Miniaturized Fluid-Pumping Systems and Column Formats for Liquid Chromatography

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This presentation will describe recent developments in the construction and testing of electrochemical concepts for use as fluidic actuation and separation elements in a chip-scale liquid chromatograph. Two specific developments will be discussed, both of which are based on coupling electrochemical phenomena with miniaturization technologies. The first examines the design, construction, and testing of a pumping mechanism. This approach is based on electrochemically-induced changes in the surface tension of mercury. The second explores the potential to miniaturize a new type of liquid chromatography – electrochemically modulated liquid chromatography (EMLC). EMLC manipulates retention through alterations in the surface charge that is controlled by changes in the potential applied to a conductive stationary phase (e.g., carbonaceous materials and thin films). In both cases, fabrication approaches will be detailed and results from continuing concept assessments will be described. Issues related to improvements of performance challenges in miniaturization will be also be discussed.