

WATCH[®] ZEOSORB[®]

ZEOSORB[®] is an Absolute Replacement of Sand

Introduction:

ZEOSORB[®] has been introduced to the process purification of drinking water and wastewater due to its large specific surface area and the selective adsorption of substances, such as ammonia, dissolved organic matter and many other cations. Moreover, **ZEOSORB[®]** has advantageous hydraulic properties, that is - the filtration capacity of large quantities of water. Compared with other adsorbents, **ZEOSORB[®]** is more stable, has better filter features, accessible and relatively cheaper.

Based on numerous studies, it can be concluded that **ZEOSORB[®]** has great potential as effective adsorbent in numerous processes of purification of drinking water and wastewater, such as water softening, the removal of ammonia (from municipal wastewater, wastewater from livestock farms, the barn manure, water from ponds and swimming pools), the removal of nitrogen, the removal of dissolved organic matter and color, the removal of heavy metals (from natural water, acid mine water, industrial wastewater), the removal of radioactive substances from wastewater, desalination seawater and many others.

ZEOSORB[®] performs as polyfunctional sorbent in the waste water treatment process and it binds a number of harmful components. However, it does not possess the ability of anions adsorption due to negative charge of its aluminosilicate network. Superficial modification of **ZEOSORB[®]**, by means of organic modifiers, allows partial neutralization of negative charge of external surface of **ZEOSORB[®]** media.

Structure and Properties:

ZEOSORB[®] is a high purity natural Aluminosilicate microcrystalline mineral. It is available in particle size of **0.5 - 1.0 mm** (18x35 Mesh) or **1.5 - 2.5 mm** (8x14 Mesh). The bulk weight is about 820 kg/m³. **ZEOSORB[®]** made by **Watch[®] Water** has high porosity and high specific surface and it is resistant to abrasion. The **ZEOSORB[®]** media is classified as a GRAS (Generally Recognized As Safe) product. It is also listed under **NSF standard 61** and German Trinkwasserverordnung (TVO) 2011.

Since the mid 2005, lab and field test data reports in the Europe have indicated that **ZEOSORB[®]** filtration media consistently outperformed sand, sand/anthracite and multimedia in both pressure vessels and gravity filtration tests.

Based on more than 100 lab. and field tests (²/₃ using pressure vessels and ¹/₃ using gravity beds) since the mid 2005, representing commercial, residential and industrial water filtration projects, it has been concluded that high purity **ZEOSORB[®]** media is superior to conventional granular media.

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ZEOSORB FEATURES

Superior Purification of

- Drinking Water
- Ground Water
- Surface Water
- Waste Water
- Swimming pool Water
- Reverse osmosis pre-filtration

Greater Ammonia Adsorption

- Reduces Turbidity < 3 micron
- Controls Chloramines formation
- Greater Surface Area
- Long lasting media (> 10 years) not consumed in process

Saves Water

- Doubles time between backwashes
- Reduces backwash time by up to 50%
- Naturally Green Product
- High capacity filtration



EASY TO USE

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ZEOSORB[®] effectively removes fine particles in the range of 0.5 µm to 3 µm, that escape conventional media.

Summary of performance test data for pressure vessels.

Filter Media	Filter rating (nominal)	Solids loading capacity
ZEOSORB[®] (18 x 35 mesh)	< 3 µm	~ 2.6x
Sand (20 x 40 mesh and Anthracite)	~ 20 µm	1x
Sand/Anthracite (20 x 40)	~ 15 µm	~ 1.4x
Multimedia	~ 12 µm	~ 1.6x

Similar results were observed for gravity beds. Some representative examples of high purity **ZEOSORB[®]** filter performance are provided below.

River water turbidity:

ZEOSORB[®] versus multimedia media filtration tests were conducted for fine particle (turbidity) removal from river water. Pressure vessels (18" diameter) were operated with a service flow of 36.7 m/h of bed area for six consecutive days and turbidity (NTU) was measured in the feed and filtered water. The filtered water average NTU was approximately $\frac{1}{3}$ of the multimedia filtrate, indicating superior fine particle removal by **ZEOSORB[®]**.

Bottled water plant:

A bottled water plant pumped groundwater to four 48" diameter pressure vessels that feed two RO units. The multimedia reduced the well water SDI by an average 5% compared to 45% to 50% SDI reduction for the **ZEOSORB[®]** media.

