

Organics Characterization with Sievers* M9 SEC DOC Detector

APPLICATION NOTE

- Want to learn more about water treatment processes for municipal or industrial plants?
- Ever wondered what makes up the slurry of organic contaminants coming into a water plant?
- Want an analytical tool to better understand organics and optimize water treatment?

The Sievers M9 SEC DOC Detector improves HPLC SEC analysis by adding organic carbon detection. The M9 SEC separates and quantifies all organic fractions not just those with a chromophore or fluorophore.

The Sievers M9 SEC DOC Detector provides improved organics analysis to better understand water treatment systems and make decisions based on changes in process or source conditions. Total Organic Carbon (TOC) analysis provides a non-specific and inclusive value of all organic compounds, but sometimes it is important to understand more about which organic fractions are present. The M9 SEC provides Size Exclusion Chromatography (SEC) analysis with Dissolved Organic Carbon (DOC) detection. The M9 SEC is designed to function with an HPLC SEC system which may include UV often at 254 nm, fluorescence, or other detectors inline prior to the DOC Detector.

In more conventional SEC applications, a UV detector is utilized to determine the molecular weight distribution of organics in the sample. However, some organics (e.g., alcohols, sugars, polysaccharides, etc.) are not UV absorbent and can therefore go undetected when using only UV. Since SEC is non-destructive, the eluent from the SEC column can be pumped through the M9 SEC to quantify the entire molecular weight size spectrum of organics in the sample as shown in **Figure 1**. Compared to complex, advanced analytical techniques like LC-MS, combining SEC-DOC analysis with UV detection provides a simple and cost-effective way to comprehensively analyze the molecular size

distribution of organic compounds in samples.

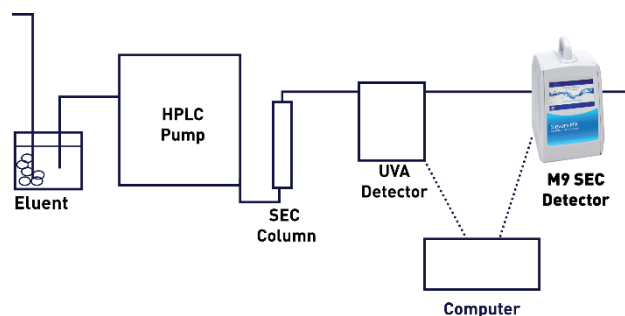


Figure 1: Schematic of M9 SEC System Setup in Lab.

SEC DOC data coupled with SEC UV data can be applied to a variety of industries to better understand organic contamination as shown in **Table 1**. The M9 SEC can help achieve better process control and regulation compliance for municipal water treatment as well as industrial water treatment for power, chemical, petrochemical, and food & beverage plants.

Table 1: Examples of Using the M9 SEC for Enhanced Process Control.

Process	Application
Source Water	Understand nature and changes in source waters
Membrane Treatment	Observe which fractions are removed through membranes to understand fouling potential and contaminant removal rates
Disinfection	Study which organic size fractions might lead to DBP formation
Chemical Treatment	Use size data to improve chemical choices and doses
Boiler Feed/Condensate Return	Protect valuable assets from fouling, corrosion, or contamination
Effluent Water	Visualize what organic fractions are left after treatment delivered to environment or distribution

Example

M9 SEC DOC data coupled with SEC UV data provides insight into which fractions of organics might be present in source water to drinking water plants or industrial plants as well as which fractions are left after each stage of treatment and what fractions are left in the effluent. For plants that use multiple sources, it is important to understand the nature and differences between sources to adjust treatment. Additionally, some source waters change drastically with seasons or with storms so understanding the effects of those changes can help troubleshoot and predict future behavior.

An example of water treatment plant (WTP) influent and effluent is shown in **Figure 2** coupling SEC-UV with SEC-DOC Detection. The M9 SEC allows for improved visualization of organics present and organics removed through treatment. The UV 254 signal only picks up a portion of the organic size spectrum, but the addition of the M9 SEC provides the complete organic footprint and together with UV detection can give insight into broad functional characterization.

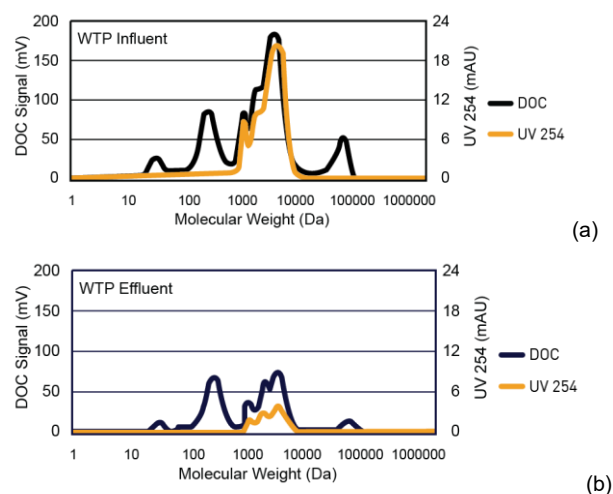


Figure 2: Example of organic size fractions present in water treatment plant (WTP) source water (a) and organics leftover after treatment in plant effluent (b).

Conclusion

The M9 SEC is a tool to better understand source water organics and how the organic footprint changes through treatment. This can be applied to municipal waters as well as industrial waters to help identify fractions of concern or which fractions affect treatment efficiency. Understanding and controlling treatment processes can:

- protect assets
- ensure compliance
- troubleshoot issues
- improve performance

References

1. Her N., Amy G., Foss D., Cho J., Yoon Y., Kosenka P.: Environ. Sci. Technol. 36, 1069-1076 (2002).
2. Allpike B., Heitz A., Joll C., Abbt-Braun G., Frimmel F., Brinkmann T., Her N., and Amy G.: Environ. Sci. Technol. 39, 2334-2342 (2005).