

On the Water Front

Rocky Mountain Water Quality Analysts Association

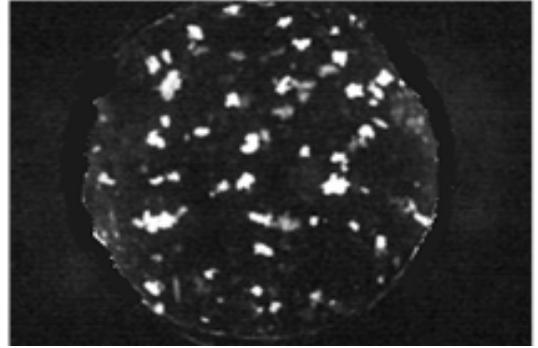
First Quarter 2011

Floc Characteristics & Filtration Pollutant-Removal Control

Contributed by Roger Jorden, ClearCorp
and Tyson Ingels, PE, CWP, CDPHE

Ask experienced surface water treatment plant operators their *real, gut check* for coagulant dosing to obtain optimized filter pretreatment, and chances are, among other things, the operator does a visual check of the floc, a very fine, fluffy mass formed by the aggregation of suspended particles. As far back as 1500 BC, flocculation has been used in water treatment. The Egyptians used it to clarify Nile River water for drinking.

Somehow, the Egyptians knew that floc formation was key to pollutant removal. Floc particles that form in the presence of target pollutants are composed of aluminum or iron hydroxide precipitates as well as various pollutant species such as *Giardia* and *Crypto*, other microbes, and disinfection by-product (DBP) precursors. Because coagulant chemistry, rapid



Floc particle characterization

mixing, and flocculation control the floc particle's physical properties, such as size, measuring floc particles is critical to surface water treatment operations and ultimately filter performance.

The Egyptians discovered the *magical* benefits of flocculation, but how did they decide how much chemical to use? Very likely, they used the same metric as today—the eye. For a very long time, operators have been able to judge how effective the chemical treatment and pollutant removal is going simply by looking at the floc particles. While filter effluent turbidity and particle counts are reliable indicators for performance after filtration has occurred, floc formation is a real-time process that coincides with coagulation.

Until early 2006, the operator's intuition, professional judgment, and visual inspection of the floc has remained the primary metric for assessing filtration pretreatment.

Continued on page 7

Table of Contents

Fluoridation Part II.....	2
May Symposium Save the Date.....	3
Health and Safety.....	3
pH and IES Probe.....	4
Analyst Scholarship Info.....	4
New WWTP Status.....	6

Water Fluoridation Part II: Best Thing Since Sliced Bread or Communist Plot?

By Diana Beehler, Town of Estes Park

*"Repeated doses of infinitesimal amounts of fluoride will in time reduce and individual's power to resist domination by slowly poisoning and narcotizing a certain area of the brain... Both the Germans and the Russians added fluorine to the drinking water of prisoners of war to make them docile and stupid."*¹

Last quarter we explored the discovery of fluoride as the cause of mottled teeth and the realization that fluoride seemed to reduce cavities, but as water professionals, we've all had a customer inquire about fluoridation. Regardless of the response, it probably wasn't what the customer wanted to hear. So how did the controversy start?

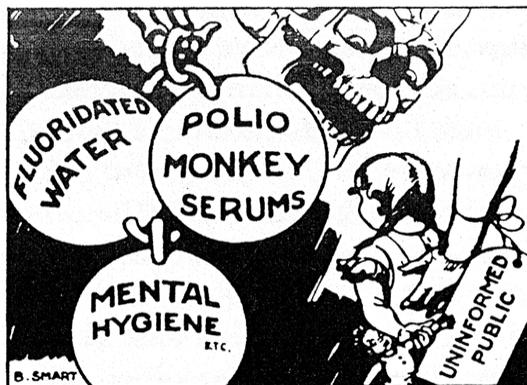
The head of the Dental Hygiene Unit of the National Institute of Health in 1942, Dr. H.T. Dean, had developed statistical proof that children drinking water with up to 1 ppm fluoride had fewer cavities.² In 1945, fluoride addition was studied in four cities located in New York, Michigan, Illinois, and Ontario. Over the next 10 years the children in these cities developed 60% fewer cavities than those in neighboring cities without fluoridation.³ The program's effectiveness prompted rapid adoption of this public health measure which resulted in a decline of dental caries over the next 40 years. Despite the success, resistance surfaced.

