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Application of tapered glass capillary microbeam in MeV-PIXE mapping of longan leaf for elemental concentration distribution analysis

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The aim of this study was to understand elemental concentration distribution in local longan leaves for revealing whether and how the plant was affected by the environment or agricultural operation since longan trees were normally heavily sprayed with fertilizer and pesticide and chemical residues might be long lasted on the leaves. The analysis was carried out using the MeV-microbeam particle induced X-ray emission (PIXE) mapping technique which was achieved by a home-developed tapered glass capillary microbeam system based on the 1.7-MV tandem accelerator and its ion beam analysis beam line at Chiang Mai University. The microbeam was coming from the capillary with a 100-μm-diameter exit and the ion beam was of 2-MeV proton. This study was interested in difference in the elemental concentration and distribution between the leaf midrib and lamina areas. In the measurement, the micro proton beam after the tapered glass capillary analyzed the leaf sample at a fixed spot of about 150 μm in diameter for 1000 seconds, while the leaf held on the sample stage was translated step by step over a 1,350-μm range across the leaf midrib edge to the leaf lamina area, resulting in total 9 data requisition spots to realize a scanning of the interesting area. The resulting data were colored to form a map of the elemental concentration distribution. Analysis from the map revealed 7 dominant elements, which were Al, S, Cl, K, Ca, Sc and Fe. It was interestingly found that in the midrib region, Al, S, Cl, K, Ca, Sc were relatively higher in concentration than in the lamina area, while the Fe concentration was in an opposite trend to that of the others. The only indication of fertilizer and pesticide elements detected in the leaf sample was of K.

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