SEASONAL ORGANICS VARIATIONS: EFFECTS ON THE EFFICIENCY OF WATER TREATMENT PROCESSES

Natural organic matter (NOM) in source water has created a lot of interest in the field of water purification.

It is of particular concern in conventional drinking water treatment since it can produce undesirable disinfection by-products (DBPs), interferes with the performance of water treatment processes such as coagulation, membrane filtration and oxidation processes, and leads to bacterial re-growth in potable water distribution systems. A thorough understanding of the changes in concentration of NOM over time can significantly contribute towards optimizing the operation of drinking water treatment processes. With the right monitoring equipment, determining NOM concentration can be both simple and cost effective.

ROLE OF NATURAL ORGANIC MATTER IN WATER TREATMENT

Role of Natural Organic Matter in Water Treatment
Natural organic matter (NOM), a major raw water constituent that negatively affects water supply systems, is almost always found in surface waters and is often found in ground water. Surface water and ground water under the influence of surface water, tend to be more susceptible to changes in NOM due to the direct interaction theses waters have with the surrounding environment.

Fluctuations in organics are notably reflected during seasonal changes in climatic conditions. The chemical characteristics and concentration of NOM have been demonstrated to change throughout the year in response to spring snow melt, heavy rain, and prolonged dry seasons or in response to sunlight and temperature conditions.

EFFECTS OF NOM FLUXES ON TREATMENT PROCESSES

In many cases, these NOM fluctuations pose challenges for water treatment plants. Studies have shown NOM to cause most operational challenges through process interference and the formation of disinfection by-products (DBPs).

Of particular importance to treatment plant operators is the problematic aromatic organics. Aromatic organics are usually found in large quantities in NOM. Humic acid for example is highly aromatic. More importantly, the aromatic organics are generally more reactive than other organics. The reactive properties of these organics lead to their combination with disinfectants such as chlorine to form harmful DBPs (such as THMs and HAAs) which have specific maximum concentration limits as defined by EPA regulations. Aromatic organics have also been shown to have increased coagulant consumption.

Dramatic changes in NOM levels from one week to the next can make it very difficult for a treatment plant to predict when and how to properly adjust the various treatment processes affected. Without the proper instrumentation to monitor NOM, plants may encounter events that compromise the effectiveness of treatment processes which can lead to additional processing costs. Some of the most common challenges from fluctuating organics in conventional water treatment plants are:

Coagulation Optimization and DBP formation: Aromatic organics will consume coagulant, increasing the coagulant demand. In the event that a treatment plant is not monitoring the aromatic organic levels, a seasonal change could result in excess sludge production from overdosing or the formation of DBPs and inefficient residual disinfectant in the distribution system due to poor organics removal (under dose).

Fouled Membranes and Clogged Granular Activated Carbon Filtration (GAC): Membranes and GAC's are increasingly popular methods used to remove organics. A rapid influx of NOM can result in fouled membranes or clogged GAC pores. Without monitoring the organics before or after the processes, an operator has little knowledge of the inefficiency of their process.

Monitoring and understanding the seasonal and weather related changes in NOM concentration will most often lead to better treatment of drinking water and a more consistent water quality. UV254 is an organics test parameter that measures the amount of organics in water using the 254 nm wavelength. UV254 is the only organics monitoring parameter with a bias towards aromatic organics, which makes it a good predictor of DBP formation as shown in Figure 1. UV254 instruments have many advantages over other organic test parameters such as TOC, especially when monitoring continuously in real-time. Because the instruments use UV light to measure organics, there are no reagents involved, eliminating the need for service contracts or repetitive costs. Monitoring the quality of incoming source water with UV254 allows operators to anticipate changes to the treatment process and react accordingly to organics variations due to seasonal and weather related changes in NOM levels. Monitoring UV254 can improve operator response time significantly allowing operators to make the necessary process adjustments before the water enters the process. UV254 also allows the treatment plant to monitor the overall efficiency of various organic removal treatment processes which almost always leads to both improved water quality and cost reductions.

MONITORING NOM WITH UV254

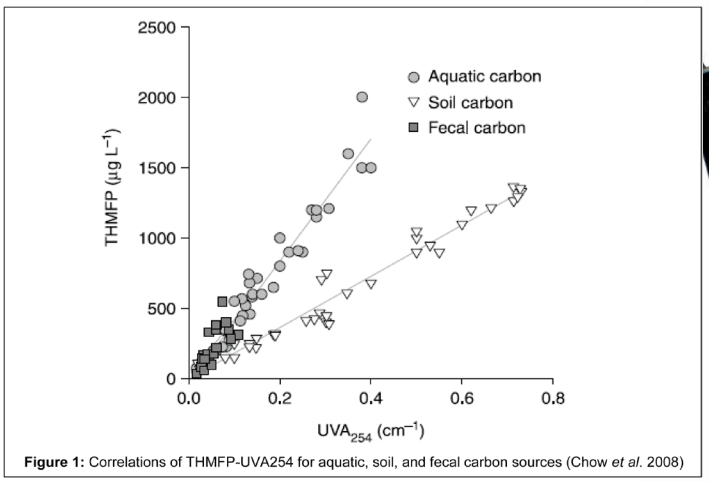

Figure 1: Correlations of THMFP-UVA254 for aquatic, soil, and fecal carbon sources (Chow *et al*. 2008)

FOR MORE INFORMATION PLEASE CONTACT:

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REFERENCE:
Alex T. Chow, Randy A. Dahlgren, Qian Zhang and P. K. Wong. 2008 Relationships between specific ultraviolet absorbance and trihalomethane precursors of different carbon Sources. Journal of Water Supply: Research and Technology-AQUA 57.7 471-480