

Optimizing Conventional Treatment

Included within the designation of Conventional Operations Assessment (COA) are all processes that occur prior to filtration, excluding disinfection. Because of its complexity, pre-disinfection is addressed separately. Most processes associated with the COA are coagulation, flocculation, sedimentation, and pre-oxidation. As such, the description of Carollo's optimization approach will focus on them.

The performance of the COA is a key element to most treatment processes and (many times) the difference between compliance and non-compliance with current and future regulations (e.g., disinfection by-products (DBPs) and arsenic). The following six steps are typically included in our assessment:

Review of Design Criteria and Historical Data

The review of the design criteria will be performed together with the plant staff and/or by review of the system specifications. This simple, and often overlooked step of the plant assessment, can provide valuable information that can result in easily performed solutions to several potential system problems. Some of the parameters that may be reviewed include:

- ▼ Shape of the reactor tank.
- ▼ Degree of flow short-circuiting.
- ▼ Type of mixing element.
- ▼ Degree of energy input.
- ▼ Effective mixing time.

In addition, historical operational data from the plant will be assessed for water quality trends, seasonal variability, and chemical usage requirements.

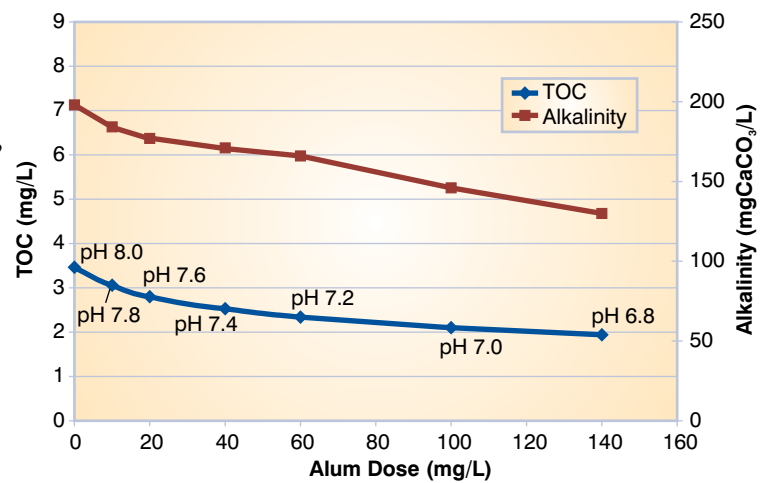
Coagulant and/or Polymer Selection and Addition Sequencing

Selection of coagulants and/or polymers is source water- and process-dependent. During selection, various chemicals and strategies, including enhanced coagulation, are tested to assess performance and determine economic feasibility. Additionally, whenever more than one chemical is added the addition sequence will be optimized. Tests can be performed in

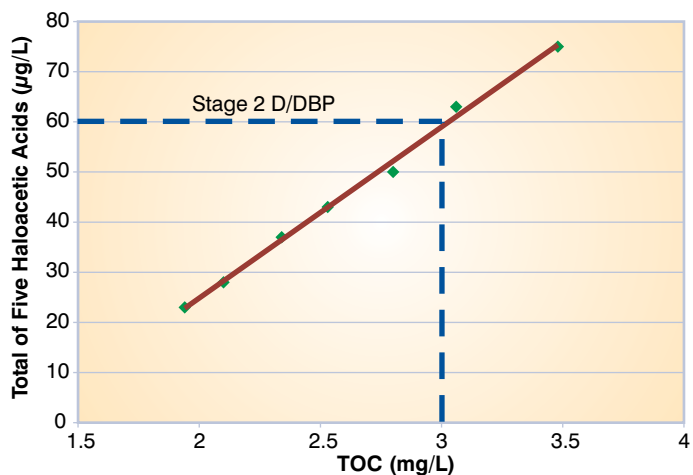
house or on site using our jar testing apparatus. The graphs below show a set of representative results. The impact of coagulant dose on TOC removal and subsequent DBP formation is shown.

Optimization of Mixing Energy Time (Gxt)

The success of the coagulation step is highly dependent on the mixing energy applied during the process. In general, a tapered approach is taken whereby different mixing energy ranges are used. The optimum mixing conditions depend on the type of treatment process, filter bed, and water characteristics. The impact of the mixing energy (Gxt) on settled water turbidity can be determined and used to optimize coagulation and flocculation performances.



Impact of coagulation dose on TOC removal.



Relationship between TOC and DBP formation.

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Jar testing apparatus.

Evaluation of Floc Formation and Its Impact on Clarifier and Filter Performance

Clarifier and filter performance depend on the quality of the floc formed during coagulation and flocculation. Floc characteristics, such as settling velocity and filterability, are some of the parameters assessed during the COA with the objective of selecting the best coagulants and/or polymers and mixing energy conditions for a specific process.

Evaluation of Settled Water Quality

Settled water quality such as turbidity, corrosivity, and disinfection by-product formation potential are important in the context of water treatment optimization. Through its multiple plant evaluations, Carollo has developed the know-how to address multiple issues afflicting treatment plants and developed strategies that improved performance and/or diminished treatment costs.

Evaluation of Pre-Oxidation Processes

Because of its broad range of applications and goals, pre-oxidation evaluation is included in our Disinfection/Oxidation Processes fact sheet. In the COA, pre-oxidation is evaluated within the context of coagulation and flocculation optimization. Pre-oxidation has been reported to improve floc settleability and overall coagulation performance. Pre-oxidants such as ozone, potassium permanganate and hydrogen peroxide can be tested.