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**GreensandPlus Filter Media:
Filter Media for Iron, Manganese, Arsenic and Radium Removal**

You may not be familiar with manganese greensand and how it has been used over the years for removal of iron, manganese, hydrogen sulfide, arsenic and radium. Manganese greensand was developed in the 1950s using the natural zeolite, glauconite. Up until that time, glauconite or marl, commonly known as greensand, was used as a water softening media. Being a zeolite, glauconite has ion exchange capacity and was used to soften water. However, it had very low capacity, about 2800 grains per cubic foot, when regenerated with 1.4 lbs. of salt. In the 1940s, synthetic ion exchange resin was developed that had much higher capacity, about 20,000 grains per cubic foot when regenerated with 6 lbs. of salt. With the exception of some special applications, the market for greensand as a softener media disappeared.

Using the ion exchange properties of the glauconite, it was discovered that a catalytic coating could be applied to each filter grain. The glauconite was screened to the proper effective size, and using manganous sulfate and potassium permanganate, a manganese dioxide coating was applied to the media. The coating was applied by going through a series of exhaustion and regeneration cycles. Each cycle deposited manganese dioxide that was held on the filter grain by ion exchange. After several cycles, enough manganese dioxide coated the filter grain to act as an oxidizing catalyst. In some waters iron can be oxidized easily using air or chlorine. However, at a low pH it may take longer for oxidation to take place. Also, manganese takes a long time to oxidize. It, therefore, requires pH adjustment and retention to make sure the oxidation is complete before filtering the precipitated manganese. The manganese dioxide coating on manganese greensand acts as a catalyst to speed up the oxidation-reduction reaction and make sure it is carried to completion in the filter, not after it.

In North America this became the industry standard for removing iron, manganese, and hydrogen sulfide. It was used for everything from the smallest point of entry system to large municipal gravity and pressure filter systems. In fact, it became so popular that the demand out paced the ability of the small mine in New Jersey to mine the glauconite and produce manganese greensand. Lead times stretched out to several months and engineers became reluctant to specify it, as they were afraid that the material would not be available when the filter plant was ready to go on line. Everyone became concerned about the ability to get product in the future.

With the demand so high, companies were willing to pay premium prices to get material fast. With the increase in the cost, it became feasible to fund research into a new product

to fill the demand. Some companies rushed products that were not fully developed to the market. They used their customers to do the trouble shooting in the field rather than fully developing the media before bringing it to the marketplace. This led to many of the substitute materials getting a bad reputation, and customers became very cautious about using any manganese greensand substitutes.

A company in Brazil was working on a substitute product and had hit a dead end in the development of the media. As the Inversand Company was the expert in producing a catalytic coated filter media, they approached us to help them work out the problems and bring the finished, fully developed product to market. Also since we had a world wide distribution network in place, they agreed that we would have exclusive distribution rights world wide with the exception of a few South American countries.

The new product was named GreensandPlus. GreensandPlus is a new water filtration media for the removal of iron, manganese, hydrogen sulfide, arsenic and radium. Its physical properties are the same as manganese greensand. However, it is superior to manganese greensand because it solves all of the problems associated with traditional manganese greensand. First among these is that it is readily available. There are no delays in production or shipments. Container loads can ship direct from the manufacturing facility to any worldwide port. This will save shipping and handling costs as well as save time by getting the media to your warehouse faster than shipping from the USA to your location.

The second improvement is that GreensandPlus is a much stronger and more durable media than manganese greensand. Manganese greensand could not be operated at a differential pressure higher than 10 psi. Since it uses glauconite, a clay type material, as its base, a differential pressure over 10 psi would crush the media into fines that would clog the filter. This would shorten the run time between backwashes, which would eventually lead to failure of the filter bed. GreensandPlus uses a silica-based material that will not crush and can safely be operated up to 15 or 20 psi differential.

The third advantage is that the media will not soften when treating water that is low in dissolved solids, low in total hardness or over 70°F. The glauconite used as the base for manganese greensand would tend to soften if the raw water was low in solids or hardness or over 70°F. This softening would lead to the media crushing, causing fines that would shorten the filter run time and eventually cause the filter bed to fail. The base material for GreensandPlus is a silica product that will not soften under these conditions and, therefore, can treat low solids, low hardness or warm water without any concern.

The fourth advantage of GreensandPlus is that it has more capacity than manganese greensand. Both types of media have a manganese dioxide coating. However, the coating on GreensandPlus has a higher valence which gives it about 50% more capacity. Manganese greensand has a capacity of 500 to 700 grains per ft². For GreensandPlus, we use 700 to 1,200 grains per ft². This means longer run times between backwashes and less backwash waste.

The next advantage is that GreensandPlus can be conditioned and regenerated using only chlorine. It does not require potassium permanganate as has been used with manganese greensand. Any strong oxidant can be used including ozone, but chlorine alone works well. Conditioning will require 4 ounces of chlorine per cubic foot with a soak time of 4

to 24 hours. This process can also be used to sterilize the system. For operations using continuous regeneration (or CR), it will be necessary to maintain a chlorine residual in the filter effluent. This will insure that the media stays regenerated.

In summation, GreensandPlus retains all the characteristics that are good about manganese greensand and improves on all the features that were lacking:

- Improved availability and faster shipments
- More durable, will not crush at high differential pressure
- Will not soften when treating low solids, low hardness or warm water
- Better capacity
- Does not require potassium permanganate for regeneration

Inversand Company has been the only manufacturer of manganese greensand for over 50 years. Over those 50 years, many competitive products have been introduced, some good, some bad. But none, until now, have measured up to manganese greensand. We can now state that after 50 years, GreensandPlus is a media that surpasses the performance of manganese greensand. This media is now being used extensively in the USA for municipal treatment systems. Several municipal systems that have replaced the manganese greensand in some of their filters with GreensandPlus now plan to put GreensandPlus in all of their filters. GreensandPlus is also being shipped to countries in South America, Asia, Europe and the Middle East. We also have distributors in Australia and Canada interested in importing and stocking it. Due to its superior performance, better availability and competitive price, we feel this product will quickly replace the inferior products that customers have been forced to use due to the shortage of manganese greensand. We can assure you that after 3 years of shortages, there will be no shortage of GreensandPlus as it is being produced in a new facility that has ample capacity.