*Asian Journal of Chemistry* Vol. 20, No. 3 (2008), 2459-2460

***NOTE***

# Reactions of Micronutrient Metal Ions with Urinary Stone Forming Minerals

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Micronutrient metal ions were added to the inhibitor solutions of different amino acids such as glycine, β-alanine, L-cystine and hippuric acid with a view to study the increase or decrease of the inhibition efficiency of mineralization of urinary sone forming minerals. Micronutrient metal ions increase the inhibition up to some extent.

**Key Words: Urinary stone, Micronutrients.**

Micronutrient metal ions *viz.*, $Mn^{2+}$, $Fe^{2+}$, $Ni^{2+}$, $Cu^{2+}$ and $Zn^{2+}$ are important for the life process. Though required in trace amounts they are essential for various enzymatic processes. They form part of urinary system. They have high coordinating abilities[1] and their complexing tendency towards the calcium precipitating ligands present in the urinary system[2-4] might effect the mineralization inhibition efficiency of complexons.

The effect of micronutrient metal ions[5] on the inhibiton effciency was studied in the Reservoir dynamic model. In the inhibitor's reservoir, (50 mL, 0.001 M inhibitor solution in water) calculated quantity of solid metal salts were added so that the concentration of metal salts was 0.0003 M in the reservoir. Two salt forming solutions [0.01 M $CaCl_2$ and 0.01 M $Ca_3(PO_4)_2$] were taken in two separate burettes (50 mL each) and was allowed to fall dropwise in the reservoir. The reaction mixture was stirred continuously over a magnetic stirrer. Similar experiments were done with 0.01 M $CaC_2O_4$ and 0.01 M $CaCO_3$ with different inhibitor solutions (glycine, β-alanine, L-cystine and hippuric acid) (Table-1).

Inhibitor efficiency was calculated separately with different inhibitors in RDM also. This is to compare the efficiencies with micronutrient metal ions. Increase or decrease of inhibition efficiency was recorded.

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TABLE–1

| Inhibitor (50 mL 0.001 M solution) | Micronutrient metal ion (0.0003 M w.r.t. main inhibitor) | Increase (+) or decrease (–) of inhibition (%) over inhibitor used | | |
|---|---|---|---|---|
| | | $Ca_3(PO_4)_2$ | $CaC_2O_4$ | $CaCO_3$ |
| Glycine | $Mn^{2+}$ | + 49.7 | + 23.03 | – 11.6 |
| Glycine | $Fe^{2+}$ | + 50.7 | + 25.90 | – 22.8 |
| Glycine | $Bi^{2+}$ | + 37.9 | + 46.90 | – 31.1 |
| Glycine | $Cu^{2+}$ | – 6.5 | + 54.60 | – 19.9 |
| Glycine | $Zn^{2+}$ | + 39.4 | + 33.50 | + 14.1 |
| β–Alanine | $Mn^{2+}$ | + 10.68 | + 48.9 | + 16.65 |
| β–Alanine | $Fe^{2+}$ | – 11.80 | + 34.9 | – 29.90 |
| β–Alanine | $Bi^{2+}$ | + 2.10 | + 60.7 | – 31.30 |
| β–Alanine | $Cu^{2+}$ | + 7.20 | + 42.9 | – 23.70 |
| β–Alanine | $Zn^{2+}$ | + 5.00 | + 39.0 | – 34.75 |
| L-Cystine | $Mn^{2+}$ | + 5.0 | – 19.50 | – 7.23 |
| L-Cystine | $Fe^{2+}$ | + 9.3 | – 17.76 | – 75.80 |
| L-Cystine | $Bi^{2+}$ | + 4.5 | – 5.50 | – 6.99 |
| L-Cystine | $Cu^{2+}$ | + 9.0 | – 20.50 | – 5.15 |
| L-Cystine | $Zn^{2+}$ | – 28.8 | – 18.80 | – 5.43 |
| Hippuric acid | $Mn^{2+}$ | – 10.80 | – 5.22 | – 6.50 |
| Hippuric acid | $Fe^{2+}$ | – 9.25 | – 1.72 | – 20.50 |
| Hippuric acid | $Bi^{2+}$ | + 26.02 | – 9.82 | – 15.90 |
| Hippuric acid | $Cu^{2+}$ | + 2.90 | – 2.48 | – 31.83 |
| Hippuric acid | $Zn^{2+}$ | – 51.10 | – 2.82 | – 16.53 |

## Conclusion

Phosphate inhibition is mostly increased by micronutrient metal ions. There was a decrease in Carbonate inhibition efficiency almost by all the micronutrients. In all the reactions $Mn^{2+}$ and $Ni^{2+}$ were found to be the most effective micronutrient metal ions in increasing the inhibition efficiency of inhibitors.

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(*Received*: 16 September 2006; *Accepted*: 17 December 2007) AJC-6129