KINETICO® MACROLITE® FILTRATION MEDIA

Macrolite is an innovative product which was jointly developed by Kinetico and 3M as a water filtration media. First utilised to remove oxidised iron from domestic water supplies, the application range for Macrolite quickly expanded to the community water systems arena with the passage of the *Surface Water Treatment Rule.*

Macrolite is innovative in that it requires no conventional pretreatment such as coagulation or flocculation to remove particle down to the 3 to 5 micron range. Filtration rates achievable are in the 37 Lpm per square foot range which is well beyond conventional filtration capability. Pressure drop across the media is very minimal and can be expanded in backwash to 100% with 37 Lpm per square foot.

What is classified as more conventional filtration technologies (ie. Rapid sand filtration) use a multimedia filter which usually consists of a garnet layer, a sand layer, and a layer of anthracite coal. These materials are mined in quarries then ground and screened to size. This arrangement is normally capable of removing particles down to about the 20 micron range. Since most particles to be removed in a municipal filtration application are lower than 20 micron, a pretreatment process becomes necessary. The pretreatment process usually involves sedimentation and coagulation/flocculation where very large particles are allowed to settle out and small particles are agglomerated into larger particles. This agglomeration of small particles is essential for the conventional filtration process, without it this type of technology is not able to remove smaller size particles such as *Giardia cysts* and *Cryptosporidium oocysts*.

It is this pretreatment process that requires the majority of the ongoing operation and maintenance costs. These costs fall into two categories, operator attention and chemical costs. Usually coagulant dosing requires continuous operator attention due to varying influent water quality. Chemical costs can vary depending on the type of coagulant used and amount used which is dependant on influent water quality.

System waste water can be a concern with conventional technologies. Most states have regulations concerning the disposal of backwash from chemically pretreated systems. Typically these systems are more in capital costs, require more operation and maintenance costs (mainly due to the chemical addition pretreatment process) and require a full time operator. All of these expenses make it difficult to manage and afford for many community water systems.

Other filtration alternatives may include membrane technology, slow sand filtration and diatomatious earth. Each of these systems have their advantages and disadvantages. For example, membrane technology whether it is an ultra filter or a reverse osmosis membrane require higher pressures to operate. Membranes also waste more water than other forms of filtration, typically 25% to 75% of the total water produced depending on the application and membrane used. Water quality produced by a membrane is quite high, but operating these systems on a large scale can be costly due to power consumption, membrane cleaning and replacement.

Slow sand filtration is popular due to its simplicity and low operation and maintenance costs. There is no chemical pretreatment and operator attention is minimal. The system utilises a biological layer to filter out particles and as the name indicates flow rates are very slow (0.06-0.60 Lpm per sq. ft.). Because of these slow flow rates, filter beds need to be very large to accommodate flows required for a town. These large filter beds take up space and require large up-front capital costs to build. Raw water quality is also a factor in considering slow sand filter, its window of application is somewhat narrow in that algae and high turbidity can cause problems.

Diatomatious earth (DE), is another no chemical pretreatment process. DE has been approved by many regulatory concerns to produce acceptable effluent standards, but is operator intensive and requires constant media replacement.

In small community water applications, Macrolite has advantages over all of these other systems. Macrolite starts out as fine granules about 40 micron in size and through a very complex manufacturing process is formed into what is known as Macrolite filtration media. It is with this manufacturing process that Macrolite gains its advantages. The material is formed to a certain size and specific gravity then fired in a kiln to its hardened ceramic state. Macrolite can be produced in a wide range of sizes as well as specific gravities, for example a 70-mesh size particle of Macrolite can be produced with a specific gravity of 2.0 to 2.7 depending on the application.

With this flexibility, a filter can be produced where smaller more dense particles of filter media are on the bottom of the filter bed, which larger, less dense particles are on the top of the filter bed. This type of configuration is effective in optimising filter run times because the entire filter bed can be utilised. The larger particles can be trapped in the top of the bed while only the smaller particles are removed in the lower bed. With this type of filter media a very efficient depth filtration can be achieved. Typical product to waste water produced is greater that 95% for most applications depending on water quality.

Macrolite’s most unique features are its shape and surface condition. The particle is very uniform and the surface condition is quite rough maximising its ability to trap small particles. Durability is another of Macrolite’s attributes. Due to its ceramic nature, Macrolite does not degrade or need to be replaced. Macrolite is chemical resistant allowing disinfection prior to filtration, as well as chemical cleaning if necessary. Although backwashing with disinfected water is usually all that is required, it is possible to use either an acid or caustic rinse to further clean the media.

Since Macrolite filters at such high rates our systems tend to be much smaller than other technologies. Macrolite also has very impressive pressure drop characteristics requiring minimal inlet pressure which reduces pumping costs. A typical pressure drop over a clean bed is 10psi, with an exhausted bed pressure drop at 15 to 20 psi.

Overall in many applications, Kinetico’s filtration systems utilising Macrolite have a clear advantage for the small towns. With the fully automated, self diagnosing filtration system there is no need for a full time operator. One to two hours of attention is all that is required for meter cleaning, record keeping and state mandated sampling.