Opposition to water fluoridation first occurred in physician Isidore Alpher's 1937 book, 40,000,000 Guinea Pig Children which warned of the dangers posed by fluorine compounds. To Alpher, the most insidious danger was the invention of fluoride toothpaste by conscienceless corporations.⁴ Rumors flourished claiming fluoridation was the brainchild of ALCOA and Colgate to pawn their chemicals on an unsuspecting public for big profits.

In the 1950s the John Birch Society, an American anti-conspiracy organization,

opposed fluoridation of water supplies asserting fluoridation was an involuntary mass medical treatment that violated individual rights. At the same time, "Red Scare" activists regularly asserted that fluoridation was part of a far-reaching communist plot. Many believed that fluoride decreased a person's power to resist domination and resulted in a

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FLUORIDATED WATER

1—Water containing Fluorine (rat poison—no antidote) is already the only water in many of our army camps, making it very easy for saboteurs to wipe out an entire camp personnel. If this happens, every citizen will be at the mercy of the enemy—already within our gates.

POLIO SERUM

2—Polio Serum, it is reported, has already killed and maimed children; its future effect on minds and bodies cannot be gauged. This vaccine drive is the entering wedge for nation-wide socialized medicine, by the U. S. Public Health Service, (heavily infiltrated by Russian-born doctors, according to Congressman Clare Hoffman.) In enemy hands it can destroy a whole generation.

MENTAL HYGIENE

3—Mental Hygiene is a subtle and diabolical plan of the enemy to transform a free and intelligent people into a cringing horde of zombies.

Rabbi Spitz in the American Hebrew, March 1, 1946: "American Jews must come to grips with our contemporary anti-Semites; we must fill our insane asylums with anti-Semitic lunatics."

FIGHT COMMUNISTIC WORLD GOVERNMENT by destroying THE UNHOLY THREE !!! It is later than you think!

KEEP AMERICA COMMITTEE
Box 3094, Los Angeles 54, Calif. H. W. Courtols, Secy. May 16, 1953

Cold & Flu Season is Still Here. So...Wash Up for Health and Safety

By Adele Hinton-Rucker, City of Aurora

We have all seen them. I call it Flush & Go. They flush after using the bathroom and the next thing you hear is the door closing behind them. Not even thinking, they touch door knobs, fax and copy machines as well as the brownies on the lunch room table. Not only is it cold & flu season, it is that time of year when everyone turns on the oven and brings homemade treats to the workplace. Yummy. Or not. Think about it, did a Flush & Go search through the goodies, handling them all, and leave you an unseen surprise?

No matter the season, what's the best way to avoid colds, flu and gastrointestinal upsets? Hand washing. We all know this, but infection control researchers keep coming to the same conclusion: We don't wash our hands often enough or well enough. So here's a quick refresher on this basic, but important, healthy habit.

When to wash:

- Before eating
- Before preparing food to prevent food poisoning and the spread of disease
- Before handling each different food, for

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Total Coliform	Regs, Fecal Coliform
Metals by ICP-MS & AA	DMRQA Participant

Save the Date

The 2011 RMWQAA
Water Quality Symposium
Friday, May 6, 2011

Hilton Fort Collins

Registration information to follow

example wash after cutting the raw chicken and before dicing the vegetables

- Always wash after using the toilet. If you have been handling chemicals, wash before using the toilet, too, and before handling contact lenses or applying makeup

How to wash:

- Take off watches, bracelets and rings.
 - Wet your hands and forearms using a stream of warm running water.
 - Lather thoroughly with soap or other cleanser. Plain soap and warm water is good enough for most hand washing, providing it is done properly.
 - Rub your hands together vigorously for at least 15 seconds (the time it takes for you to sing the "Happy Birthday" song twice). Scrub your wrists, the front and back of your hands and your fingers. Clean under your fingernails.
 - Rinse well under warm running water.
 - Repeat the steps if necessary.
 - Dry your hands completely on a one-use towel or under an air dryer. Use a paper towel to turn off the faucet and open the door without contaminating your hands again.
- Thanks in advance for washing your hands. Remember, I would like to have a brownie too.

