DEVELOPMENT OF A MICRODIALYSIS-MICROCHIP CE SYSTEM FOR ON-LINE MONITORING

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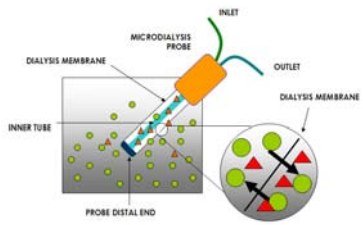
BACKGROUND

Microdialysis

- Analytes diffuse across dialysis membrane based on concentration gradient.
- Slow flow rates are generally preferred due to higher analyte recoveries across the probe.
- Provides a protein-free sample.
- Both on-line or off-line analysis can be performed.
- Temporal resolution influenced by injection volume requirements of the analysis system.

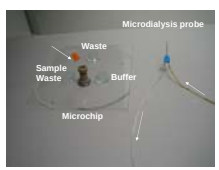


Microchip CE

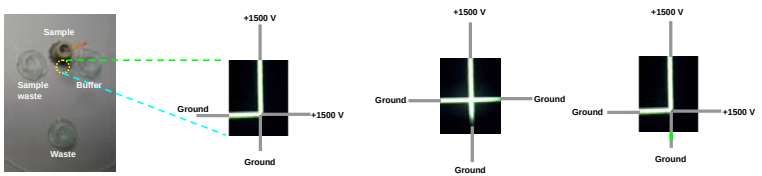
- Small sample and reagent volumes required.
- Improved temporal resolution.
- Fast analysis times.
- Multiple steps (e.g. sample introduction, mixing, derivatization, separation) can be integrated.
- Can be mass produced, inexpensive.

Microdialysis-Microchip CE

- Delivery of sample from microdialysis probe.
- Reduced instrument footprint.
- Highly integrated micrototal analysis system.



Sample Injection Mechanism

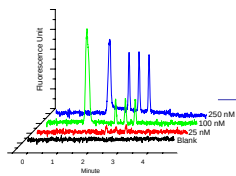


Research Objective

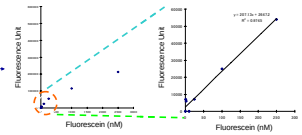
To develop a continuous monitoring system capable of analyzing endogenous compounds and drugs from the brain.

RESULTS

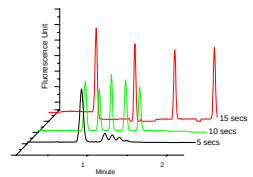
Evaluation



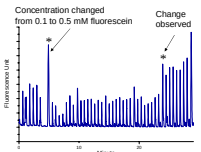
Injections of fluorescein



Calibration plot

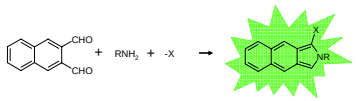


Temporal resolution (injection frequency)



On-line microdialysis sampling in-vitro

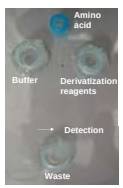
Derivatization and separation on-chip

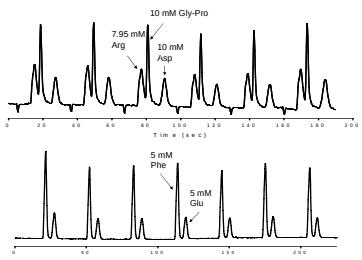


Naphthalene 2,3 dicarboxaldehyde

RNH_2 : Primary amine
-X : Thiol/ CN^-

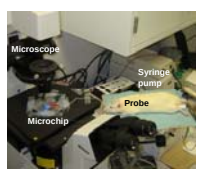
CBI – derivative (fluorescent)

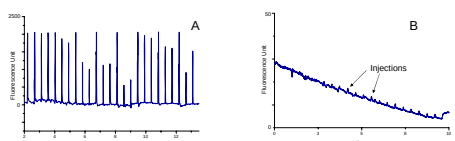




On-line monitoring

- Objective is to study the diffusion of fluorescein to the brain.
- Probe implanted in SD rat (striatum).
- Fluorescein delivered through the probe.
- Detect fluorescein diffused into the brain by microscope-microchip CE.
- Low levels of fluorescein were recovered after 30 minutes (Fig. B) of terminating delivery.





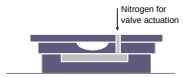
Monitoring fluorescein from brain (A) during and (B) 30 mins after terminating delivery

FUTURE STUDIES

- Microchip with PDMS pressure actuated valve.

Why valves over voltage-controlled injections?

- Reduction/ absence of electrokinetic sampling bias i.e. ideal for samples containing analytes with widely different electrophoretic mobility.
- Reproducible injections – precise pressure control required.



Citations & Acknowledgement

1. Chen, S.; Lin, Y.; Wang, L.; Lin, C.; Lee, G. Anal. Chem (2002), 74, 5146-5153.
2. Huynh, Bryan H.; Fogarty, Barbara A.; Martin, R. Scott; Lunte, Susan M. Analytical Chemistry (2004), 76(21), 6440-6447.
3. Li, Michelle W.; Huynh, Bryan H.; Hulvey, Matthew K.; Lunte, Susan M.; Martin, R. Scott. Analytical Chemistry (2006), 78(4), 1042-1051.

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