi, Romania. doinah@uaic.ro Toxicol Sci. 2011 Oct 5. [Epub ahead of print]*

103. Studies in Surface Science and Catalysis, 2004 – Elsevier Dietary supplementation with the tribomechanically activated zeolite clinoptilolite in immunodeficiency: effects on the immune system. *G Rodríguez-Fuentes*

104. Adsorption of lead (II) ions on transcarpathian clinoptilolite. *VI Gomonaj, NP Golub, KY Szekeresh… - Adsorption Science & …, 2001 - Multi-Science*

105. DETERMINATION OF APOPTOTIC EFFECTS OF CLINOPTILOLITE ON HUMAN T LYMPHOCYTES [PDF] *from iyte.edu.trME USLU - 2008 - library.iyte.edu.tr*

106. 32-O-03-Study of the reaction of a Ca-clinoptilolite and human bile. *R Simón Carballo, G Rodríguez-Fuentes… - Studies in Surface …, 2001 – Elsevier 170 32 -Zeolite minerals and Health Sciences (Thursday pm) 32-O-01 - Biomedical applications of zeolites *K. Pavelic 1, B. Subotic I and M. Colic 2 I Rudjer Boskovic Institute, Zagreb, Croatia," 2Molecutec Corporation., Goleta, USA - pavelic@rudjer, irb. hr Natural and ...*

107. Studies of the effect of calcite and magnesite on the uptake of Pb2+ and Zn2+ ions by natural kaolinite and clinoptilolite [PDF] *from iyte. AAS, XRPD, SEM/EDS, and FTIR edu.trB Zünbül - 2005 - library.iyte.edu.tr. Sorption Studies on Mineral Mixtures 51 ... clinoptilolite and magnesite minerals, in addition to magnesite-clinoptilolite mixtures*

108. The Basic Science of Poisons. *Klaassen CD, ed. 1996. Casarett and Doull's Toxicology: New York: McGraw-Hill.*

109. Heavy Metals and Health. World Resources Institute (WRI). *Accessed online at http://www.wri.org/wri/wr-98-99/metals2.htm.*

110. OSHA. Heavy Metals. Occupational Safety and Health Administration. *Accessed online at http://www.osha-slc.gov/SLTC/metalsheavy/index.html.*

111. A field study on the effect of the dietary use of a clinoptilolite-rich tuff, alone or in combination with certain antimicrobials, on the health status and performance of *…[PDF] from 67.20.90.220DS Papaioannou, CS Kyriakis, C Alexopoulos… - Research in veterinary …, 2004 – Elsevier*

112. A field study on the effect of in-feed inclusion of a natural zeolite (clinoptilolite) on health status and performance of sows/gilts and their litters

113. The effect of feeding clinoptilolite on the health status, blood picture and weight gain in pigs *DS Papaioannou, SC Kyriakis… - Research in veterinary …, 2002 – Elsevier.*

114. The effect of feeding zeolite (clinoptilolite) on the health status of sheep. *L Vrzgula, P Bartko, J Blazovský... - Veterinární medicína, 1982 - ncbi.nlm.nih.gov*

115. P Bartko, L Vrzgula, M Prosbova… - Veterinární medicína, 1983 - ncbi.nlm.nih.gov

116. Effects of high-sulfur water and clinoptilolite on health and growth performance of steers fed forage-based diets *[HTML] from animal-science.orgKM Cammack, CL Wright, KJ Austin… - Journal of animal …, 2010 - animal-science.org*

117. The effect of natural zeolite (clinoptilolite) on the state of health and the indices of the internal environment of calves during the first 15 days of postnatal development. *L Vrzgula - Nutrition reports international (USA), 1986 - agris.fao.org*

118. Effects of short-term supplementation of clinoptilolite in colostrum and milk on hematology, serum proteins, performance, and health in neonatal dairy calves *[PDF] from um.ac.ir M Mohri, HA Seifi… - Food and Chemical Toxicology, 2008 – Elsevier*

