Spray characterization of pneumatic concentric nebulizer used in Inductively Coupled Plasma – Mass Spectrometry (ICP-MS)

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Abstract

A Type-C glass concentric pneumatic nebulizer, widely used for sample introduction in MS, is characterized. This class of nebulizer disintegrates a pre-filmed liquid sample by the aid of a highly compressible co-flowing gas stream whose velocity is order of magnitudes larger than that of the liquid. Although the ICP-MS nebulizers generally follow the fundamentals of pneumatic atomization, they require separate characterization due to their specific design, dimension, geometry and different flow parameters typical for the ICP-MS operating conditions. For instance, employing the Nukiyama-Tanasawa (NT) and the Rizk-Lefbvre (RL) models, to the ICP-MS nebulizers for size prediction leads to erroneous results. Nevertheless RL model is modified to improve the agreement with experiment. The theoretical unseeded axial gas velocity is compared to the measured mean velocity of the sprayed droplets where shown, the difference is larger at lower gas flow rates. The results of size and velocity characterization are then used to study nebulizer performance at different flow conditions and are then fed into a Maximum Entropy Principle (MEP) model to predict aerosol size and velocity distribution. In the present task, a new point-wise MEP-based model is implemented.

Key words: Spray characterization, ICP-MS concentric nebulizer, Maximum entropy principle

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