Following environmental transformations of metal-containing nanoparticles: Addressing analytical challenges

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Expansion in the use of engineered nanomaterials (ENMs) will almost certainly lead to their release into the aquatic environment. Physiochemical processes are likely to quickly transform the state of ENMs. The environmental fate and exposure risk of ENMs will depend on how these transformations affect the environmental behvior of ENMs. Current analytical approaches can be implemented to characterize altered ENMs, which are generated by processes such as dissolution, chemical weathering (oxidation, sulfidation) and heteroaggregation. These methods however, are challenged by the expected low ENM concentrations and the high background of naturally-occurring nanoparticles (NNPs), which may be similar in size, shape and composition of the altered ENMs. Development of new techniques employing elemental analysis by ICP-MS, which utilize the unique elemental composition of ENMs, may provide a means of overcoming limitations of existing analytical methods. Utilizing the capabilities of field flow fractionation-ICP-MS for high resolution size and elemental analysis, and particle by particle analysis using single particle ICP-MS (spICP-MS) with multielement detection, may allow for improved characterization of ENP alteration. In this talk the specific challenges to be overcome will be discussed and examples of the application of these new ICP-MS methods for quantifying ENM dissolution and heterogregation will be given.