

ALUM INJECTION - MYTH OR MIRACLE?

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Alum injection is emerging as one of the new technologies for use in storm water treatment systems. This paper has been prepared to present only a few of the arguments that I have heard both in support of, and opposed to, its use. I'll apologize now for inaccuracies: I have no first hand experience and am only relating what I've heard. If this paper generates a significant response, we may set up a workshop and get real experts to discuss real issues.

Alum, according to my chemical dictionary, is any one of several compounds: Aluminum ammonium sulfate, aluminum potassium sulfate, or aluminum sulfate. This material has been added in wastewater treatment plants in some places for years. The result is a partial stripping of particulate matter from the water column. This removal process includes any nutrients or other materials that may be adsorbed to the surface of the particles. Recent applications have been to add the alum to storm water ponds and thereby aid in the removal of particles and nutrients from storm water, as well as wastewater. Apparently there are several permanent installations in place, the most famous being Lake DOT in Orlando. Others in the area include Lake Lucerne, Lake Davis, and Lake Osceola in the Orlando - Winter Park area.

So what have I heard? I'll start with the neutral side; and part of the reason for this paper. I recently received a call from a permit writer. I'll refrain from giving a name or district. He (generic) was searching for research on the treatment because he (generic) was trying to review a permit application and knew nothing nor could find anything on its effectiveness. He (generic) was looking for his reasonable assurances. I had heard nothing specific and could not help him (generic).

I have heard from some people that the treatment is the "**state of the art**" and represents the new technology and the solution of tomorrow. Others have told me that the treatment is an "**incredible waste of time and money, doesn't work, and is toxic**". Neither could support their claims with data.

IN FAVOR:

- SPACE - Because a chemical treatment is used in conjunction with the biological treatment and physical treatment of regular ponds, the system doesn't require the same physical space for installation.

A conventional wet or dry pond must store the water long enough for certain physical processes to work. In a conventional system, the water enters the pond, slows, coagulation occurs, settling occurs, some stripping occurs through adsorption, and pollutants are removed to the sediment. Dissolved and particulate material may be further removed by biological processes occurring in the vegetated zone should one be present. Some planktonic based biological processes may also remove this material from suspension. Once removed from suspension,

pollutants will not be discharged into the receiving waters. All this takes space. Space equals property. Property equals cost. More property equals higher cost.

Alum based systems, which accomplish some of the above noted treatments at a chemically accelerated rate, require less property and therefore, at a lesser cost. A significant side effect of less property is less excavation which also costs money. Smaller ponds equal less excavation costs and even more savings over conventional systems.

- LOCATION - Because of the chemical nature of the treatment, it has been suggested that the process could even occur in pipes themselves under what is termed a continuous injection system. When it rains, an automatic sensor detects pipe flow and the first part of the rain (the most polluted part) is treated even before it gets to the ponds. This allows for off line ponds to be located at several locations along a given collection pipe giving flexibility to designers.

- UNDERGROUND HOUSING - Some of the equipment can be built into vaults underground and thus creating a less cluttered landscape.

- INCREASED TRANSPARENCY - The alum reacts with particulates, including phytoplankton, and increases water clarity. This is considered to be an aesthetic benefit. I've not heard anything about any changes to water color.

- PHYTOPLANKTON CONTROL - As noted above, part of the effect is to remove phytoplankton. This improves clarity and aids in controlling phytoplankton blooms.

- QUICK RESULTS - Apparently the clarification of the water is pretty quick. The expected water clarification can occur in a matter of days.

- LONG TERM SEDIMENTATION SEALING - There is speculation that the sediment may compact eventually and that nutrients and pollutants will be sealed in the bottom for long periods. There is also speculation that the sedimentary floc will act as a long term sink even if compaction does not occur.

IN OPPOSITION:

- SYSTEM FAILURE - System failure in an alum pond will quickly produce undesirable conditions. Too little alum and the system blooms. Too much and it can cause toxicity as well as waste money on wasted chemicals. System imbalance is included in failure.

- OPERATIONAL COST - Unlike conventional ponds, alum ponds have daily or weekly operational costs to prevent the above noted imbalances or failures. This includes operator training and certification as well as chemical supplies, routine maintenance, and electricity.

- CAPITAL MAINTENANCE - The pumps etc need routine maintenance on a fairly frequent basis (noted above). This costs money. They will eventually require replacement. The frequency of this cost is unknown.

- PERSONNEL - A system based on alum must have operators. These may be additional personnel. In an urban area, this may be many, many personnel. Training and personnel retention become operational expenses.

- TOXICITY - Alum and its byproducts happen to be very toxic, especially in salt water. Nobody is really sure to what it is toxic, but everyone tells me it's toxic. This is reported to affect humans, benthic and pelagic organisms.

- SEDIMENT (FLOC) REMOVAL AND DISPOSAL - There is a good deal of uncertainty regarding how often the flocculated sediments must be removed from a system. This is probably no more frequent than in a typical retention pond. A more pressing concern is whether the sediments will be classified as toxic waste and require disposal through expensive out of state shipping and special handling.

- RESUSPENSION - Opponents speculate that the floc will never compact and will resuspend with storm events. After enough has accumulated, should a resuspension event (wind) followed by a hydraulic input event occur (both associated with a good storm), the floc, laced with pollutants, will go over the weir.

- INCREASED AQUATIC PLANT GROWTH - Alum controls the phytoplankton and reduces turbidity. Will Hydrilla and other rooted aquatic plants grow more quickly? The photic zone is deeper. The sediment is enriched. Aren't we trading one problem for another?

- NO BENTHOS - The flocculent material created by the treatment never really solidifies but forms a very loose unconsolidated layer over the bottom. This makes life on or in the bottom of the treatment pond extremely difficult if not impossible. The **In Favor** people say "So what? It's a treatment pond." But some of the treatment occurs because of the benthos.

- PHYTOPLANKTON CONTROL - As noted above, part of the affect is to remove phytoplankton. What does this do to the food chain? Do we care (see "so what" theory above) if the food chain in a treatment pond is intact? Without phytoplankton or benthos, will there be fish? Could anyone eat them anyway? If not people, could avifauna (etc) survive a steady diet of alum pond fish?

DISCUSSION: I have none. Because none of the above statements have been backed up by any facts, or studies, or data, or even documented observations, I have nothing to discuss. As I said at the beginning of this paper, I've heard a lot of talk and have seen no data. This is just a compilation of hearsay. I'd very much like to read some actual scientific studies on this. The kind that starts off with an hypothesis, develops a test, collects data, and interprets the results to form a theorem. Remember those? If you know of anything like this, or just have more hearsay, write (don't call);

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