

Zeolite Filter Granules (Iron Filter Media)

Background

Zeolite filter media offers advantages over conventional sand, sand & anthracite or multimedia for gravity flow or pressure vessel beds. Historically, natural zeolite mineral deposits were discovered in the 1950's and zeolite has been quarry, mined, crushed, air-drying and sieve sized to produce commercial products for >30 yrs. Natural zeolite (Clinoptilolite) is crystalline, aluminum oxide/silicon oxide classified as a crystalline, molecular sieve, mineral consisting of hydrated $\text{Ca}_2 (\text{Na}_2 \text{ or } \text{K}_2) \text{Al}^8\text{Si}^{28}\text{O}_{72} \cdot 24 \text{H}_2\text{O}$ (Fig. 1). Most zeolite deposits are low quality and can't be used as molecular sieve beds or water filtration media. Zeolite has been used for water softening and to remove NH_4 ion using slow flow rates (1-2 gpm/ft^2) and Na-ion regeneration cycles. Since 1985 numerous technical and engineering studies have demonstrated the utility of zeolite mineral as an effective water filter media.

Zeolite Filter Media

Zeolite Filter Granules are a high quality, granular, filter media that achieves superior filtration & solids loading compared to conventional filter media. The zeolite media is from a unique, mineral deposit in the western USA having high porosity, hardness, high surface area (~28 m^2/gm) and surface, micro-mineral, projections that make it an ideal water filtration media (fig 2 & 3).. The 14 x 40 mesh filter media has a dry bulk wt.55 lb/ft^3 & is attrition resistant. The zeolite mineral is classified under 21CFR Part 182.2729 & 40 CFR Part 180. as GRAS (Generally Recognized As Safe) and is NSF Standard 61 Listed.

Advantages of Zeolite Media

This zeolite filter media removes finer particles and has higher solids loading capacity vs

Fig 1. Zeolite (Clinoptilolite) crystal structure.



sand/anthracite or multimedia and is competitive with fine sand (Table I).

ADVANTAGES & BENEFITS

- Cost-effective replacement for sand, garnet & multimedia.*
- Lower DP for a given flow rate (gpm/ft^2).*
- Highest solids loading reduces backwash frequency..*
- Superior filtration performance at high flux rates.*
- Requires less backwash water.*

APPLICATIONS

- *Bottle water & drinking water plants.*
- *Economical pre-filter for RO.membranes.*
- *Well water & Industrial wastewater filtration.*
- *Cooling tower, chillers, heat exchanger water filtration..*

Tables II, III & IV list the zeolite media service flow rates & specifications for water filters.

Figure 2. High magnification (SEM) photomicrograph showing micro-crystal structures (0.2- 0.9 μ spacing) on the surface of the zeolite granules.

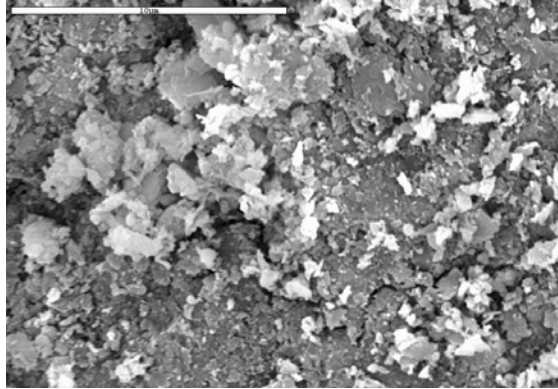


Figure 3. Photomicrograph (SEM) showing the relatively flat, minimal, surface structure of a sand particle.