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Electrochemistry Workshop Wrap-up by Stephen Ellis, SACWSD

RMWQAA hosted an electrochemical workshop on December 2, 2010. Kim Johnston and her colleagues from Thermo-Orion taught the workshop which was held at the new Foothills Animal Shelter in Golden, CO. Thirty-one people attended.

To start the day, Kim shared her incredible knowledge of pH theory and application with the group. She showed many different types of pH probes and discussed how to choose the right probe for an application. The next topic was conductivity and the relationship between conductivity and TDS (total dissolved solids).

After a lunch break, we moved on to dissolved oxygen (DO). The theory behind the science of older membrane style probes was compared to the theory supporting newer optical DO probes. Then, the class learned to calibrate and store optical DO probes.

And if that wasn't enough to set our heads spinning, we talked about the different types of ion-selective probes. Problems with the probes specifically nitrate and ammonia ISE probes were addressed. This discussion personalized the training and many said they learned several ways to improve the use and care of the probes they currently use. To top it all off, we got watched one of the Shelter's dogs get adopted!

RMWQAA SCHOLARSHIP

Every year, RMWQAA supports our industry by giving a \$500 scholarship. In 2008, the RMWQAA board members created this annual scholarship to encourage and assist students who wish to pursue higher education at a college or university in the fields of water, wastewater, and/or environmental science.

To qualify for the annual scholarship:

- ◆ Candidates must be enrolled in a 2yr or a 4yr college or university for study related to the water environment profession.

- ◆ Candidates must be a member of RMWQAA or sponsored by a member.
Note: The scholarship entitles the recipient to a one-year complimentary membership in the Rocky Mountain Water Quality Analysts Association.

- ◆ The recipient must show proof of enrollment in an environment-related program at a college or university to receive a scholarship.

Application: www.rmwqaa.org or

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submissive population. Dr Charles Bett, a prominent anti-fluoridationist of the time, proclaimed the fluoridation was “better THAN USING THE ATOM BOMB.” The bomb had to be made and transported while “POISONOUS FLUORINE has been placed right beside the water supplies by the Americans themselves ready to be dumped into the water mains whenever a Communist desires!”⁶

In 1964 Stanley Kubrick released the movie *Dr. Strangelove or: How I Learned to Stop Worrying and Love the Bomb*. In this movie, General Jack D. Ripper starts a nuclear war in the hope of impeding a communist plot to “sap and impurify” the “precious bodily fluids” of the American people with fluoridated water.⁵ By the sixties, the public began to connect conspiracy arguments with irrational fear and paranoia. Satires appeared in other movies too, such as *In Like Flint* (1967) in which fear of fluoridation was used to indicate insanity.⁵

In 1992, the idea that water fluoridation was a capitalist scheme regained support in the Covert Action Quarterly article *Fluoride: Commie Plot or Capitalist Ploy.*” The article claimed the aluminum industry used fluoridation in the 1940s as a disposal method for toxic fluoride wastes and got a profit from the practice.⁴

Most modern opposition centers on the ethics of forced medical treatment or the increase of ailments i.e. cancer, Down Syndrome, heart disease, osteoporosis and bone fracture, Alzheimer disease, lowered intelligence, allergies, AIDS, and other health conditions. CDC studies have shown adverse skeletal effects at fluoride levels above 14 mg per day (equivalent to about 4.3 mg/L in water), however many studies conducted in sev-

eral countries show no consistent evidence linking the consumption of fluoridated water to mortality. Acute effects from overdosing have occurred at 30-1000ppm.² The final argument against fluoridation is ethics. Opponents claim immorality. Since the public can’t “opt out,” they lose their freedom of choice and fluoridation becomes forced, involuntary medication.⁷

What is the right answer? Although early studies showed fluoridation greatly reduced cavities in children, US studies from 1979-1989 showed the reduction was between 8-37%. Proponents feel that communities of low economic status are burdened with dental problems and less access to proper dental hygiene education and dental care benefit the most.² Opponents argue that fluoride does not need to be swallowed to prevent tooth decay and there are other ways to provide it. They note declines in tooth decay at the same rate with and without water fluoridation. This suggests there are a number of causative factors, including better nutrition that can reduce dental caries. Most in the US support community water fluoridation, but the number of systems deciding to add fluoride has decreased. Is it a program that has outlived its time? It all depends on who you talk to.

