

Trapping the Enemy

Enhanced filter trapping offers a new way to improve water quality and fend off RWIs. Here's how it works. | by Jeff Williams, SeaKlear

Properly maintained sand filters do a fine job of keeping swimming pool water free of much of the undesirable bits and pieces that become suspended in it during normal use.

But what if you could make the filter do a better job, improving its performance in ways that could even contribute to better sanitation and hygiene in the pool? That prospect was behind several years of effort in our laboratories. We were looking for ways to link together tiny,

suspended particles into larger, stable aggregates that would have difficulty squeezing through the pore tunnels in depth filters. In other words, we wanted to give the filter the ability to trap more. To do so, we used characteristics of naturally occurring biopolymers — already widely used for clarification of pools — because they showed a superior capacity to flocculate (or form larger clumps) and sediment out suspensions of particles in water.

We needed a formulation with

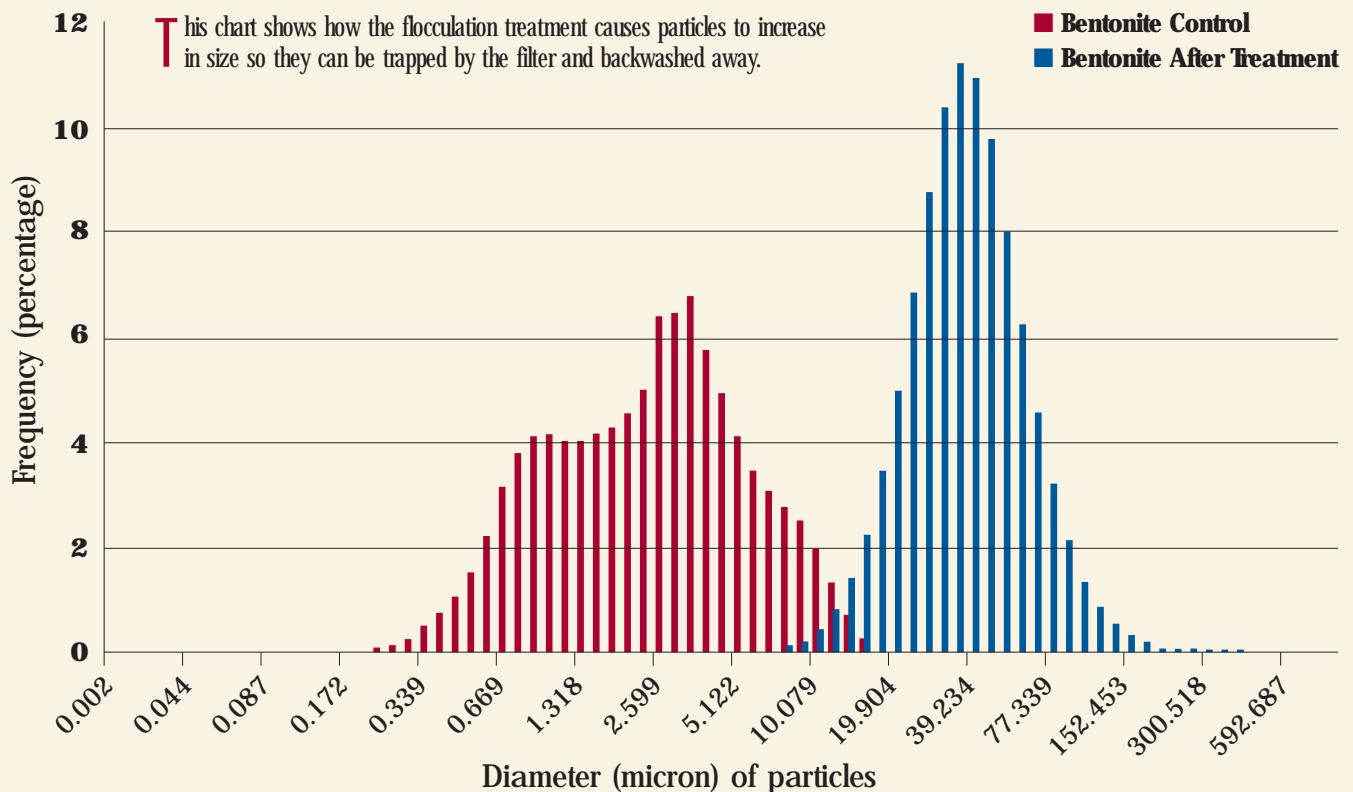
the right molecular characteristics to cause the combination of aggregation and stability necessary to retain clumped particles in depth filter media such as sand. We set our sights high, targeting the removal of submicron-sized particles. The pore paths in sand beds are typically 50 microns and up, so we had to generate clumps this large to be successful.

If we could enable filter media to remove particles that were in the submicron size range, we stood a good chance of being able to

remove microbial organisms as well. The most troublesome of those measure only a few microns, or even less, and therefore routinely pass right through filters with the flow of water. While proper pool sanitation can be counted on to inactivate most disease-causing agents, there are some, such as *cryptosporidium*, that show little sensitivity to chlorine.

Being able to remove these parasites by enhanced filtration would be useful in reducing the chances of recreational water illnesses.

SIZING IT UP



SOURCE: SEAKLEAR

It was not easy. Molecular weight, shape, charge, and absolute and relative concentrations of the biopolymers, plus timing of exposure, all turned out to be critical factors. Data from laboratory experiments showed that with the proper polymer treatment, inert particles (for our purposes, bentonite clay) could be flocculated into larger clumps, enabling many of the resulting aggregates to be removed in a single filter

bed pass. Later experiments involving biological as well as other inert particle types showed similar success, even to the extent that suspensions of live *cryptosporidium* cysts could be taken out at a rate of 99.9 percent in a single pass through sand.

Accomplishing this required sequential treatment of pool water with two differently acting biopolymers — one charged positively, the other negatively. But in the

right proportions and concentrations, this could be achieved reliably and repeatedly.

Here's how it works: Polymer molecules from stage 1 alter surface charges on small particles in water, destabilizing the normal tendency they have to repel one another (and therefore keep separate, and fully suspended, indefinitely). The particles aggregate and become enmeshed in the lattice of long, cross-linked polymer molecules to form much bigger clumps. If the concentration of the cationic (positively charged) polymer is too low or high, this doesn't happen. Stage 2 polymers (negatively charged) then entangle the complexes, firming them up so that they can withstand being trapped in the filter bed, until the back-flush takes them out into the waste stream. The net

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Cryptosporidium is not the only biological agent that can be trapped in this way; other waterborne microbes (*Giardia*, *E. coli*), as well as algae, are similarly affected. Polymer additions for large pools can be accomplished by controlled metering, but a manual process, properly timed, also is entirely practical for smaller scale operations. Stages 1 and 2 polymers are completely biodegradable and safe for bather exposure, and the concentrations required are extremely low — in the ppb range.

With particle removal possible at the submicron level, overall water clarity also improves. Thus, giving sand filters the ability to trap such small particles offers operators a new way to fight RWIs and improve water quality. ■