



**Microflocculation**

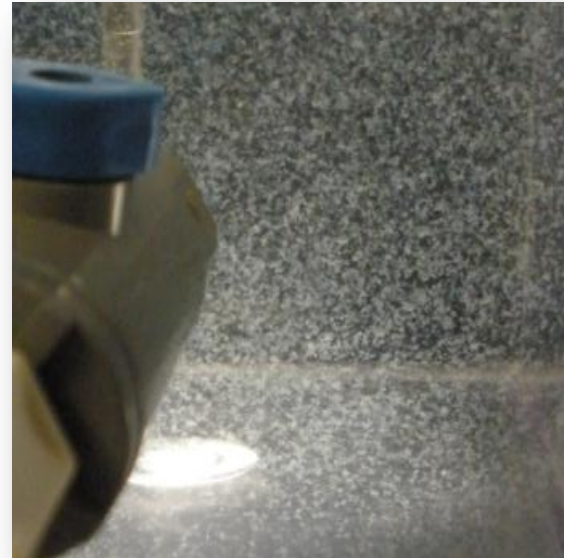
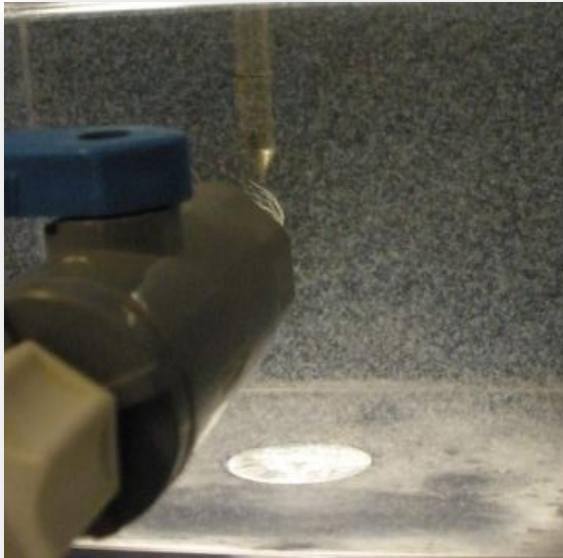
# MIOX & Microflocculation

- ▶ An emerging process option, gaining interest
- ▶ MIOX investigating the use of Mixed Oxidants to induce microflocculation effect
- ▶ Microflocculation can improve performance and/or reduce cost.
- ▶ Mixed oxidant/microflocculation may be right for your application.



# What is Microflocculation?

- ▶ A reduction in coagulant demand for the same final (filtered water) turbidity
- ▶ **OR** a reduction in final turbidity at the same coagulant demand.



# Benefits of Mixed Oxidants in Microflocculation

- ▶ Use of mixed oxidants in pretreatment can achieve lower turbidity levels and reductions of up to 40% in coagulant and polymer required.
- ▶ Customers report faster floc formation and improved settling due to the quality of the formed floc.
- ▶ Disinfection by-product (DBP) formation can also be reduced due to increased removal of NOM during flocculation.



# MIOX Customers Report:

- ▶ Larger floc that forms more rapidly, even at colder temperatures
- ▶ Heavier floc conducive to good settling
- ▶ Formation of a vortex around the rotating paddle
- ▶ High degree of clarity in both the supernatant and the water between the floc particles
- ▶ Very low turbidity of the supernatant (typically < 0.1 NTU)



# Occurrence of the Microflocculation Effect Can Be Predicted

## MICROFLOCCULATION MAY OCCUR WHEN

- $\text{Ca}^{2+} + \text{Mg}^{2+}$  (as Ca)  $\div$  Dissolved Organic Carbon (DOC)  $\geq 10$
- Turbidity  $\div$  DOC
  - $> 0.5$  NTU/mg C/L if  $\geq 2$  NTU
  - $> 1.3$  NTU/mg C/L if = 2-10 NTU
  - $> 2$  NTU/mg C/L if  $> 10$  NTU

\* Cationic Flocculent Aid Required

Source: Becker and O'Melia (1996)



# MIOX Solutions: Santa Fe, New Mexico



- ▶ 10 MGD SWTP, 6 well sites
- ▶ TTHMs:  
Reduced from  
>60 - >100  $\mu\text{g/L}$  to 33  $\mu\text{g/L}$
- ▶ Microflocculation:  
60%-66% reduction in alum dose,  
settling achieved in <20 minutes,  
even at 38 F
- ▶ Turbidity:  
Reduced from 0.6 NTU to 0.25 NTU

# MIOX Solutions: McAllen, Texas

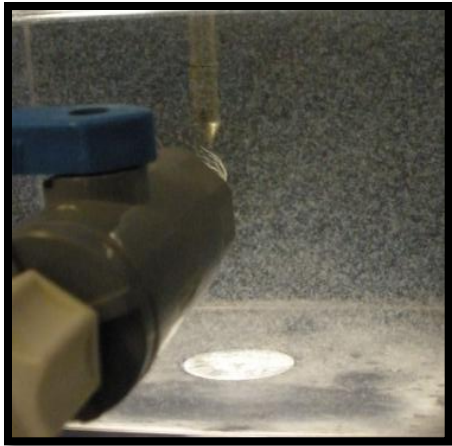


- ▶ Water obtained from Rio Grande, plant capacity is 8.2 MGD
- ▶ Microflocculation jar tests were conducted here and three other regional SWTPs in early 2009
- ▶ All plants showed evidence that MOS could be used to induce microflocculation
- ▶ MIOX is currently working to conduct a microflocculation pilot study at a SWTP in the area

# Jar tests at the McAllen North Plant, TX, successfully demonstrated the Mixed Oxidant-induced microflocculation effect.

| Jar Number | Aqualum dose (mg/L) | ClO <sub>2</sub> dose (ppm) | MOS dose (mL) | Settled Turbidity (NTU) | pH  | Floc Size          |
|------------|---------------------|-----------------------------|---------------|-------------------------|-----|--------------------|
| 1          | 70                  | 0.0                         | 0.0           | 1.05                    | 7.4 | Pin point          |
| 2          | 65                  | 1.4                         | 0.0           | 0.93                    | 7.5 | Pin point/pin head |
| 3          | 60                  | 0.0                         | 0.25          | 0.64                    | 7.6 | Pin head/snowflake |

Floc from the Mixed Oxidant + Aqualum test was larger and settled faster.



Aqualum only



$\text{ClO}_2$  +  
Aqualum



Mixed Oxidant +  
Aqualum

# Turbidity was reduced using less Aqualum when used with Mixed Oxidant.