119. The effect of the zeolite clinoptilolite on serum chemistry and hematopoiesis in mice. *[PDF] from 67.20.90.220I Martin-Kleiner, Z Flegar-Metri, R Zadro… - Food and chemical …, 2001 – Elsevier ...*

120. Investigation of ammonia removal from polluted waters by Clinoptilolite zeolite *[HTML] from bioline.org.brAR Rahmani, AH Mahvi, AR Mesdaghinia… - International …, 2004 - bioline.org.br ... 4 th. Ed., Mc Graw Hill Co., New York, 2003; Schoeman JJ, Evaluation of a South African Clinoptilolite for ammonium-nitrogen removal from an underground mine water. Water ... th. Ed., American Public Health Association, NW.*

121. Experimental studies on safety and efficacy of the dietary use of a clinoptilolite-rich tuff in sows: a review of recent research in Greece *[PDF] from zeocat.esSC Kyriakis, DS Papaioannou, C Alexopoulos... - Microporous and ..., 2002 – Elsevier*

122. Development of adsorbent for the simultaneous removal of organic and inorganic contaminants from aqueous solution. *Choi JW, Chung SG, Hong SW, Kim DJ, Lee SH. Source Water Research Center, Korea Institute of Science and Technology, P.O. BOX 131, Cheongryang, Seoul 136-791, Republic of Korea E-mail: yisanghyup@kist.re.kr.*

123. Fluorous Metal-Organic Frameworks with Superior Adsorption and Hydrophobic Properties toward Oil Spill Cleanup and Hydrocarbon Storage. *Yang C, Kaipa U, Mather QZ, Wang X, Nesterov V, Venero AF, Omary MA. J Am Chem Soc. 2011 Oct 25. [Epub ahead of print] PMID: 21981413 [PubMed - as supplied by publisher]*

124. Enhanced ammonia nitrogen removal using consistent ammonium exchange of modified zeolite and biological regeneration in a sequencing batch reactor process. *Wei YX, Ye ZF, Wang YL, Ma MG, Li YF Environ Technol. 2011 Aug-Sep;32(11-12):1337-43. PMID: 21970175 [PubMed - indexed for MEDLINE]*

125. Adsorption of volatile organic compounds by metal-organic frameworks MIL-101: Influence of molecular size and shape. *Yang K, Sun Q, Xue F, Lin D. J Hazard Mater. 2011 Nov 15;195:124-31. Epub 2011 Aug 11. PMID: 21871718 [PubMed - in process]*

126. Removal of arsenic from water using Fe-exchanged natural zeolite. *Li Z, Jean JS, Jiang WT, Chang PH, Chen CJ, Liao L. J Hazard Mater. 2011 Mar 15;187(1-3):318-23. Epub 2011 Jan 14. PMID: 21315510 [PubMed - indexed for MEDLINE]*

127. Properties and applications of zeolites. *Rhodes CJ.. Sci Prog. 2010;93(Pt 3):223-84. Review PMID: 21047018 [PubMed - indexed for MEDLINE]*

128. Enhanced denitrification and organics removal in hybrid wetland columns: comparative experiments. *Saeed T, Sun G. Bioresour Technol. 2011 Jan;102(2):967-74. Epub 2010 Sep 21. PMID: 20934326 [PubMed - indexed for MEDLINE].*

129. Characteristics of organosulphur compounds adsorption onto Jordanian zeolitic tuff from diesel fuel. *Mustafa F, Al-Ghouti MA, Khalili FI, Al-Degs YS. J Hazard Mater. 2010 Oct 15;182(1-3):97-107. Epub 2010 Jun 8. PMID: 20580157 [PubMed - indexed for MEDLINE]*

130. Removal of sulfonamide antibiotics from water: Evidence of adsorption into an organophilic zeolite Y by its structural modifications. *Braschi I, Blasioli S, Gigli L, Gessa CE, Alberti A, Martucci A. J Hazard Mater. 2010 Jun 15;178(1-3):218-25. Epub 2010 Jan 18. PMID: 20133061 [PubMed - indexed for MEDLINE]*