

LICENSING OPPORTUNITY

ETH transfer – Linking Science and Business

Micro-arrays for high throughput mass spectrometry

Keywords

Single-cell analysis, Metabolomics, Mass spectrometry (MS), Matrix-assisted laser desorption/ionization (MALDI), High throughput analysis, Automatic pico-litre aliquoting

Summary

High-density micro-arrays for mass spectrometry (MAMS) enable rapid pico-litre-volume aliquoting by moving a droplet over an array of hydrophilic spots on an otherwise omniphobic surface. After subsequent application of MALDI matrix, ultra-sensitive analysis of microscale samples, for example, single cells may be performed.

Patent Status

- Patent pending EP

Background

Molecular systems biology requires an analytical platform to study phenomena related to cell individuality and cell population heterogeneity that enables non-targeted molecular analysis of single cells. However, it faces three major problems: (i) sample preparation, i.e. isolation of single cells, (ii) the required ultra-high sensitivity to detect the minute amount of metabolites in single cells (femto- to attomoles) and (iii) high-throughput capability (to achieve statistically meaningful results among other things).

Invention

A conductive support such as steel or transparent indium-tin oxide (ITO) is coated with an omniphobic layer (e.g. polysilazane). Then, by laser ablation, a dense pattern of hydrophilic spots is created with sizes of 30 – 300 μm and a spacing of several hundred micrometers (Fig. 1). The array may be labeled (by the laser) in order to identify individual spots. The recipient sites can be easily and reproducibly filled with pico-liter volumes (containing few to single cells (Fig. 2) or any other compound of interest) by dragging a droplet over the platform.

Features & Benefits

- High throughput MS
- Unsupervised and very fast aliquoting of pico-litre volumes
- Extremely high sensitivity: detection of attomole quantities of compounds (e.g. in single cells)
- Deposition of single cells
- Very low sample and reagent consumption

Fields of Application

- Drug discovery and screening applications
- High throughput single-cell analysis (Fig. 3), e.g. cancer and stem cell analysis
- High throughput combinatorial screening
- Collection of effluents from micro-scale capillaries/microcolumns or microfluidic devices for MS
- Calibration of surface analysis techniques
- Studies on the chemical communication within microbial cell populations, for example, the so-called “quorum sensing”

References

- Urban, P. L.; Jefimovs, K.; Aman-tonico, A.; Fagerer, S. R.; Schmid, T.; Madler, S.; Puigmarti-Luis, J.; Goedecke, N.; Zenobi, R. *Lab Chip* 2010, 10, 3206-3209.

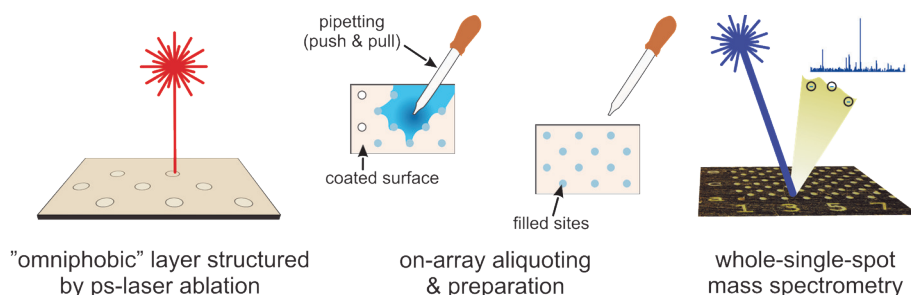


Fig. 1: Fabrication of MAMS, sample deposition and MALDI analysis

P.t.o. →

Ref. No. T10-031

ETH Zurich
ETH transfer
Zurich, Switzerland

+41 44 632 23 82
transfer@sl.ethz.ch
www.transfer.ethz.ch

ETH

Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

LICENSING OPPORTUNITY

ETH transfer – Linking Science and Business

Micro-arrays for high throughput mass spectrometry (cont.)

