

Coagulation Technology

✘ Charge Neutralization

Coagulation for turbidity and DOC removal performed in drinking water plants utilize coagulant addition to neutralize charge which promotes particles and DOC to agglomerate and form a floc. Polymer is routinely added afterwards to create a larger floc to aid in floc removal efficiency for clarifiers and / or sand filters. The degree of **charge neutralization** is related to the zeta potential of the water; however, it routinely changes in surface water due to changes in turbidity, pH and water chemistry from weather and other events. This necessitates Water Plant Operators to routinely perform jar testing to determine optimal coagulant dosages to help maintain their Water Plant operations and efficiency.

✘ Sweep Floc Coagulation

A second form of coagulation is called **Sweep Floc Coagulation**. Sweep Floc Coagulation is a physical process in which a large mass of floc is generated to collide with the DOC and particles and entrain them in the floc. Since sweep floc coagulation does not rely on charge neutralization, jar testing is eliminated. Sweep floc coagulation is more effective at removing both DOC and particles versus that of charge neutralization coagulation; however, it requires significantly greater coagulant dosages (140ppm – 200ppm) to generate a sufficient mass of sweep floc to be effective.

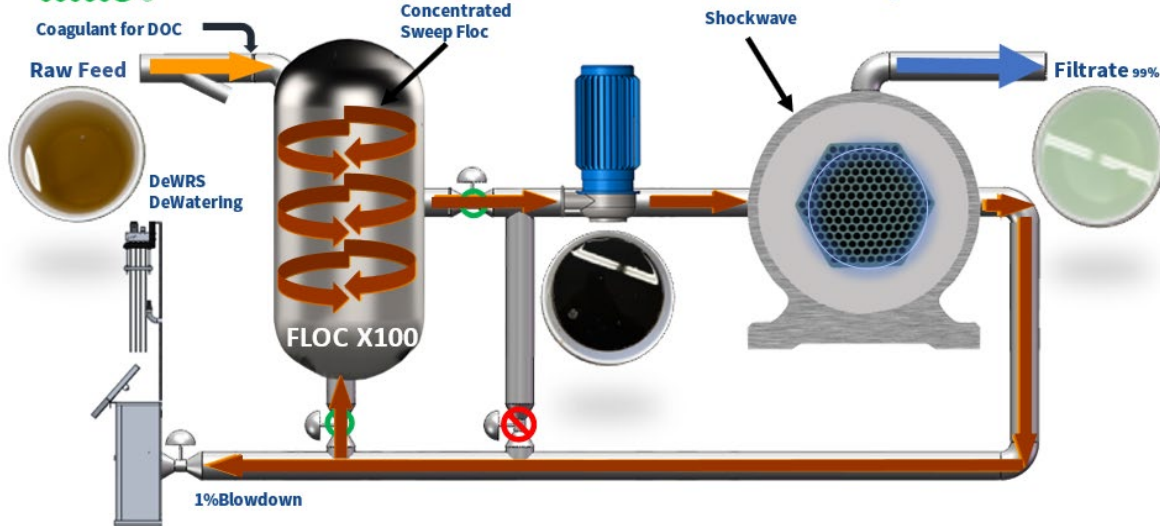
✔ Concentrated Sweep Floc Coagulation

Continuous Ultra Filtration (**Cuf**) technology solves the high coagulant Dose of Sweep Floc and reduces the Dose required by Charge Neutralization by creating an In-Situ **Concentrated Sweep Floc** in the **Cuf** process itself. The water recovery of the **Cuf** process is typically 99% of feed flow, which means the floc is concentrated 100 times in the **Cuf** process. A coagulant dosage of just 10ppm in the **Cuf** feed generates 1000ppm of **Concentrated Sweep Floc** in the **Cuf** process. Coagulation occurs in the **Cuf** process and eliminates all pre-treatment. The CUF's shockwave technology allows **Cuf**'s 5th Generation SiC membranes to produce pristine filtrate continuously at extremely high flux rates (250GFD – 300GFD). The Need for polymer is eliminated.





Cuf Process – Concentrated Sweep Floc



The **Cuf**'s internal concentrated sweep floc and its extremely high mixing from its internal cross flow maximizes DOC removal with reduced coagulant dosages. To prove this point, the CUF concentrated sweep floc process was pilot tested alongside 3 polymeric membrane technologies which all utilized charge neutralization coagulation upstream of their filters.

Cuf Sweep Floc Performance Vs. Charge Neutralization

Porter, TX Pilot



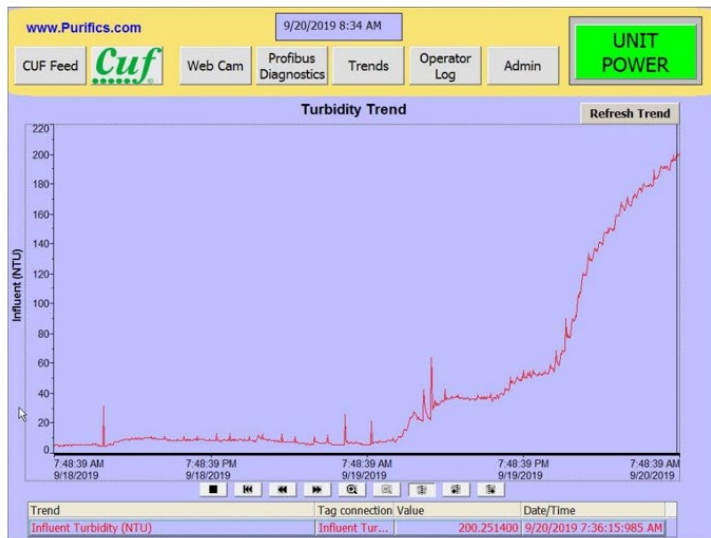
| Process | Purifics | Toray | Pall | Koch |
|---|--------------|-------------|-------------|-------------|
| Specific Flux GFD/psi | 31 | 2.8* | 8.6* | 7.7* |
| NTU (Feed 150) | 0.013 | 0.036 | 0.012 | --- |
| TOC Removal % (Feed 6ppm) | 58% | 38% | 28% | 28% |
| ACH Dosage (ppm) | 18 | 35 | 20 | 30 |
| TOC Removal Efficiency (% removed per ppm ACH) | 3.2 | 1.1 | 1.4 | 0.9 |

As shown in the Table above, Purifics' concentrated sweep floc technology achieved the greatest TOC removal while dosing the lowest coagulant concentration. Normalizing the TOC Removal Percentage per mg/L of coagulant dosed, the **Cuf** process was 3 times more efficient than traditional charge neutralization coagulation followed by membranes.





Puriflora's Concentrated Sweep Floc technology is not reliant on zeta potential thus its coagulant dosage never changes, regardless of turbidity changes. No jar testing is ever required. During the Porter pilot above, a tropical storm (Imelda) passed through which increased turbidity in the raw water from 5 NTU up to 200 NTU within 24 hours. The **Cuf** coagulant dosage remained constant at 18ppm and filtrate turbidity remained constant at 0.013 NTU and the **Cuf** operated at the same flux and recovery.



CUF Feed & Filtrate



CUF Concentrated Sweep Floc

As shown above the **Cuf** generates an enormous mass of concentrated sweep floc in-situ which maximizes DOC removal and is highly effective at removing heavy metals and color.

✓ THM & HAA Prevention

Concentrated Sweep Floc is highly effective at removing THM & HAA precursors to achieve DBP far below MCLs with the use of free chlorine for secondary disinfection. It significantly reduces chlorine demand up to 75% over baseline.

Cuf Better Water at Lower Cost