Cooling tower makeup water:

A major chemical plant facility in USA had turbidity problems with river make-up water being used for a cooling tower. The sand/garnet gravity filter inadequately removed turbid particles after rain events. The sand/garnet was replaced with an equal volume (15.45 m³) of 0.5 x 1 mm **ZEOSORB[®]**. When operated at the same flow rate 6.1 m/h, it removed greater than 98% of the turbidity against only 20% for the sand/garnet.

Produced water filtration:

A German oil company wanted to convert unusable oil production water into irrigation water. The production water was processed for oil/water separation: chemical flocculation; clarification; and ozone oxidation. It was then filtered using two pressure vessels (72" diameter) with high purity **ZEOSORB[®]** media operating at approx. 29 m/h. The filtrate was used directly as feed water for an RO unit and the product water was recycled as agricultural irrigation water.

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ZEOSORB[®] System



Typical down flow system

ZEOSORB is a high-purity filter media that
Ensures many advantages
Over conventional granular,
Sand, anthracite, multimedia and
Other filter media products for
Removal of suspended particles and Turbidity.
Backwash cycles and labor costs are reduced.

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Reverse Osmosis prefilter:

An electric utility installed a 340 m³ water treatment facility with two multimedia filters and RO equipment to produce boiler make-up water. The RO units could not be operated due to filter vessel pressure loss problems and an elevated SDI in the filtrate.

The two multimedia bed were replaced with equivalent bed volumes of 18x35 mesh high purity **ZEOSORB[®]** media and the strict design specifications for the RO feed water have been consistently met for over two years.

Prefilter for Granulated Activated Carbon:

Municipal water supplied to restaurant contained elevated iron and other fine particles. Cartridge (5 µm) filters rapidly loaded and caused reduced water flow to the Granulated beds and chiller.

A backwashing **ZEOSORB[®]** filter (10" diameter vessel with a 24" bed depth) was installed and tested by an independent engineer and technical consultant.

The feed water had 0.1µm to 10µm particles (average SDI or slit density index = 4.3). The **ZEOSORB[®]** media bed effectively removed the iron particles. The product water particles were in the 0.1 µm to 2.3 µm range, with an average SDI = 0.

Applications

- ❖ Sand/anthracite and multimedia bed replacement
- ❖ Surface and ground water filtration
- ❖ Economical filter beds upstream to RO and Nano-membranes

ZEOSORB[®] for Physical filtration barrier to pathogens such as bacteria and bacterial spores:

Physical filtration barriers for accumulation or collection of microorganisms in water that endanger human health have been in focus during the last several years. **ZEOSORB[®]** will be an ideal collector of pathogens such as giardia, cryptosporidium, and other bacteria and their spores. Most of these organisms and their spores are in the size range of 0.5 - 10 micrometers (microns). In contrast, the water permeable pores in **ZEOSORB[®]** are mostly smaller than .05 microns; therefore the **ZEOSORB[®]** fragment or granule can "surface collect" a high percentage of these microorganisms while the water passes through the **ZEOSORB[®]** fragment.

All drinking water standards for microorganism pathogens, and turbidity can be most easily met using a natural, relatively low-cost material, such as **ZEOSORB[®]** rather than "sand" which is chiefly quartz grains.