For information on CDC recommendations and your state's levels go to

<http://www.cdphe.state.co.us/pp/oralhealth/Snapshot.html>
<http://apps.nccd.cdc.gov/MWF/Index.asp>

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Treatment Plant Plans Clear Final Hurdle Before Going to State

Denver Regional Council of Governments board approved the Metro Wastewater Reclamation District's Northern Treatment Plant (NTP) Wastewater Utility Plan and application for Site Location Approval at its meeting last night.

The Metro District plans to submit the NTP Wastewater Utility Plan and application for Site Location Approval to the Colorado Water Quality Control Division by December 1. The Wastewater Utility Plan is the engineering report that supports the District's application for Site Location Approval for the NTP. The North Front Range Water Quality Planning Association approved the NTP Wastewater Utility Plan and application for Site Location Approval on September 23, 2010. Approval of the NTP Wastewater Utility Plan and the application for Site Location Approval by both regional governments is the last step required before submitting the documents to the state for its approval.

The 24-million-gallon-a-day Northern Treatment Plant will serve communities in the northern metropolitan Denver region that need updated and expanded wastewater treatment, said Metro District Manager Catherine R. Gerali.

"Existing facilities will soon reach their capacity limits," Gerali said, noting that the facility will be "one of the most

advanced in the western United States."

She added that advanced treatment is required because protecting the South Platte River in the years to come requires "treating to more stringent standards" than existing facilities currently can meet. The new facility will include effective odor control and the architecture and landscaping will blend in with the surrounding community, she said.

The new facility will be located at the northwest corner of Highway 85 and 168th Avenue (Weld County Road 2). The estimated in-service date is 2015. The Metro District is the largest wastewater treatment agency in the Rocky Mountain West. The current treatment facility at 64th and York treats about 150 million gallons of wastewater a day. The service area includes a population of nearly 1.7 million people and encompasses approximately 715 square miles, including Denver, Arvada, Aurora, Brighton, Lakewood, part of Westminster, Wheat Ridge, and Thornton, together with about 40 sanitation and water and sanitation districts in the metropolitan Denver area. For more information visit

www.metrowastewater.com

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Continued from page 1

This concluded an amazing 3,500 year period of primarily using qualitative measurements to assess floc particles. A study in 2006 supported by the American Water Works Association and Colorado School of Mines and led by Tyson Ingels evaluated the possibility of quantitatively measuring floc particles.



The study used a pilot-scale filtration plant located at the City of Golden's water treatment plant (WTP) in Colorado which uses a conventional coagulation-flocculation-clarification-filtration treatment process. Demonstration projects were held at two additional utilities: Utah Valley WTP which uses direct filtration and Boulder Reservoir WTP which uses dissolved air flotation (DAF) for treatment. DAF uses air to make floc particles float for removal by a skimming process. (we may not want this sentence) ClearCorp developed and donated two prototype instruments using floc particle digital imaging for digital image analysis. They were the Floc Monitor, an *in situ* floc process sensor-computer, and the RoboJar, an automated jar tester that uses the same sensor system as the Floc Monitor.

The key conclusions of the study include:

- Floc particle characteristics are a valid predictor of granular-media filtration



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performance

- Measuring floc particles provides a faster response than traditional feedback measures i.e. particle counts and filter effluent turbidity

Floc particle formation may be the most direct real-time surrogate for infectious organism removal for the coagulation/granular filtration process

For more information or a free pdf formatted copy of the study titled "Optimizing Granular Media Filtration through Bench-Scale and *In-Situ* Floc Particle Characterization," contact Tyson Ingels by email at tyson.ingels@state.co.us

References

Drewes, J.E. & Ingels, T., et al, "Optimizing Filtration Processes through Online Floc Particle Characterization," 2007 awwarf.org, #91191.

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