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January, 2023

By the Pond

It's time for the Atlanta Koi Club's first meeting of 2023!

Last year was a great year for the club that saw record turnout and participation from our members and the community at some of our biggest events like the 2022 Koi Auction, Pond Tour and of course, the Koi and Goldfish Show. We certainly worked hard at those events and also got to play hard at the highly-anticipated 2022 Summer and Winter Socials! With each new year, we are given the opportunity to reflect on the year before and use those experiences to plan ahead for success.

During Sunday's meeting, we'll be outlining what's new to look forward to in 2023 for the AKC. This should be a very informative meeting, so please make sure to plan to attend and ask questions, bring ideas and plenty of suggestions!

The Zoom Meeting information is below:

The Atlanta Koi Club is inviting you to a scheduled Zoom meeting.

Topic: AKC January 2023 Virtual Meeting - Sunday, January 15th
Time: Jan 15, 2023 03:00 PM Eastern Time (US and Canada)

Membership
Happy New Year Members!

Emails went out a couple of weeks ago in regard to renewal of memberships for 2023. Some people did not get an email because they do not owe until next year. If you think you owe, please check your junk folder or contact me with any questions at membership@atlantakoiclub.org. 2023 membership renewal is due at the end of the month, January 31st. Remember, you will receive benefits when you participate in the auction and show if your renewal is received by January 31. This is also a good time to purchase name badges from our website if you haven't already so that you can receive a free raffle ticket at our meetings.

Rhonda Eubanks
AKC Membership Chairperson

Good afternoon and Happy New Year!

Hope everyone had a safe and WONDERFUL **holiday season** and are enjoying the warmer weather while it's here! After our December 2022 break, Club activities are set to resume for the year. With that said, I am asking any and all members for suggestions for topics that you would like to learn more about!

We have a fairly large & active club here in Atlanta, with so many very talented, experienced or simply enthusiastic and passionate members. If anyone would like to **volunteer to speak & share their knowledge so others could benefit & grow as hobbyists**, it would be a **HUGE** help for the club! If you have speakers, vendors, organizations, universities or industry/hobby experts you'd like to hear from or connections with them, please send me their information as well!

In addition, our meetings simply are not possible without meeting locations. One joy of being in a koi club is for members to meet & check out each others' ponds so we can all experience new fish, filtration or a new way of doing things. Please, if you have not already, **consider hosting a club meeting** and reach out to me or any member of the board if you have any questions or concerns.

Here are the Atlanta Koi Club 2023 Meeting Dates:

- **January 15th (Sunday) @ 3pm -** *Topic, Location Needed*
- **February 12th (Sunday) @ 3pm -** *Topic, Location Needed*
- **March 19th (Sunday) @ 3pm -** *Topic, Location Needed*
- **April 22nd (Saturday) - Koi Auction at Furkids**
- **May 6th (Sunday), @ 3pm -** *Topic, Location Needed*
- **June 10th (Saturday) @ 5pm -** *Topic, Location Needed*
- **July 15th (Saturday) - Summer Social, Location Needed**
- **August 12th (Saturday) @ 5pm -** *Topic, Location Needed*
- **September 10th (Sunday) @ 3pm -** *Topic, Location Needed*
- **October 13th - 15th - 2023 Atlanta Koi & Goldfish Show**
- **October 22nd (Sunday) @ 3 pm -** *Topic, Location Needed*

November 11th (Saturday) @ 6 pm - Winter Social, Location Needed
Feel free to reply to this email with any meeting topics, speakers or meeting locations for consideration. Over the next week or so, a follow-up email will be sent with the details for the January 2023 AKC meeting.

Here's to a great year - let's start strong and stay strong!

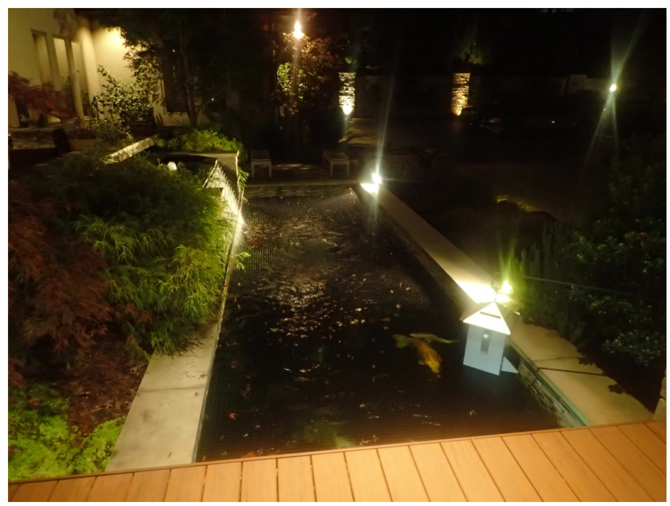
Marlon Tiller
Vice President

Winter Social last November

On November 12th, we had out traditional winter social at the home of Brad an Diana Mohs. Brad and Diana outdid themselves by furnishing multiple main courses and deserts, in addition to pot-luck goodies from attending members. While most of us stayed inside to survive the autumn chills, a few brave individuals ventured outdoors to gape in awe of their pond. Following is a description of details of their pond:

The surface of the pond is approximately 500 square feet and it averages 4.25 feet deep

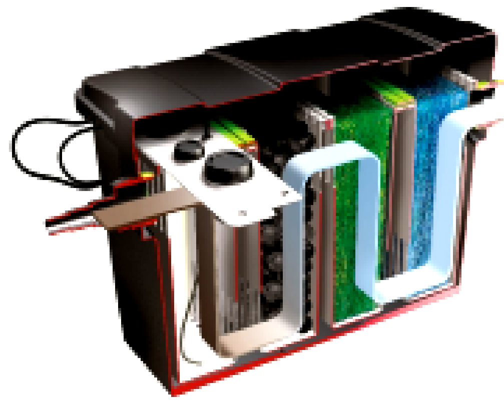
- Total gallon volume of the entire pond system (including pumps and piping) is approximately 17,000 gallons
- Water leaves the pond through two pairs of 4-inch Rhino-II bottom drains and two no-niche skimmers
- The air bladders on the four drains are fed by two Medo linear piston air pumps (ultra durable)
- Each pair of drains feeds a 300-gallon, 4-foot-diameter vortex settling tank
- Using pairs of drains to each tank reduces likelihood of fish getting sucked into the drain
- Each settling tank has one overflow pipe to control the maximum water height in the pond and triple intakes to feed the filtration system
- The settling tanks, piping and control valves for both water and air are housed under the drawbridge section of the deck over the pond
- Each settling tank and each skimmer feeds a fully independent filtration system that includes a pump, filter and UV sterilizer
- Each pump is a 1.5HP High-Flow Performance Pro and moves approximately 7500 gallons per hour
- Each filter is an Aqua Ultima II 20,000 (rated for 10,000 to 20,000 gallon ponds and 7500 GPH flow rate)
- Each UV sterilizer is a stainless tube Aqua Viper 400watt with 3-inch inlet/outlet ports



More photos of Brad and Diane's Social {Party in November. Note that their pumps and piping were located underneath the wooden drawbridge at their front entrance (shown below). Unfortunately, the cameraman (me) was unable to jump across the moat while the drawbridge was up, so I couldn't gape in astonishment of their system.

Mechanical Filtration and Why It's Important

By Ken Austin
Certified Koi Keeper – Koi Organisation International



Koi ponds are plagued with two major types of pollutants (ammonia and organic solids) and there are two major types of filters for those pollutants. A bioconverter (biofilter) will convert toxic ammonia to nitrate. Nitrate is still a pollutant, but it is much safer for the fish. A mechanical filter traps the organic solids (algae, feces, plant material, etc.), usually in a manner that makes it easy for the pond keeper to remove the solids from the system. The removal of solids is why mechanical filters are important. Solids anywhere in the pond system will decompose and add ammonia back into the water. That decomposition process also removes oxygen from the pond water, reducing the oxygen available to the fish.

Many pond keepers only have a single filter. Those types of filters perform both functions – converting ammonia and trapping solids. They are popular because they do not take up much space and they reduce the overall cost of pond construction. Often they can be fed by a single pump which results in lower electrical costs. The function of converting ammonia requires significant water flow in order to convert the ammonia as fast as it is produced by the fish. The function of trapping solids restricts water flow to allow for settling and/or entrapment. That conflict of purposes makes the single filter less efficient at both ammonia conversion and trapping solids.

Mechanical filtration is a physical process (i.e., one not reliant on chemicals or biological organisms) used to remove impurities in the form of solids (i.e. not dissolved). They trap or collect suspended and settled solids for removal from the pond system.

The placement of mechanical filters in the system is important to getting the maximum benefit from them. The mechanical filters should be placed before the biofilter. This ensures the water is as free of solids as possible, which will prevent the biofilter from clogging and becoming inefficient. The mechanical filter should be typically placed before the pump. This provides removal of solids as soon as possible when they appear in the system, i.e. before they breakdown into hard to remove smaller particles or decompose into other pollutants.

