Process Instruments (UK) Ltd.

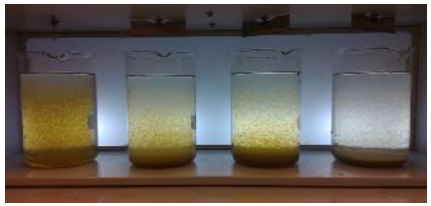
Coagulation Control; Past, Present and Future

Mike Riding – Process Instruments (UK) Ltd.

What We Sell

Coagulation

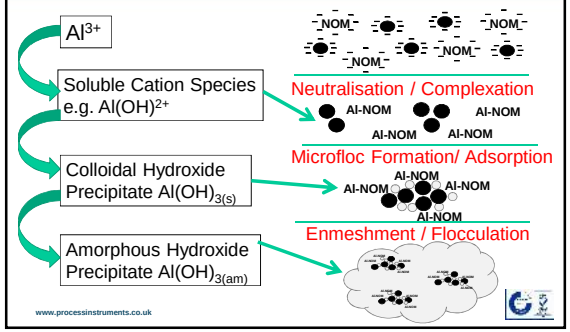
The use of chemicals to make very fine particulates gather or clump together so they will settle out of the water and be of a more filterable size.



Coagulation Mechanisms

- Charge neutralisation and destabilsation (Colloids)
- Complexation and precipitation (NOM)
- Enmeshment (Colloids)
- Adsorption (NOM)

Charge Neutralisation



Parameters That Impact Coagulation

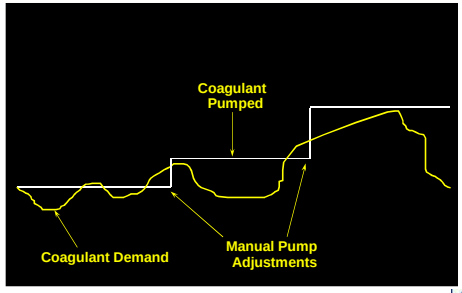
Changes in:

- Coagulant Dose/Makeup
- Turbidity
- Organics
- Disinfection/Oxidation
- pH
- Temperature
- Physical

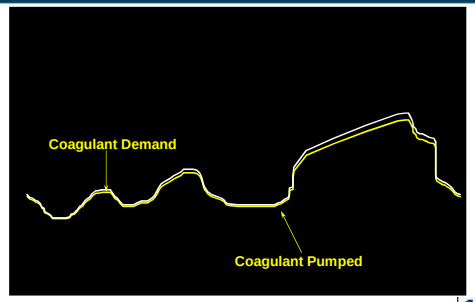
Coagulation Control in the past...

- Manual Control
- pH Control
- Turbidity Control
- Streaming Current Control
- UV Control

Manual Adjustment



Chemical Feed Automatically Controlled



Benefits of Automatic Control

- Improve Overall Plant Performance: Consistent, High Quality Finished Water
- Optimise Organics Removal
- Reduce Chemical Costs
- Reduce Soluble Aluminum Carryover
- Increase Length of Filter Runs
- Less Sludge Generated
- Less Sludge Disposal Costs

Coagulation Past and Present

- Single Parameter
  - pH (Raw)
  - pH (Post Coagulation)
  - Turbidity (Raw)
  - Turbidity (Settled)
  - Streaming Current (Post Coagulation)
  - Colour/UV254 (Raw)

Coagulation Control in the past...

