9th Congress of the Society for Reproductive Biology
02-04.09.2021, Poznań
virtual meeting
Towarzystwo Biologii Rozrodu

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Poster PIV13

Matrix deposition optimization during MALDI MSI analysis of oocytes

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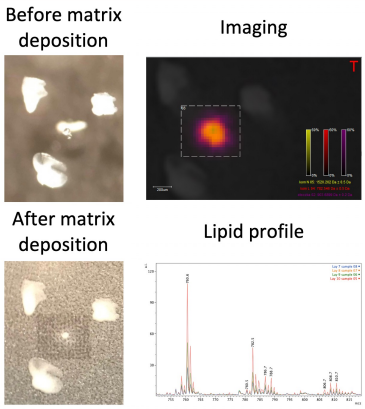
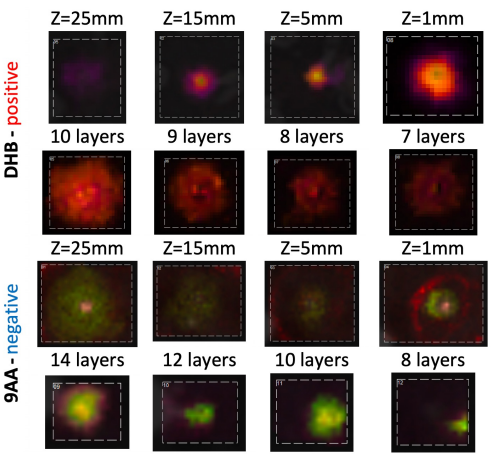
Advantages of MALDI analysis

MALDI mass spectrometry imaging is a unique tool for oocyte analysis. In this approach, a single oocyte is placed on a special surface: ITO glass. Then, it has to be covered with matrix - a low molecular weight organic compound, in an organic solvent. Matrix facilitates the desorption and ionization of molecules present in the sample. The process is caused by a hit of a laser beam. The intensity of the peak in obtained lipid profile corresponds with its amount (in comparison with different cells), and a heat map of molecule localization on the glass may be created. SunCollect offers wet matrix deposition where two parameters are crucial: the height of the matrix spraying nozzle and the number of matrix layers.





Different ion modes, matrices and kinds of lipids

MALDI analysis might be performed in positive and negative ion mode. Each of them demands a characteristic matrix (DHB (2,5-dihydroxybenzoic acid) for positive and 9AA (9-aminoacridine) for negative ion mode). Different ion modes offer the identification of various kinds of lipids. In the positive ion mode, mainly glycerophosphocholines and sphingomyelins are detected. Meanwhile, the negative ion mode is suitable mainly for glycerophosphoethanolamines, glycerophosphoserines, and glycerophosphoinositols. Assessing the quality of our measurements, we were focused on two features. First, the peak intensity on the spectrum that assures a good dynamic range of the measurements. Second: the quality of obtained picture.

Conclusions and future perspectives

In both matrices, four different positions of the spraying nozzle above the sample surface and the influence of the number of the matrix layers on the quality of obtained MS spectra were tested. In the positive ion mode, the intensity of the peaks increases with the height of the nozzle. We also observed that lower nozzle height could be responsible for the unwanted "splashing" of the cell. Thus, the highest nozzle height (Z=1) and ten (l=10) matrix layers were chosen for the positive ion mode.
For the negative ion mode, the peak intensity increased with the number of the matrix layers as for the positive ion mode. Thus, 14 layers (l=14) were chosen to be optimal. At the same time, lower nozzle height (Z=25) seemed to be better in negative ion mode.
Optimizing the matrix deposition is the first step in developing mass spectrometry imaging analysis for such material as a single oocyte, and we hope that this technique brings a lot of new discoveries in the field.

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The research was supported by The Polish National Science Center (NCN) grant number 2018/29/B/NZ4/02243