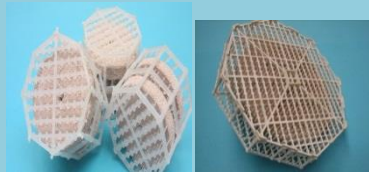




Waste Water Treatment

WASTE WATER



BIO often placed in durable Plastic



More Bacteria with High Surface Area

- ✓ **100 times more surface than other substrates**
- ✓ **Can Host larger colonies of bacteria than other media**
- ✓ **Over 2,000,000 m²/m³ of surface area, or over 10,000 m²/Kg of media**

Problem

Water from Industrial and Municipal Waste Treatment contains phosphorus, nitrogen and organic nutrients that can exceed allowable discharge limits. MetaMateria Bio-Lair and PO₄ Sponge products address these needs and can enhance performance of aeration and denitrification processes, often avoiding expansion costs.

Products

MetaMateria **Bio-Lair** and **PO₄ Sponge** are highly porous ceramic products that provide both biological and phosphorus nutrient removal from waste water for many applications, including on-site community septic systems, municipal waste treatment facilities, channels containing waste overflow, industrial food processing and other operations to meet existing and future nutrient regulations.

Bioremediation

Bacteria are used to remove organics and nitrogen compounds (ammonia & nitrates) and biologically tie up phosphorus. Bacteria reproduce on solid surfaces in water and Bio-Lair provides enhanced performance due to its considerably higher surface area compared with plastic. Bacteria concentrations in water are typically increased by 5 times or more compared with a conventional air activated sludge process. Biomass contained in the media, can lower biomass concentration in clarifiers and will accelerate breakdown of organics and ammonia, thereby increasing capacity of existing aeration facilities by 2 times or more. Enhanced performance is commonly done using plastic media, such as kaldnes and Linpor in IFAS and MBBR systems. In order to obtain desired surface area of 100-300 m²/m³ the media fill volume needs to be 10-50%.

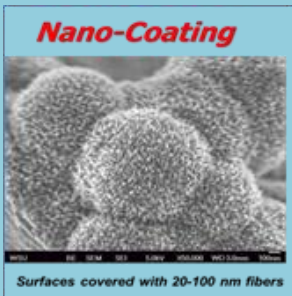
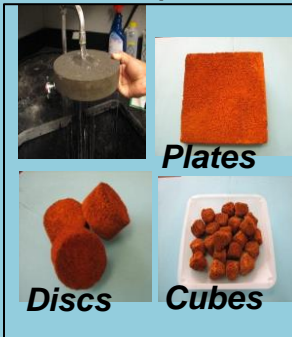
Bio-Lair media provides 2,000,000 m²/m³ or 10,000 m²/Kg of media. This higher surface reduces the volume of media needed. The highly porous ceramic Bio-Lair media is often packaged in an open plastic cage to provide durability and additional surface for aerobic bacteria growth that is can be scoured off during operation. A denitrifying zone exists within the porous ceramic that is effective in lowering nitrates.

Benefits Available with Bio-Lair

- Higher effective biomass in waste water to cut treatment time
- Less media (compared with plastic) to treat same volume of water
- Nutrients (BOD, TKN, Phosphorus) are expected to be below 3 mg/L
- Both ammonia and nitrate/nitrite converted
- Larger bacteria population stabilizes against load changes
- Reduced sludge production and handling
- Improves sludge volume index (SVI)

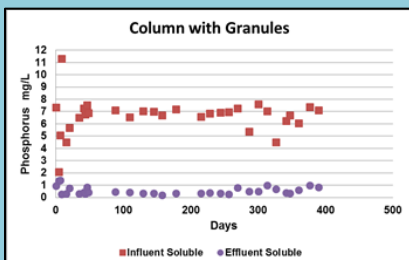


PHOSPHORUS (PO4 Sponge) Examples



Absorption Comparison

Sorption Media	mg-P/Kg
PO4 Sponge - Meta	
High > 5mg/L	80,000
Low < 2 mg/L	25,000
Iron Ore (Hematite)	1,430
Iron Slag	420
Crushed Red Bricks	510
LECA (expanded clay)	800
Activated Fe Alumina	17,100
Filtra-D	2,500
Phostec	7,000



Patents pending

PO4 Sponge – Phosphorus Removal

MetaMateria offers a unique product **for absorption of phosphorus (PO4 Sponge)**. PO4 Sponge absorbs considerably more phosphorus (P) than other natural and manufactured products, especially at low concentrations needed to meet future regulatory limits or clean runoff water. PO4 Sponge is a cost effective alternative to chemicals provides a simpler treatment approach. The higher P capacity comes from use of nanotechnology that provides far more adsorption sites for P capture. P can be removed and PO4 sponge reused multiple times. P can be recovered.

PO4 Sponge removes reactive soluble phosphorus at both high and low concentrations, so it can be effective for treating waste water or lower levels found in lakes, streams and agriculture water runoff. Phosphorus can be lowered below 0.09 mg/L (ppm), making it ideal for many applications. The product has a long life and continues to remove phosphorus from waste water for over 1 year.

Capital and Operating Costs

These depend upon the application, but will be economically viable for most applications, where chemical treatment is too costly or too complex. The average cost for PO4 Sponge declines with reuse, since regeneration is an inexpensive operation.

Unique Capabilities for PO4 Sponge Include:

- **Holds much more phosphorus** than other products - less product needed
- **Effective at both high and low concentrations**
- **Can be reused multiple times**
- **Concentrations Below 0.03 mg/L** can be reached
- **Long Life & Cost Effective** removal for most applications
- **High Influent** above 100 mg/L (ppm) can be treated
- **Product can be Regenerated and Reused** multiple times
- **Phosphorus can be Recovered** from regeneration liquid
- **PO4 Sponge removes other metal ions**
- **pH Remains Stable** for good process control
- **Water Passes Easily thru Product** at lower pressures
- **Flexible Shapes & Sizes** for most applications

For More Information:

Dr. Richard Schorr, CEO
irschorr@metamateria.com
 614-599-0939 (mobile)

Tim Marth, VP
tmarth@metamateria.com
 614-499-2617 (mobile)