Fig. 2: Yeast cells deposited on a transparent ITO MAMS chip. Using a humidifier (that produces a stream of small droplets), the liquid volume in the reservoirs can be held to a constant level, keeping the cells viable. Scale bar is 50 μm

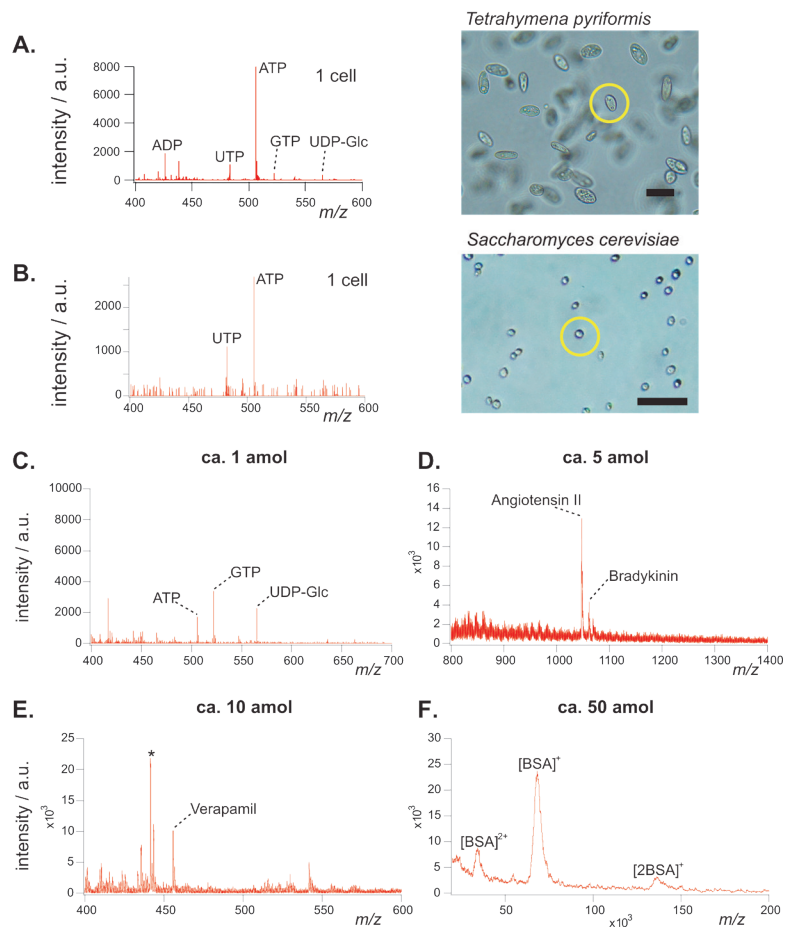
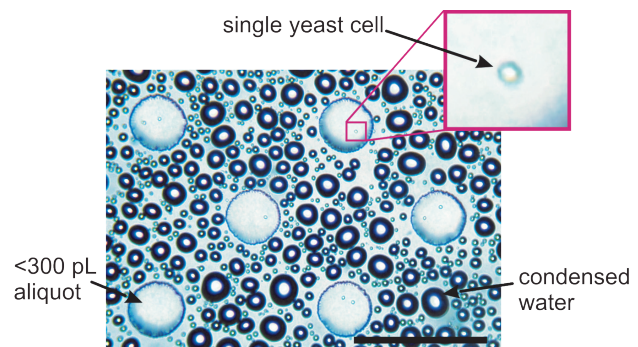


Fig. 3A and B: Spectra of single cells (*Tetrahymena pyriformis* and *Saccharomyces cerevisiae*); scale bars 50 μm
Fig. 3C to F: MALDI detection of various chemical compounds at attomole level
C: Various trinucleotide phosphates (metabolites), D: Angiotensin II and Bradykinin (peptides), E: Verapamil (drug) and F: Bovine serum albumine (protein)

Ref. No. T10-031

ETH Zurich
ETH transfer
Zurich, Switzerland

+41 44 632 23 82
transfer@sl.ethz.ch
www.transfer.ethz.ch

ETH

Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich