

Laser desorption/ionization mass spectrometry of biologically active substances using zeolite matrix

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Zeolites are crystalline aluminosilicates with nanometer-order cages. Zeolites have high catalytic activity due to the charge imbalance at the Si-O-Al bridging sites, and those sites are compensated by cations. Hydroxyl (OH) groups having Brønsted acidity exist in H⁺-exchanged zeolite, and it is well known that the Brønsted acid site is responsible for the various catalytic activities of zeolite.

Matrix-assisted laser desorption ionization (MALDI) mass spectrometry is a valuable tool for studies of biopolymers. However, MALDI mass spectrometry has several drawbacks including (1) low ionization efficiency, (2) suppression of protonated analyte peak intensity by alkali metal ion contaminants, and (3) inapplicability to compounds with low molecular weights due to the dissociation of matrix molecules. We have recently developed a "zeolite matrix," which is a complex of organic MALDI matrix and zeolite. The zeolite matrix prevented the dissociation of matrix molecules. In addition, the intensity of the protonated analyte peak was moderately enhanced due to efficient proton supply from Brønsted acid sites on the zeolite surface.

In this study, we exchanged proton on the zeolite surface with alkali metal cations. By using 2, 4, 6-trihydroxyacetophenone (THAP) adsorbed on cation-substituted zeolite, we succeeded in observing large ion peaks of cation-adducted analytes. It was also found that the zeolite matrix is applicable to biologically active substances such as acetylsalicylic acid, barbital, phenobarbital, colchicine, digoxin, amygdalin, and so on, which cannot be detected by conventional MALDI. We are fully convinced that the zeolite matrix can further improve the applicability of MALDI-MS.

Biography

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