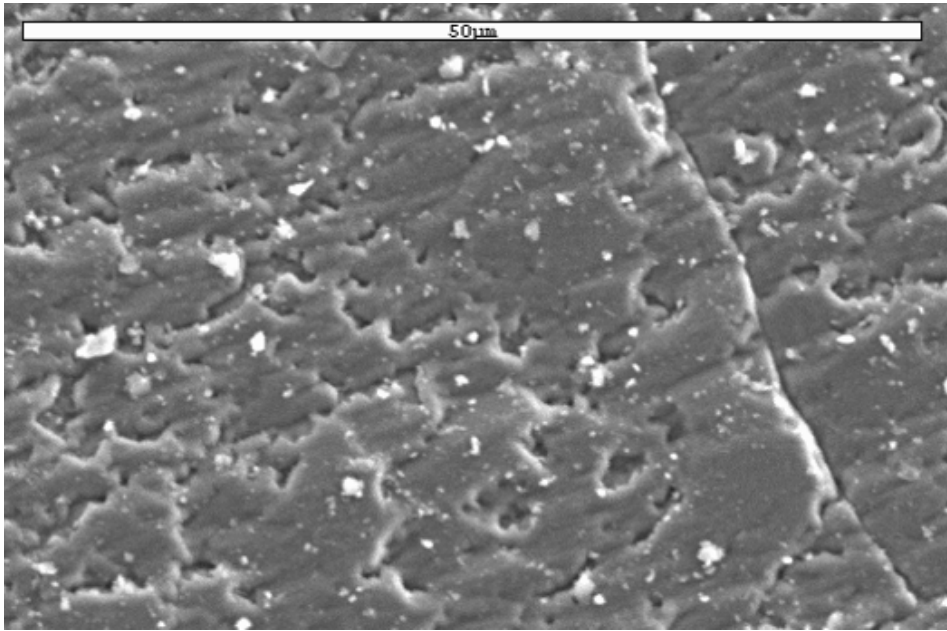


Table I. Comparison of Zeolite vs Sand & Multimedia Service Flow Rates, Performance & Backwash Water Requirements.

FILTER MEDIA	SERVICE FLOW RATES	SOLIDS LOADING	NOMINAL FILTRATION RATING ⁴	BACKWASH WATER/CYCLE
Sand (20 x 40 mesh)	6-9 gpm/ft ²	Low	20μ	X gal
Fine Sand¹ (~0.2mm)	10-17 gpm/ft ²	Low	<5μ	~0.80-0.85X
Multimedia	12-18 gon/ft ²	Moderate	~15μ	1-1.1.2X
Zeolite² Standard Design	12-20 gpm/ft ²	High	<5μ	0.70-0.75X
Conical Design ³	15-25 gpm/ft ²	<High	<5μ	0.45-0.50X

¹ Vortisand (Sonitec, Quebec, Canada) use a fine sand in the Vortisand design, pressure vessels.

² Zeolite Filter Granules, 14 x 40 mesh zeolite filter media.

³ Interceptor vessel design, PEP Filters, Mooresville, NC 28117-9920.

⁴ Electronic & laser scatter sizing analysis statistics variability increases dramatically in the 1-4μ range, hence the data are reported as <5μ, which is considered a practical resolution limit for particle sizing.

Table II. Pressure Vessel Sizing & Flow Rate Specifications (conventional design).

FILTER BED FLUX RATE ⁵	SERVICE FLOW RATE (gpm)							
	9	21	38	59	85	150	340	
12 gpm/ft²	12	27	47	74	106	189	425	
15 gpm/ft²	14	32	56	89	127	227	509	
18 gpm/ft²	16	35	63	98	141	251	565	
TANK Dia. →	12"	18"	24"	30"	36"	48"	72"	

⁵ The standard zeolite filter media bed depth is 3 ft. Reducing bed height proportionally reduces the solids loading capacity & increases the backwash frequency.

Table III. Pressure Vessel Sizing & Flow Rate Specifications (Conical Vessel⁶).

FILTER BED FLUX RATE	SERVICE FLOW RATE (gpm)						
	15 gpm/ft ²			47	74	107	
20 gpm/ft ²			63	98	142		<i>used for higher</i>
25 gpm/ft ²			78	123	178		<i>flow rates.</i>
TANK Dia. →			24"	30"	36"		

⁶ *Interceptor vessel design, PEP Filters, Mooresville, NC 28117-9920. Surface area 3.14 ft², 4.91 ft², 7.1 ft² for 24", 30" & 36" respectfully.*

Table IV. Gravity Flow Zeolite Media Bed Design Specifications.

FILTER BED FLUX RATE ⁷	SERVICE FLOW RATE (gpm)							
	2 gpm/ft ²	9	21	38	59	85	150	340
4 gpm/ft ²	9	21	38	59	85	150	340	
TANK Dia. →	12"	18"	24"	30"	36"	48"	72"	

⁷ *The standard zeolite filter media bed depth is 3 ft. Reducing bed height proportionally reduces the solids loading capacity & increases the backwash frequency.*