A surface skimmer is a type of mechanical filter and should be designed and placed so that it "skims" the water. Skimming the surface of the pond removes dust, leaves and other forms of pond pollution. The pollutants floating on the surface of the pond block our view of the Koi. A surface skimmer will go a long way in assisting the filtration system to make the pond water more clear.

Mechanical filters come in a variety of designs, such as:

- Settlement chambers/tanks - Settlement takes place when the velocity or turbulence is greatly reduced as the water flows through the chamber.
- Open media filters - A media like sand and gravel is placed in a chamber which traps the passing solids.
- Screening - Often used in conjunction with settlement chambers, screens, pads or barriers (like brushes) made of a variety of materials are used to trap solids.
- Sand Filters - variations of pressurized or swimming pool sand filters.
- Floating bead filters – Typically used for bioconversion but also used as mechanical filters.
- Cartridge filters – Media is housed in a cartridge. It is generally removed and hosed off for cleaning.
- Bag filters – fine mesh bag – can be a long tapered 'sock' stuck into a large diameter pipe.
- Vortex - These are usually a cylindrical tank with the water entering at a tangent. This causes the water to spin inside the tank or vortex. The spinning water movement causes solids settle towards the middle and can be removed from the bottom.
- Sieve – A device designed so water flow across a perforated metal screen called a sieve which acts to separate solids from the water. It differs from screening type filters because the solids do not remain trapped in the sieve itself but are diverted to a collection chamber.
- Rotating Drum – A device designed so that water flows across a drum wrapped with a screen. The drum continuously rotates so that water jets can spray the solids off the screen into a collection chamber.
- Protein Skimmer – also called a foam fractionator removes very small suspended solids as well as some dissolved organic material by mixing water and air, creating foam that is separated from the water with the organic material trapped in the foam.

These are just some options for mechanical filtration. A better understanding of turn-over rates, sizing filters and comparing filter types is available in the K.O.I. course #203 – Filtration, and the advanced course #303 – Advanced Filtration. K.O.I. also offers a course in Anoxic Filtration #311. Click on any course number at the following URL to learn more about it:
https://koiorganisationinternational.org/courses

Sodium Thiosulphate Dosage Rate
By: Ted Baughman

This question was posed: "What is the correct amount of Sodium Thiosulphate to dose for 1ppm of Chlorine? There are different dosage rates floating around in print and on the internet."

- K.O.I.: 26.50g / 1000gal (Cover S. *K.O.I. Guide (Basic)*, Section 11. Rockfall (CT): Koi Organisation International; 2012)
- Koiphen: Enter *"1000"* in the *"gallons"* field and enter *"1"* in the *"ppm"* field. You should see a *"result"* of 13.262 grams or 0.469 ounces. (source: https://www.koiphen.com/forums/koicalcs.php?do=calcst)

As we can see from the recommendations described above, it looks like two sources are giving very different advice. Let's try to apply some chemistry principles and see if we can understand the discrepancy. We'll assume we're talking about a 1000 gallon pond and go from there. Here are a few facts worth memorizing:

- 1gallon = 3.785 Liters (L)
- 1part per million (ppm) of 'stuff' = 1milligram (mg) of 'stuff' per liter
- 1000mg = 1gram

With this information we can calculate exactly how much chlorine we're talking about. First, we convert a 1000gal 'English' pond into a 'metric' pond:

1000gal * (3.785L / 1 gal) = 3785L

Now we convert ppm for this volume into an exact quantity of material. We substitute 'chlorine' for 'stuff' from the facts above:

1ppm chlorine = 1mg chlorine/1L pond
(1mg chlorine / 1L pond) * 3785L pond = 3785mg chlorine = 3.785g chlorine (divide mg by 1000 to get grams)

Note: THIS WORKS FOR EVERYTHING! If you want 1ppm of potassium permanganate in a 1000 gallon pond, you add 3.785g of potassium permanganate. If you want 1ppm salt in a 1000 gallon pond, you add 3.785g of sodium chloride. This is why your life could be much easier if you convert "gallons" to "liters" ONE TIME. Write that number down in front of your log book/pondside notepad (you have one, right?), and then whenever you need to do a 'ppm' type addition, just **multiply your high falutin', euro-friendly, fancy pants pond size number by the ppm desired, divide by 1000 to go from mg to gram, then do your business**. If you want to show off, start referring to your pond in liters, it sounds bigger. (Next thing you know, people will be measuring their koi in centimeters…)

Getting back to the chemistry, a one-step conversion of chlorine with thiosulfate requires conditions of very high pH. Fish don't like that.

