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Potentiometric study of Cd (II) and Al (III) binary and mixed ligand systems with Ascorbic acid, Citric acid, Uracil and Vitamin B_1 under physiological conditions

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Over two thirds of the elements found in nature are metals. Among them, metals such as Na, K, Ca, Fe and Mg are considered essential for living organisms while some metals like Pb, Cd, As, Al, Hg and Sb are known to be toxic when present in excessive amounts. This can lead to various undesirable effects in biological systems, as toxic metals cannot be transformed into harmless compounds inside the body via biological processes. The only way to remove excessive amounts of such toxic elements is chelation therapy. With the injection of suitable complexing agents, toxic metals are excreted with urine or faeces. Poly-carboxylic acids and amino acids etc. have been used successfully in chelation therapy. Today, there is increased attention to investigate common drugs and dietary ligands for chelation therapy with minimal side effects.

Ascorbic and citric acids, uracil and vitamin B_1 are chalators available in food and are taken as vitamin supplements. Cd(II) and Al(III) are toxic metals that enter the human body via various ways. Thus, this work attempted attempted to study the mixed ligand interactions of the two above mentioned mentioned metals with the respective ligands in the physiological conditions by calculating stability constants of binary and ternary complexes formed at 37 ± 0.2 ^{0}C and ionic strength of 0.15 M.

Stability constants have been determined through potentiometric titrations following the method suggested by Irving and Rossotti. It was found that all four ligands form ML type binary complexes with Cd(II) and ML_2 type with Al(III). Uracil shows the highest affinity towards both metals by forming binary complexes with large formation constants. Al (III) forms five different ternary ligand systems of six possible ligand combinations, where as only three mixed ligand systems were formed by Cd(II). All ternary systems have higher formation constants compared to their respective binary systems reflecting higher stabilities of ternary systems.

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