

Comparative Raman study of four Zn(II) metallothionein isoforms from plants

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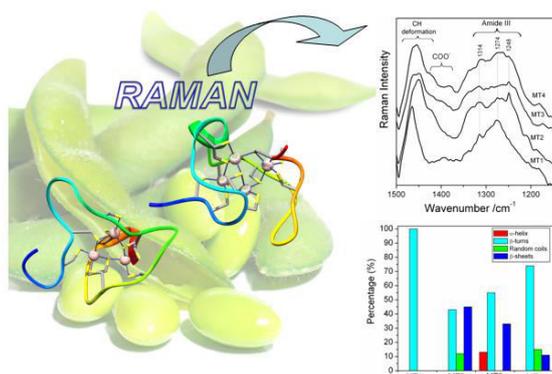
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Metallothioneins (MTs) are intracellular, low molecular weight, sulfur-rich proteins, characterised by a high content of Cys (close to a third of the total number of amino acids), and a high capacity for binding both biologically essential (Zn^{II} and Cu^I) and non-essential (Cd^{II} , Hg^{II} or Ag^I) transition metal ions.

Primary structure of plant MTs differ from that of animal MTs by the presence of some aromatic residues and a peculiar amino acid sequence organization consisting of two or three short Cys-rich domains linked by Cys-devoid regions. The members of the plant MT family are characterized by great sequence diversity, requiring further division into four subfamilies.

The general structural feature characterizing all MTs is the presence of metal-thiolate clusters, involving terminal and bridging cysteinyl thiolate groups. Recently, it has been shown that metal coordination to the MT polypeptides constitutes a more complex scenario than the simplistic consideration of metal-thiolate bonds contributed by the MT Cys residues. Particularly, the participation of other ligands in the metal coordination sphere of MTs has been shown for other amino acid side chains (His, Asp, Glu) [1,2]. Despite the well-known potentialities of Raman spectroscopy in protein investigation, this technique, to our knowledge it has been scarcely used in MT structural studies until now [3].



In this work structural differences among in vivo-synthesized Zn-metallothionein (MT) complexes from the four subfamilies of the soybean (*Glycine max*- *GmMT*) MT system were revealed by using a very promising experimental approach consisting in using Raman spectroscopy, in combination with other analytical and spectroscopic strategies.

Metal clusters with different geometry can be hypothesized for the four *GmMT*s: a cubane-like metal cluster in Zn-*GmMT*1, and dinuclear Zn-S clusters in Zn-*GmMT*2, Zn-*GmMT*3 and Zn-*GmMT*4 [4].

As regards secondary structure elements, a large content of β -turn segments is present in all four Zn-*GmMT*s, specially for isoforms 1 and 4. β -strands give a contribution to the folding of three *GmMT*s isoforms, and the highest percentage was found in Zn-*GmMT*2 (~45%). Conversely, the α -helix content is negligible in all the *GmMT*s except in Zn-*GmMT*3, where this peculiar feature coincides with the possible involvement of the two His residues in metal coordination [4].

References

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