BENEFITS

- **Better Filtrate Clarity:** Typical sand/anthracite filter beds have a 12 to 15 micron nominal filter rating. **ZEOSORB[®]** typically would have a nominal filter rating of less than 3 microns. This property greatly reduces the effluent turbidity, generally measured in national turbidity units (NTUs).
- **Increased flow rate in gravity System:** In a sand/anthracite filter media system the flow rate is typically 3 to 5 m/h. In a **ZEOSORB[®]** filter media system, the flow rate is typically in the 10 m/h range.
- **Increased flow rate in pressure vessel systems:** In a sand/anthracite pressure vessel filter system the flow rates are typically 15 to 17 m/h. In a **ZEOSORB[®]** pressure vessel filter system the flow rates are typically in the 29 to 37 (and sometimes 48) m/h range.
- **Lower capital requirement to increase Filtration Capacity:** Generally, the capacity of a filter plant can be doubled with no increase in the plant by switching the filter media to **ZEOSORB[®]**.
- **Fewer Back wash cycles:** **ZEOSORB[®]** requires only one half of the backwash cycles that are required by sand/anthracite.
- **Less Back wash water:** The fewer backwash cycles generally cut the amount of backwash water by one third to one half. This means treating less backwash water and greater plant capacity.
- **Greater Loading due to greater surface area:** **ZEOSORB[®]** generally has 6 to 7 times the surface area as sand. This makes **ZEOSORB[®]** a much better filter media with greater holding capacity.
- **Long media bed life:** The anticipated filter bed life of **ZEOSORB[®]** is 10 yrs.
- **Land application of spent ZEOSORB media:** Under most conditions, **ZEOSORB[®]** filter bed can be applied to lawns and gardens as soil amendments.
- **Simpler Handling:** **ZEOSORB[®]**, monomedia beds simplify materials handling, shipments and bed loading.
- **Better Cleaning:** Active, dynamic, bed tumbling and mixing during backwash efficiently cleans bed granules.

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Flow rates, backwashing guidelines

For pressure vessels, a 36" bed depth is generally used with under gravel, plus approximately 30% freeboard, much less than to multimedia beds. The optimum service flow rate for pressure vessels ranges from 29 to greater than 48 m/h of bed area, depending on the water filtration application. For example, use 29 m/h for RO and GAC pre-filtration; use 37 m/h to achieve low turbidity well water, surface water and for industrial projects; and 44 to 48 m/h rate to get high water volume for projects with lower filtration requirements. Since **ZEOSORB®** has some "fines" from mine production, it is important to backwash it prior to placing in service. The backwash rule-of-thumb is to achieve 25 percent bed expansion using a backwash rate of 48 m/h until the water is clear for new **ZEOSORB®**, and for six minutes for routine operational backwash cycles.

Material Properties

Chemical composition:
Natural Aluminosilicate

Physical Properties:

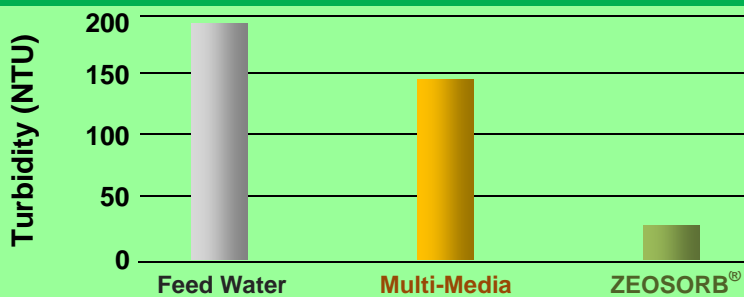
Filtration (nominal)	< 3 micron
Porosity	24 - 32 %
Particle Size	0.5-1.0 mm x 1.5-2.5 mm
Surface Area	30 m ² /gram
Mesh size	18 x 35 and 8 x 14
Color	Pale green/grey
Water Retention	Holds 50% of its weight
Surface Absorption	Hydrophilic
Packaging	30 liters in a bag; 40 bags in a pallet

Performance and Cost Comparison

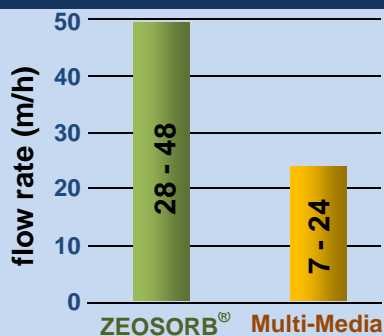
Filtration Performance



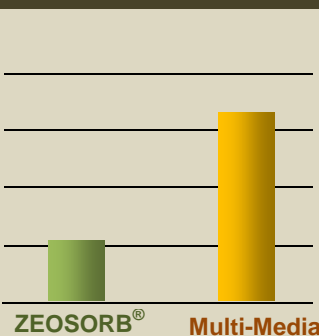
Turbidity Reduction



Service Flow Rate



Media & System Cost



Operation conditions and exchange capacity

Bed depth	400 - 1000 mm
Freeboard	30 - 50 %
Service flow rate	20 - 48 m/h
Back wash flow rate	25 - 50 m/h
Cation exchange capacity	1.7 - 1.9 mg/g
Thermal Stability	Up to 600°C
Stable against acids and bases	



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