

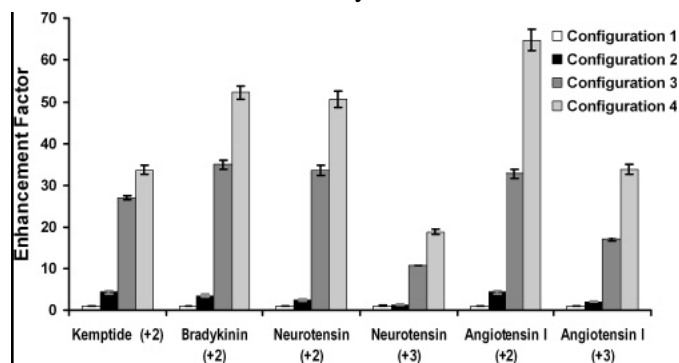
Reference: Ryan T. Kelly, Jason S. Page, Rui Zhao, Wei-Jun Qian, Heather M. Mottaz, Keqi Tang, and Richard D. Smith, "Capillary-Based Multi Nanoelectrospray Emitters: Improvements in Ion Transmission Efficiency and Implementation with Capillary Reversed-Phase LC-ESI-MS", *Analytical Chemistry*, **2008**, 80, 143-149.

Bioanalysis and Sample: In this paper, Ryan T. Kelly and coworkers developed novel nanoelectrospray emitter arrays by HF corrosion. The ESI emitter is then positioned 1-1.5 mm away from interchangeable heated capillary inlet. Instead of skimmers, tandem electrodynamic ion funnels are applied in the new apparatus. The nanoelectrospray emitter arrays, heated capillary inlet and electrodynamic ion funnels together make a brand new ESI interface.

Importance: ESI-MS plays an important role to determine and structure biomolecules; however, the detection limits are not satisfied which mainly because of the ESI interface. The incomplete droplet desolvation and low transmission efficiency cause tremendous sample lost. Therefore, newly designed interface is critical to improve sensitivity of ESI-MS. By employing emitter arrays, flow rate is lowered to facilitate desolvation; by using electrodynamic funnels the transmission efficiency is improved. Last, the whole interface has a shorter distance to further control possible ion lost during ESI.

Technique: HF corrosion is used to create capillary emitters with higher aspect ratio but not tapered inside. Epoxy is cured to make the inside of PEEK tubing sleeve. The heated capillary inlets are fabricated by electrical discharge machining. Agilent 6210 (Santa Clara, CA) time of flight mass (TOF) spectrometer with either commercially available emitter or self made interfaces is used to carry out all the MS experiments. For the first time, the emitters are conjunct with LC to study post-column process of the emitters.

Example of Results: The left figure shows the results of 4 peptides with 4 different ESI configurations. The 1st one has a commercially available emitter and unmodified TOF mass spectrometer. The 2nd to the 4th



one have 1, 19, and 19 emitter (arrays), and 1×430μm i.d., 19×400μm i.d., 9×490μm i.d heated capillary inlets separately. The 4th configuration has the highest enhancement factor (~20 and above) for all the 4 peptides' peaks concerned compared to the 1st configuration. The reason that 4th excels 3rd is the larger capillaries and shorter length of the heated capillary inlets.

Opinion: Ryan T. Kelly et.al innovate ESI interface which has an incredible enhancement factor in MS signals. The post-column studies on the emitters show no lost in resolution or peak broadening; instead, an improvement in signal to noise ratio. However, the enhancement factor of signal to noise in MS doesn't match that for signal, which is because the noise is from chemical contamination and amplified along with the analytes. Possible way to solve this is to use ion mobility spectrometry which separate ions spatially based on their charge difference.

Other Reference: Ryan T. Kelly, Jason S. Page, Keqi Tang, and Richard D. Smith, *Anal. Chem.* **2007**, 79, 4192-4198