

TM-Sprayer™

Tissue MALDI Sample Preparation System

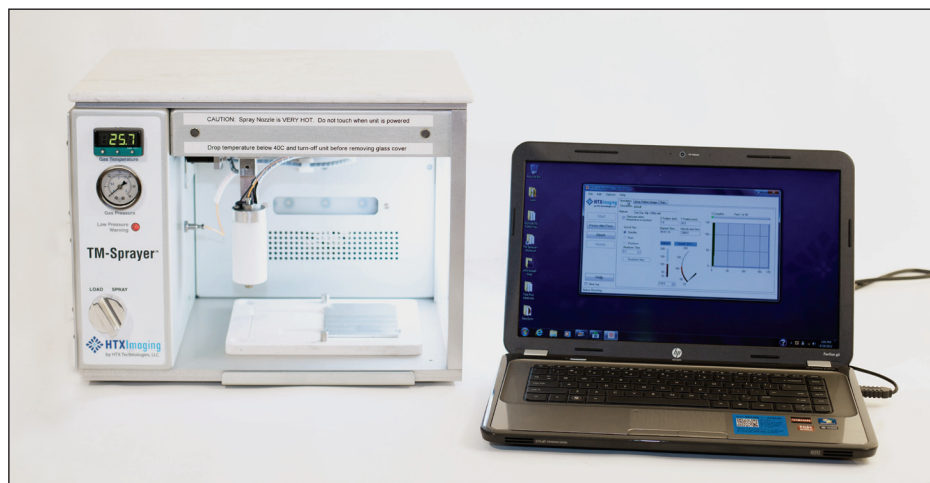


HTX Imaging

by HTX Technologies, LLC

TM-Sprayer™ Tissue MALDI Sample Preparation System

The HTX TM-Sprayer™ System is an automated MALDI matrix deposition system offering high reproducibility and superior data quality for Mass Spectrometry Imaging



HTX TM-SPRAYER™

The HTX TM-Sprayer™ is an easy-to-use, versatile spraying system that provides an automated process for Sample Preparation in Mass Spectrometry Imaging.

The patented spray technology of the TM-Sprayer™ guarantees a very fine, uniform and consistent matrix coating crucial for high-resolution imaging and relative quantification of analytes.

The new HTX Technologies' spray nozzle, featured in the next generation TM-Sprayer, creates a fine solution mist that can be deposited in a precise and adjustable pattern over all or part of any MALDI plate.

Spray characteristics (wet or dry) are easily adjustable via the intuitive operator interface. Users can create and save methods for reproducible operation.

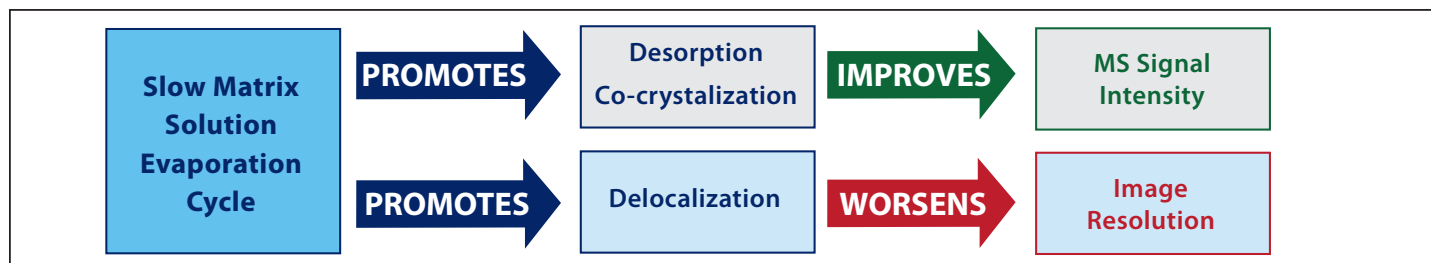
Key Characteristics

- ◆ Patented technology providing very small matrix droplets (<20 microns)

- ◆ High flow rate and fast sample prep (10 to 20 minutes per plate)
- ◆ Highly consistent matrix deposition across entire sample area (+/- 3% by weight)
- ◆ Unique use of temperature and nitrogen flow to control evaporation rate and matrix crystal formation
- ◆ Validated protocols for most matrices (e.g.: SA, CHCA, DHB)
- ◆ Validated protocols for Trypsin digestion
- ◆ Continuous matrix coverage as needed for high-resolution imaging
- ◆ Rugged operation and easy clean-up

Addressing the Matrix Deposition Challenge

The main challenge when preparing samples for MALDI Mass Spectrometry Imaging is to balance the positive effects of the matrix solution penetrating the tissue and co-crystallizing with the analytes, and the negative effects of analytes delocalization.



MATRIX DEPOSITION CHALLENGE

Where other available systems can only vary matrix solution volume and drying time between depositions, the TM-Sprayer adds two new dimensions by providing temperature control of the drying gas (nitrogen) and nozzle velocity as additional control variables. Having access to these additional control parameters enables the user to better optimize extraction and signal intensity without compromising resolution.

Automated Matrix Deposition

Because the base concept of the TM-Sprayer is similar to that of the airbrush (mixing air and liquid flow to create a fine spray), users find it very easy to operate the TM-Sprayer, while also enjoying the many benefits of automation:

- ◆ Reduced exposure to matrix solution
- ◆ High mechanical reproducibility

- ◆ Elimination of matrix hot spots
- ◆ E-capture of method parameters
- ◆ Smooth movements with location and speed electronically controlled
- ◆ Ability to limit spray to small areas
- ◆ Reduced solvents and matrix usage
- ◆ Reduced variability
- ◆ Time efficiency
- ◆ Automated cleaning cycle

Speed Advantage

The patented spray technology of the TM-Sprayer enables high matrix solution flow rate (typically 200µl/min) and rapid deposition of adequate matrix amounts onto the sample surface.

