KINETICO®

Macrolite™

Physical Characteristics

- Kinetico's Macrolite media is a manufactured ceramic material with a spherical shape and a textured surface.

- Macrolite starts out as fine granules about 40 micron in size and, through a very complex manufacturing process, is formed into the final media product. It is through this manufacturing process that Macrolite gains it's advantages. The raw materials are formed to a certain size and specific gravity then fired in a kiln to its final ceramic state.

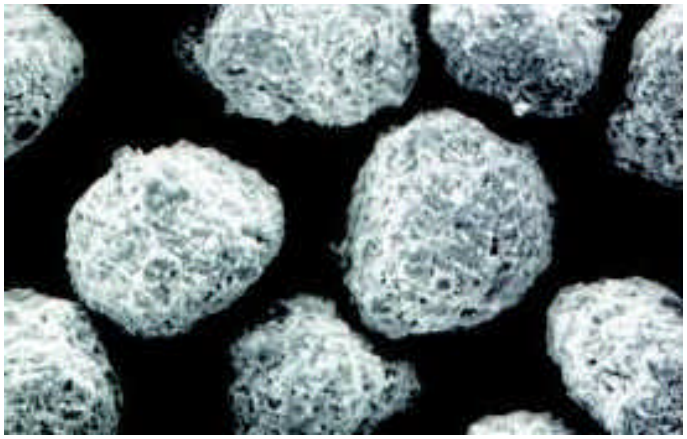
- The 70 mesh media used in our municipal systems has a diameter of approximately .215 mm and a specific gravity of 2.5.

- Macrolite is chemically inert and is compatible with all types of acids, caustics, and oxidants. It has an indefinite service life and normally never needs replacement.

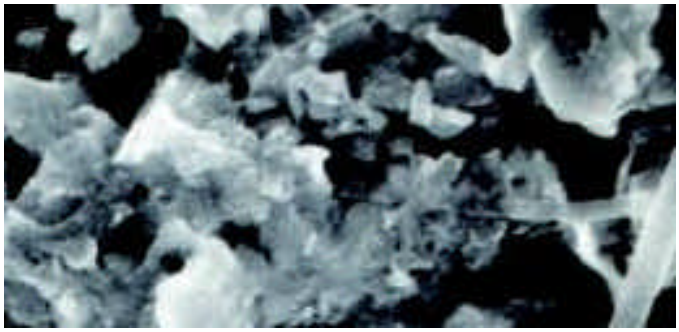
Removal Mechanism

Macrolite media depends on physical straining as the primary removal mechanism. The media's most unique characteristics are its shape and surface condition. The media is spherical and the surface is quite rough, maximizing its ability to capture small particles.

Conventional granular media differs in size and has angular shapes which tend to either interlock and restrict, or settle in positions which leave large intersticial gaps. Instead, Macrolite is a manufactured product with an intentionally spherical shape. The rounded shape provides a relatively uniform matrix of intersticial passages between the media granules. These uniform passages are key to the media's outstanding flow vs. straining capability relationship. The spatial uniformity provides higher filtering performance than any randomly shaped media could achieve regardless of how carefully graded it may be. It should also be noted that the media's shape also provides repeatability, since the filter bed will settle into a similar relationship each time after backwashing instead of the varied granule to granule relationships which occur with irregular, angular media.



100x Magnification



2000x Magnification

The second physical characteristic which gives Macrolite its performance is the surface texture. The surface of the media is rough and physically captures small and mid-sized particles as they work their way through the passages between the media granules. This capture is a simple physical phenomenon created by collisions within the filter bed caused by the momentum of the particle and the winding flow path through the bed. Through experimentation and experience, the proper bed depth and flow rate was determined in order to provide a sufficient number of these collision opportunities to occur. The effectiveness of this portion of the physical removal is not haphazard or by chance. It is a determinable dynamic relationship of influent particle size distribution, flow rate, and bed depth. This capture within the bed also increases the filter depth and area, giving it greater capacity and correspondingly longer runs than a filter which traps all the particulate on top of the bed.

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Media Performance
The 70 mesh Macrolite media displays remarkable performance. Without any sort of chemical pretreatment it has demonstrated it's ability to achieve:

- 3.5 log removal of Giardia Lamblia
- 3.0 log removal of 5 micron particulate
- 3.7 log removal of Cryptosporidium

Additionally, it has shown it's ability to remove a large percentage of very small particulate. These removals vary with water chemistry, but can be around 90% for 2 micron and 50% for 1 micron. These are "low" log removals, but can contribute significantly to turbidity reduction on certain source waters.

Independent filter challenges have been conducted by Analytical Services and IEA to evaluate Giardia and Cryptosporidium removal capabilities. In order to accurately test this removal capability, these studies were conducted at several different sites using actual cysts, as opposed to testing in a lab with cyst sized particles. These test results can be found at the end of this section.

Source Water Compatibility
Kinetico's basic Macrolite filtration systems are suitable for use on source waters with turbidities of less than 10 NTU. As with all filtration systems, this upper limit can be extended with suitable pretreatment. For example, a clarifier or a course media prefilter could be used to handle exceptionally dirty source water.

Macrolite's lack of flocculation also makes it ideally suited for treatment of groundwater under the direct influence (GWUDI) or spring water sources that are subject to the SWTR. Typically, "clean" waters such as these require heavy doses of coagulants and extended mixing to achieve adequate particle removals. Kinetico's elimination of this process and ability to filter small particulate allow Public Water Systems (PWS) with GWUDI sources to comply with the SWTR and get Giardia and Cryptosporidium removal capabilities as simply and inexpensively as is possible.

Media Fouling
Natural organic matter (NOM) can effect the filters. Whether the NOM is an algae bloom or a flood induced spike of organic debris, the duration of the filter run is decreased and the length of the backwash is increased.

The characteristics of the backwash cycle provide a thorough and effective backwash, even when the bed is loaded with organic material. The air sparge improves the breakup of NOM, greatly decreasing the required backwash duration in applications with high NOM levels.

In situations of extreme NOM loading, several "standard" solutions are possible, with the final choice being determined by overall system needs and economics. These choices include more aggressive backwash procedures, prefiltration, oxidation of organics upstream of the filter, or a combination of these. Kinetico's filtration systems are compatible with all of these strategies.

It should also be mentioned that bacterial growth within the filter bed is kept in check with the use of filtered and chlorinated water drawn from the storage tank for backwashing.

Irreversible fouling is not a problem issue for Macrolite. It is a ceramic material with extremely durable physical characteristics. In difficult applications where quantities of fouling material are present, a number of "industry standard" methods (such as acid or caustic introduced into the backwash) can be used to clean the media. These methods are not necessary with typical potable water sources, however it should be noted that chemical draw ports are located in the standard plumbing arrangement should it be decided that chemical based system maintenance is needed.

Pressure Drop
Macrolite filtration systems have very favorable pressure drop characteristics. Typically, there will be an 8 psi pressure drop across a clean filter bed while operating at the 10 gpm per sq. ft. design flow. Backwashing is initiated when differential reaches 20 psi. A minimum of 35 psi dynamic inlet pressure is required for optimum operation of the system.

As one would expect, filter performance improves as pressure differential increases. A unique aspect of the media's performance is the filter bed's resistance to particle breakthrough and "cracking" as is common with conventional granular bed filters. The media's physical geometry and depth filtration allow differential pressures upwards of 50 psi to be attained without significant particle breakthrough. In practice however, the control system prevents these pressure levels from ever occurring.