

# Development of high sensitivity mass spectrometry imaging based on DIUTHAME chip

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## 1. Introduction

We have developed DIUTHAME (Desorption Ionization Using Through Hole Alumina MEMbrane) as an alternative tool to matrices. Ionization process of DIUTHAME and a comparison of the features with MALDI are shown in Fig.1 and Table 1.

Table 1: a comparison of the features with MALDI

Item	DIUTHAME	MALDI
Background noise	None	Matrix noise appears
Ease of handling	Easy	Expertise is required
Reproducibility	High	Not so high
Spatial resolution	High	Not so high
Ionization of large molecules	Possible depending on samples	Possible

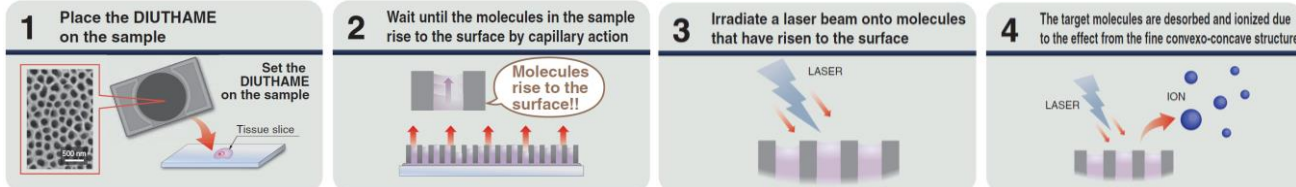


Fig.1: Ionization process using DIUTHAME

## 2. Methods

In the effective area of DIUTHAME, platinum coating was applied on the nano-structured porous alumina. At this study, cationizing agent (NaCl or LiF) was additionally coated on platinum to improve signal intensity. An evaporation method was adopted for the purpose of uniform coating of the cationizing agent. Positive ion mass spectrum and MS imaging were acquired by MALDI TOF-MS (autoflex maX, Bruker).

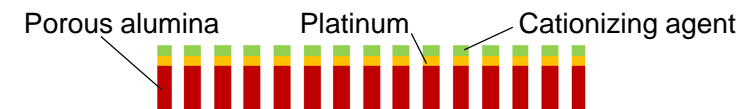


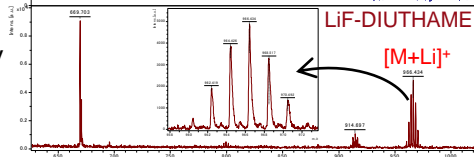
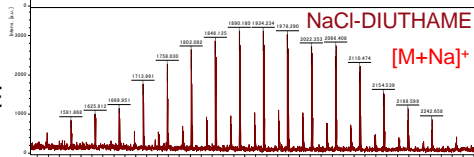
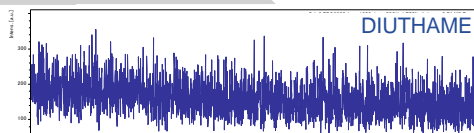
Fig.2: Cross section of DIUTHAME coated with cationizing agent

To date, many samples have been measured using DIUTHAME. Principally matrix-free DIUTHAME doesn't have proton donating function, so DIUTHAME provides lower signal intensity for some samples compared with MALDI. This study is aiming to confirm the signal intensity could be improved by adding the coating of cationizing agent.

### 3-1. Results: mass spectrum

◆ **PEG2000**, 1mg/mL in pure water

PEG: Polyethylene glycol



Signals obtained only by NaCl-coated DIUTHAME (NaCl-DIUTHAME)

◆ **DBDE**, 0.1mg/mL in chloroform

DBDE: Decabromodiphenyl ether, C<sub>12</sub>Br<sub>10</sub>O

Signals obtained only by LiF-coated DIUTHAME (LiF-DIUTHAME)

### 3-2. Results: MS imaging of mouse brain

Mouse brain sliced to a thickness of 10 μm with a cryostat. Then MS imaging was taken for both standard DIUTHAME and NaCl-DIUTHAME.

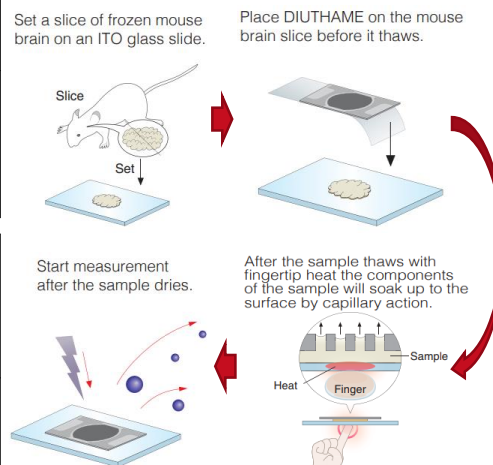
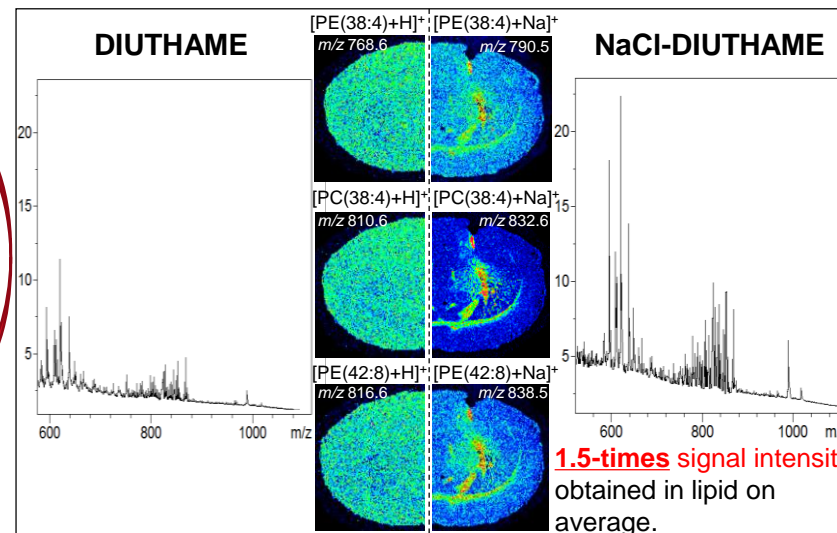


Fig.3: Pretreatment of mouse brain sample using DIUTHAME



## 4. Conclusion

- The results of mass spectrum show that the signal intensity was increased by adding cationizing agent coating.
- MS imaging results show that NaCl-DIUTHAME increased signal intensity of lipids by 1.5-times on average compared to non-cationizing agent.
- We will try to do further improvement for pretreatment process and coating material in order to increase the signal intensity of DIUTHAME. And then apply these know how to the blotting method, which is unique idea just for DIUTHAME.