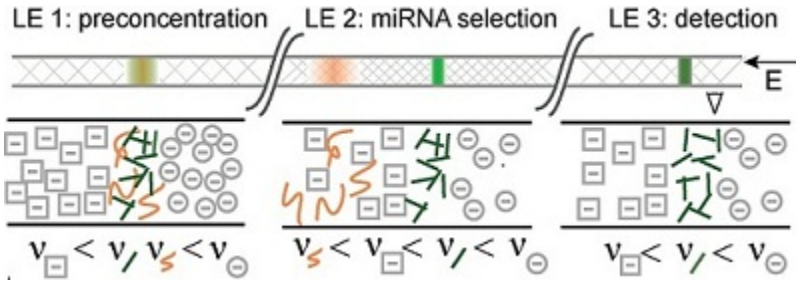
Docket #: S10-317

Enhanced isotachophoresis with serial zones

Researchers in Prof. Juan Santiago's laboratory have developed a modular on-chip isotachophoresis (ITP) system to extend ITP capabilities to include sensitive and selective extraction of nucleic acids. This microfludic technique establishes several initial zones of leading electrolyte (LE) arranged in series along the separation channel. As an ITP-focused sample transitions between zones, its mobility and reactivity are modified. The modifications may include sieving nucleic acids, denaturing structures, lysing cells, or hybridizing with charged species. These zones can be used to preconcentrate, select, change local denaturing conditions, and detect various analytes.

Stage of Research
The inventors have used this ITP method to quantify global microRNA (miRNA) abundance in total RNA.



Schematic showing three-zone ITP process for extraction of microRNA from total RNA. In the first zone (LE 1), we use low sieving matrix concentration to quickly but indiscriminately focus short RNA. In a second zone, we increase sieving matrix concentration to purify microRNA (straight, green bars) and reject longer RNA (curved orange segments). In a third zone, we decrease matrix concentraiton and denaturant concentration for optimal detection conditions. See Persat et al., 82, 23, Anal. Chem., 2010.

Applications

- **Novel ITP assays**, such as:
  - *ITP for nucleic acid extraction*, such as quantitation and isolation of miRNA
  - *preconcentration and purification* method prior to subsequent downstream analysis, whether on- or off-chip and including hybridization, PCR, microarrays, and sequencing

Advantages

- **Versatile** - can be applied to any ITP experiment
- **Sensitive** - low sample requirements (miRNA quantitation requires ~10ul volumes with 10-50ng of total RNA)
- **Fast**
- **Selective**
- **Less labor-intensive** - potentially reduce the amount of off-chip preparation required before analysis

Publications

- U.S. Published Patent Application 20140014515, "Enhanced Isotachophoresis Assays Using Additives with Spatial Gradients".
- Persat, A., Chivukula, R., Mendell, J.T. and Santiago, J.G., "Quantification of Global microRNA Abundance by Selective Isotachophoresis" 82, 23, *Analytical Chemistry*, pp. 9631-9635, 2010.

Patents

- Published Application: 20140014515
- Published Application: 20160153934
- Published Application: 20190271661
- Issued: 9,151,732 (USA)

Innovators

- Juan Santiago
- Alexandre Persat
- Giancarlo Garcia
- Charbel Eid

Licensing Contact

Michael Spaid

Technology Licensing Associate 2

Email