HIGH SPATIAL RESOLUTION PROTEIN IMAGING USING THE TM-SPRAYER™

In this experiment, 10µm thick rat cerebellum tissues section were mounted on ITO coated glass slides, allowed to dry 30 min in a dessicator and then washed in ethanol to remove disturbing lipids and salts. The sections were then air dried before applying matrix with the TM-Sprayer.

TM-SPRAYER METHOD

Matrix: Sinapinic Acid

Number of Passes: $NP = 8$

Matrix concentration: $Cm = 5\text{mg/ml}$

Matrix flow rate: $FRm = 100\ \mu\text{L/min}$

Nozzle velocity: $V = 600\ \text{mm/min}$

Track spacing: $TS = 3\ \text{mm}$

OTHER PARAMETERS

Nitrogen pressure: 10 psi

Dry gas temperature: 75°C

Nozzle distance: 46 mm

Spray Pattern

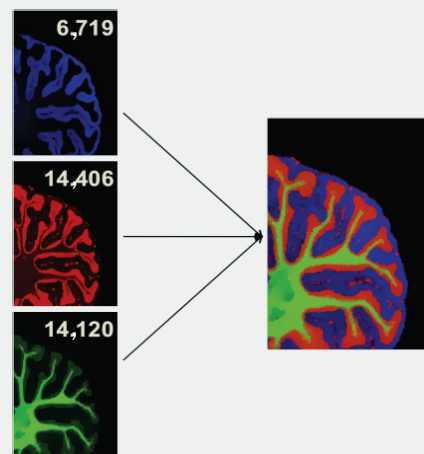
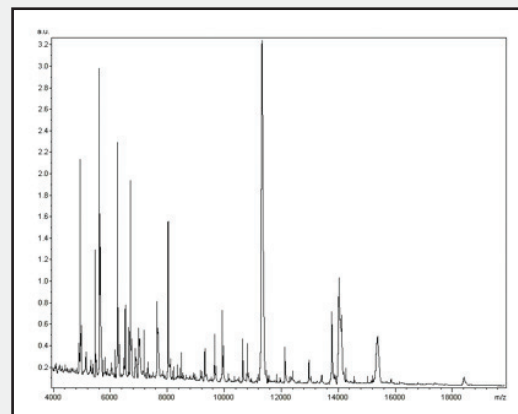
8 passes with alternating criss-cross and off-sets for optimum homogeneity and inter sample variation of less than 3%.

Amount of matrix deposited per unit of tissue surface

$$Wm = \frac{NP \cdot Cm \cdot FRm}{V \cdot TS}$$

$$Wm = 0.22\ \text{mg/cm}^2$$

Spectra were acquired using a Bruker Autoflex Speed equipped with a 1 GHz Smartbeam laser. One hundred shots were collected per pixel with a spatial resolution of 35 µm. Processing of the acquired data was performed using the Bruker FlexImaging 2.1 software.



A standard 25mm x 75mm (1in x 3in) glass slide can be prepared in less than 10 minutes. A larger 81mm x 123mm MALDI plate in less than 30 minutes.

Simple Method Development

The concept of the TM-Sprayer allows the control of the amount of matrix deposited independently of the matrix deposition quality (wet vs. dry) and provides an exact calculation for the weight of matrix per unit of surface.

$$W_m = \frac{NP \cdot C_m \cdot FR_m}{V \cdot TS} = K \cdot \frac{NP}{V}$$

Having quantitative control over the matrix deposition makes method development very logical and intuitive.

Chemical Compatibility and Quantity

The components found in the matrix flow path consist of glass, stainless steel and PEEK, which make the system compatible with all common HPLC approved solvents, as well as most matrices, surfactants, modifying agents and internal standards.

The minimum solution amount needed for a glass slide preparation is 1ml, making the TM-Sprayer a practical option for the deposition of expensive compounds, such as internal standard, drug candidates or high purity trypsin.

High Capacity

The open area of the spray chamber is 140mm x 180mm large and accepts up to ten glass slides or two microtiter plates. Users are able to run large number of samples under identical conditions with confidence.

Mass Spectrometer Compatibility

Tray holders with defined target location make programming easy and are conceived to accept MALDI plates from all major Mass Spectrometer manufacturers.

TM-Sprayer™ Specifications

Deposition: Spray deposition in linear or serpentine modes with variables offsets

Spray Nozzle Flow: 50 to 500µl/min

Sheath Gas: Ambient to 130°C (+/- 2°C), software selected

Gas Supply: Sheath gas flow 3-5 liter/min

Spray Nozzle Position: Spray nozzle mounted on Cartesian stage

Electrical: 24V DC External power supply. Input, 100-240 V, 2.5 Amp, 60-50 Hz

Dimensions/Weight: 41 x 38 x 33cm (16 x 15 x 13 in), 18kg (40lbs)

**HTX TECHNOLOGIES PRODUCTS ARE FOR RESEARCH USE ONLY.
NOT FOR USE IN DIAGNOSTICS PROCEDURES.**

TM-Sprayer™ is available worldwide exclusively from HTX Technologies, LLC.
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HTX Technologies offers innovative sample preparation systems for advanced analytical platforms. Our integrated workflow solutions include user training, instruments, software, consumables and method development services.



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