The Impact of Carbon Source as Electron Donor on Composition and Concentration of Dissolved Organic Nitrogen in Biosorption-Activated Media for Stormwater and Groundwater Co-treatment

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Results and Discussion

High resolution mass spectrometry is a key technology for in-depth, dissolved organic nitrogen (DON) characterization. High-field Fourier transforms ion cyclotron resonance mass spectrometry (FT-ICR MS) enables high-level interrogation of the impacts on microbial activity and community from the carbon addition and different inlet total nitrogen concentration in the co-treatment of stormwater and groundwater with biosorption activated media. The DON analyses of composition and concentration revealed the relationship between the microbial community status and the DON utilization pattern in the treatment system. As shown in Figure 1 of the van Krevlen diagrams, the higher inlet nutrient concentrations have changed the survival strategy of microbes via increasing their cell size. Even though their surface area to volume ratio (SA/V) decreased but they have a much stronger capability to store the DON hence they have more time for DON digestion, as a result, less DON species was detected by FT-ICR-MS. Carbon addition is not as critical as for the low nutrient concentration scenarios since the DON can be used as an electron donor as well. However, for low nutrient concentration cases, the microbes preferred to stay in smaller cell sizes so that their larger SA/V can help them absorb nutrient more effectively. This would result in weaker digest capability for DON as the microbes did not have enough time to break down large organic molecules. It would be better if carbon may be added into the inlet to help increase the bioactivity, but they cannot be as efficient as the scenario of high nutrient concentration at inlet due to the limitation of their cell size.

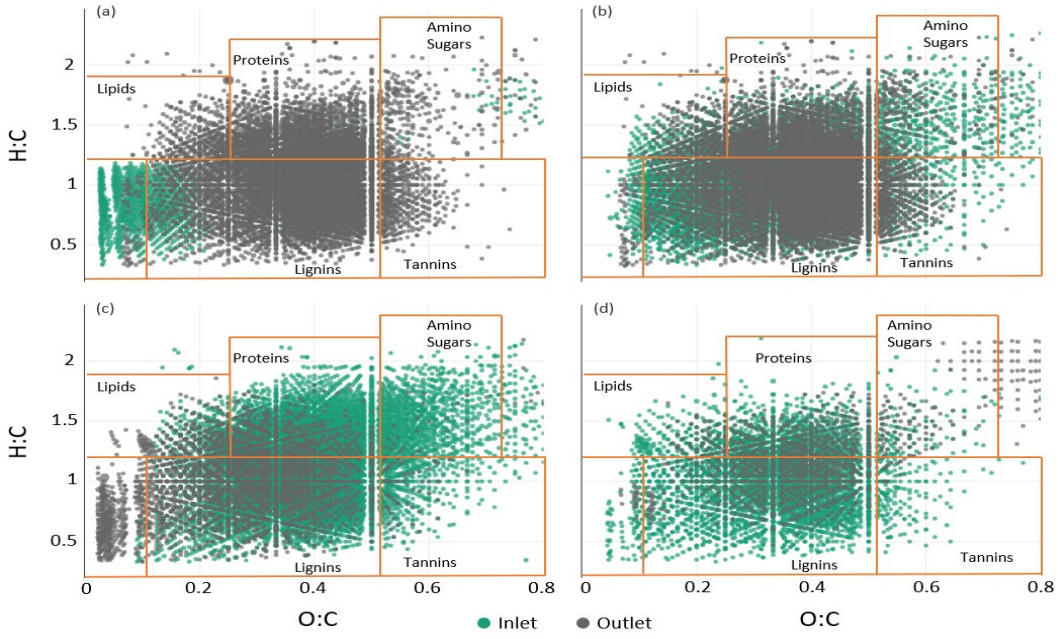

Figure 1: van Krevlen diagrams derived from negative-ion electrospray ionization FT-ICR mass spectral analysis for all N-bearing formulas in the mass spectra of the inlet and outlet with the low TN inlet for BAM with (a) no carbon addition (LSN), (b) carbon addition (LSC), and the high TN inlet with (c) no carbon addition (HSN), (d) carbon addition (HSC)

Acknowledgments

This work was supported by NSF Division of Materials Research through DMR-1157490 and DMR-1644779, the State of Florida; Florida Department of Transportation (No. BDV24 TWO 977-14).

References

[1] Chang, N-B., *et al*., Environmental Science & Technology, **52**(16), 9380-9390 (2018).