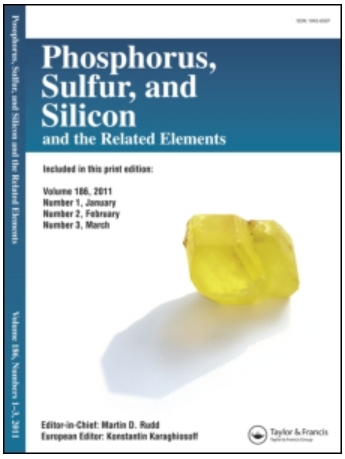

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Biomedical Implications of Polyphosphates

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Biomedical Implications of Polyphosphates

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The polyphosphates have the capacity of forming chelates with most of the metal cations[1]. Polyphosphatic complexes with trace- and macroelements are used as fodder additives for animals. In our experiments we studied the effect of pyrophosphate (PP), tripolyphosphate (TPP) and hexametaphosphate (HMP), at different concentrations (0.909 mM, 1.818 mM and 2.727 mM), on the enzymatic activity of carbonic anhydrase (CA), and the effect of polyphosphate chelates on the enzymatic activity of alkaline phosphatase (AP), both zinc-enzymes. The metal ion, which can be dissociated in the presence of a chelating agent, is essential for their catalytic activity [2]. The presence of metal atoms as essential constituents of some enzymes, and the metal requirements of others for maximum activity, provide an obvious link between enzymatic reaction and coordination chemistry.

The mobilization of the zinc, and the concomitant decrease of enzymatic activity, is explained by a SN2 mechanism, with the formation of an intermediary ternar complex enzyme-Zn-ligand:

$$EZn + L \underset{}{\overset{1}{\rightleftharpoons}} [EZnL] \overset{2}{\rightarrow} E + ZnL$$

The metal complexing power increases with the length of the polyphosphate chain and with the concentration, the highest inhibition of purified enzyme was observed for 2.727 mM HMP (a/a_0 = 6.96%) at 2 hours of incubation. There is no correlation between the efficiency of the ligand and K_{LZn}/K_{EZn}. The highest inhibition of blood CA was for HMP (a/a_0 = 4.27%) at 2 hour of incubation. After 20 hours the enzymatic activity is restored (a/a_0 = 84.84%), the polyphosphates being hydrolysed by the sanguine polyphosphatases.

The "in vivo" experiments with polymetalic chelates showed an increase in the alkaline phosphatase activity with 27.35%. The greater affinity of the ligand for Zn^{2+} makes possible the exchange of the Zn^{2+} with Ca^{2+} when Ca-AP, which has a higher enzymatic activity, is formed.

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