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- pH Control
- Turbidity Control
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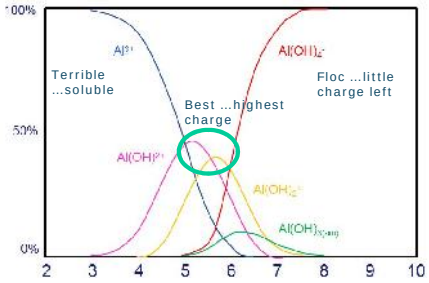
Dosing Alum



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Coagulation Mechanisms

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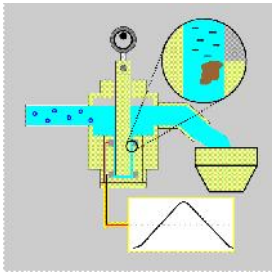
Charge Neutralisation

Charge Measurement Streaming Current Technology



Reciprocating Piston

Probe With 2 Electrodes Embedded In Annulus

Colloidal/Ionic Adsorption

High Flow Velocity Causes Ion Displacement

Difference In Potential Arises Between Electrodes

Streaming Current

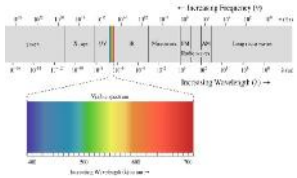
- Streaming Current responds immediately to changes in raw water conditions (e.g. turbidity, organics, flow).
- Measures what it is we are trying to do, which is neutralise charge.
- Feedback control. Gives immediate alarm if coagulant feed is disrupted or lost.
- By defining and controlling to an optimum setpoint streaming current value, coagulant dosage adjustments are made much faster and more reliably than jar testing.

Coagulation Control in the past...

- Manual Control
- pH Control
- Turbidity Control
- Streaming Current Control
- UV Control

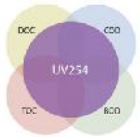
Using light absorption

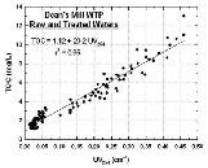
- Many chemical compounds have specific absorbance characteristics at different wavelengths of light
- By measuring the light absorbed by a water sample at particular wavelengths, the concentration of a contaminant can be determined



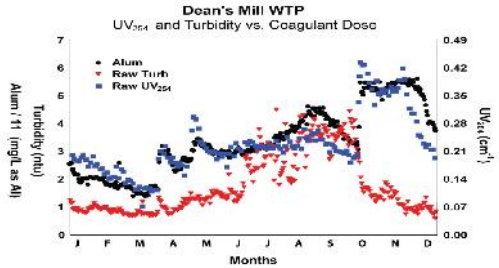
TOC Surrogate

- Excellent surrogate parameter to TOC, DOC, COD and BOD
- Provides accurate detection without the cost of reagents
- No ongoing maintenance or service required
- Ability to find a correlation by comparing sample data (graph)





Coagulation Optimisation



Source: James K. Edzwald, Organics Removal Presentation, NY AWWA Section, Saratoga Springs, NY - April 24, 2008

Coagulation - Past

- Multi Parameter
  - pH (Raw)
  - pH (Post Coagulation)
  - Turbidity (Raw)
  - Turbidity (Settled)
  - Streaming Current (Post Coagulation)
  - Colour/UV254 (Raw)

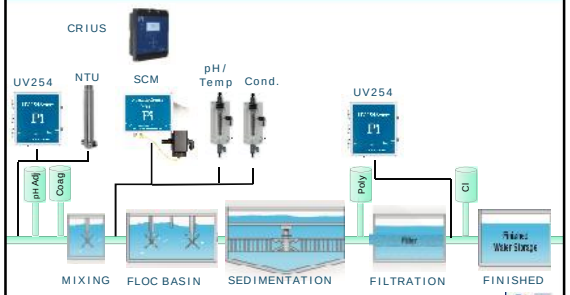
What should an automatic control system be?

- Modular yet bespoke (affordable)
- Multi Parameter (one at a time?)
- Capable of using existing plant instrumentation
- Affordable for smaller plants
- Simple (not sentient!)

Future Coagulation Control

Controller
- Charge
  - UV
- Turbidity
  - pH
  - Temp

Conventional WTP



One size fits all?

Better Tools

- Laboratory Charge Analyser (Streaming Current)
- 5 Min Dosage Determination
- Clear End Point, No Risk Of Subjective Interpretation

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Thank you!

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Jar Testing

- By standard methods, 30 to 45 minutes to perform.
- More complicated as number of additives increases.
- Possibility of subjective interpretation.