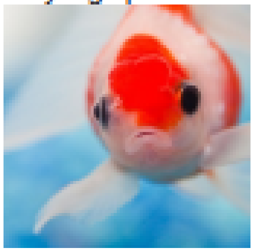


Figure 1: You want to do what?! (https://i.pinimg.com/originals/44/37/af/4437af4702ee85e47a3be6752692711b.jpg)

We'll need to track down a balanced chemical equation that better matches the pond environment and apply it.

Hatchery International (https://syndel.com/wp-content/uploads/2019/01/Ins-and-Outs-Of-Dechlorination.pdf) published a piece that breaks the chemistry down into two steps, based on an initial reaction between free chlorine (Cl_2) and sodium thiosulfate ($Na_2S_2O_3$) to reduce the chlorine down to hydrochloric acid (HCl), followed by a second reaction to convert the HCl into NaCl. Generally speaking, chemistry shows the ingredients on the left, and the product on the right. Sometimes you'll see double arrows, which means things can go back and forth, but that's not the case here. The number in front of the letters refers to the number of molecules needed in the process. If there is no number in front of the name (e.g. H_2O) then there is only one.

$$Na_2S_2O_3 + Cl_2 + H_2O \rightarrow S + 2HCl + Na_2SO_4$$

$$2HCl + Na_2S_2O_3 \rightarrow 2H_2O + S + SO_2 + 2NaCl$$

In addition to the chemical equations, Hatchery International also included the empirically determined (i.e. they just tried things until they found something that worked) guidance that *across pH ranges, 2 to 7 'parts' sodium thiosulfate will bind 1 part chlorine.*

I hate the 'parts' nomenclature because it ignores molecules, but let's calculate the numbers we get at each of the "recommended" dosages:

> 3.785g chorine * 2 "parts" sodium thiosulfate pentahydrate = 7.57g sodium thiosulfate pentahydrate
>
> 3.785g chlorine * 7 "parts" sodium thiosulfate pentahydrate = 26.50g sodium thiosulfate pentahydrate

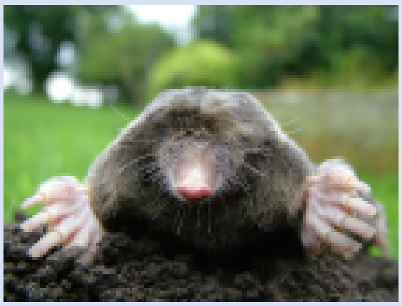
That latter equation matches the K.O.I. recommendation, which makes sense. Someone came up with empirical ranges of effective rates to neutralize under a variety of conditions, and K.O.I. used the 'worst case' scenario for their recommendation.

But, how do you know that there is a sound basis behind these numbers? That's where we dive deeper into the chemistry.

If we look at the reactions that Hatchery International uses, you'll see that 1 molecule of sodium thiosulfate (in red) will convert 1 molecule of chlorine (green) into 2 HCl molecules. In the next reaction, 1 more sodium thiosulfate molecule will convert the 2 HCl molecules into salt. The summation is you need **2 molecules of sodium thiosulfate per 1 molecule of chlorine**.

What is a Mole?

Individual molecules are really, really hard to count. This comes up a lot, so chemists created a tool for this, it's called a "mole." It lets us convert the large numbers of individual molecules found in chemical equations into real world weights. You can use it as well: you just need to search out the 'molecular weight' of your chemical; and understand the concept behind 'moles.'



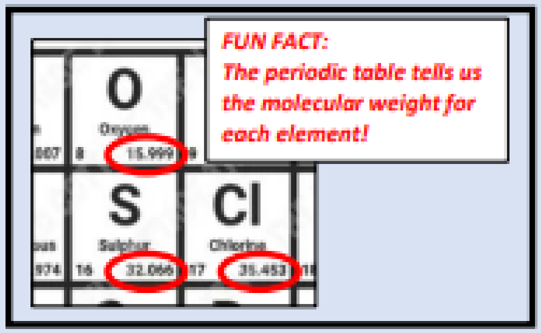


Figure 2: No, not this. (https://commons.wikimedia.org/wiki/File:Close-up_of_mole.jpg)

A mole is just a collection of molecules. Think, think of it as the number of seats on an airplane. **It doesn't matter (mostly…) how big or small the people are, it's just a set number of seats.** It's actually 602,300,000,000,000,000,000,000 (which means you definitely want to spring for the first-class seat), but you actually don't need to deal with the number at all. If you weigh a plane after filling every seat with ballerinas, it will weigh considerably less than a similar plane loaded full of sumo wrestlers, *even though each plane has the same number of passengers.*

Figure 3: This plane is going to be heavy! (https://boingboing.net/2014/07/31/29-sumo-wrestlers-on-a-plane.html)

From the first section, we know we're dealing with 3.785g of chlorine. Chlorine is kind of a ballerina-sized molecule, whereas sodium thiosulfate is more of a sumo wrestler. Chlorine has a molecular weight of 70.90g per "mole", so we divide to convert g into moles.

3.785g chlorine (1 mole chlorine / 70.90g chlorine) = 0.0534 moles chlorine

Now, based on the chemical reactions, we can trade our 2 plane loads of ballerinas for 1 plane load of sumo wrestlers, which is what the 'mole' system allows us to do so easily:

0.0534 moles chlorine * (2 moles thiosulfate / 1 moles chlorine) = 0.1068 moles thiosulfate

Now we need the weight. This is where we answer the question, "how much does 0.1068 moles of thiosulfate weigh?"

Unfortunately, there are two forms of sodium thiosulfate, basically "with water" and "without water". They have different molecular weights:

$Na_2S_2O_3$ (anhydrous or "dry") = 158.11
$Na_2S_2O_3 * 5H_2O$ (pentahydrate) = 248.18

Basically, the pentahydrate comes with 5 water molecules attached. Yes, even though it is a dry looking, dry feeling, white powder, it's actually bound up with a bunch of water molecules. You'd never know! At the molecular scale, think of it as sumo wrestlers, but each one is carrying 5 cases of water. Same wrestlers, but they're heavier when they get on the plane.

Fortunately, virtually all the sodium thiosulfate you're likely to buy is of the pentahydrate form, so check the label to be sure, but use the bigger number. The calculation in either case is easy. Just multiply the number of moles (from above) by the molecular weight of the form you have:

0.1068 moles thiosulfate * (248.18g sodium thiosulfate pentahydrate / 1 mole sodium thiosulfate pentahydrate) = 26.50g sodium thiosulfate pentahydrate

Nice – this exactly matches the 7 'parts' recommendation, as well as the K.O.I. recommendation.

Of course, you might be able to get by with less. You'll notice that the first reaction you use up half of the sodium thiosulfate breaking down the chlorine into HCl. But, in many ponds, <u>you'll have enough carbonate buffering capacity to where you don't have use sodium thiosulfate to neutralize the HCl,</u> because you have carbonates that do it for you.

You'll notice that ½ of the recommendation above almost exactly matches the Koiphen calculator recommendation (13.262g), which strongly implies it's based on the first reaction. Koiphen should really specify sodium thiosulfate *pentahydrate*, but other than that, it's reasonable to assume that **most ponds have enough buffering capacity to handle the small amount of HCl generated from the conversion of chlorine to HCl.** You add thiosulfate to break the chlorine down into HCl, then let the pond handle the neutralization.

As to the rest of the stuff, how you get your 13.26g or 26.50g into the pond really doesn't matter a whole lot, as long as it all gets dissolved. I don't really work in cups, ounces or tablespoons - and you have to go out of your way to buy a balance that doesn't work in grams - so there's little excuse for the archaic English approach. Just figure out how many grams you need to get into the pond, weigh it out, dissolve in 'ample' water and toss it in. You could make up 10x more than you need (say, 265g) and dissolve it in any controlled volume of water, for example, 10 soup cans or 10 boots full of water. Then, add one soup can or one boot full out of the stock whenever you need it.

Thanks for reading through, and hopefully this gives you a sense of how chemical theory is working behind the scenes. Making the switch to handling your 'chemistry' using metric measurements is the real take-home lesson. I've never been able to reconcile the distrust of SI units (where everything is handled by multiplying or dividing by 10) with the love for cups, ounces, stones, farthings, etc… Beyond debate, *that* math is truly torturous!

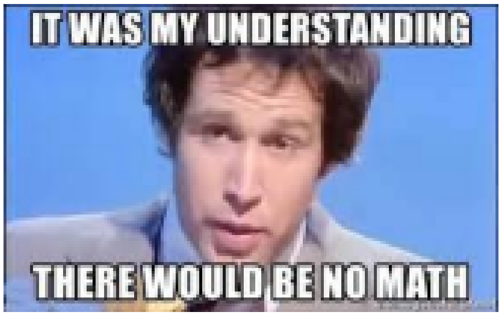


Figure 4: Sorry! (https://www.nbc.com/saturday-night-live/video/debate-76/3004161)

Credits to Jennifer Treiberg for the helpful edits and Bill Layman and Monte McQuade for bringing the interesting questions.

Ted Baughman is a member of the Washington Koi & Water Garden Society and the Northwest Koi and Goldfish Club. He and his wife, Jennifer Treiberg, are scientists who occasionally bring their training in chemistry to the ponding world.

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