

CHEMICAL KINETICS
AND CATALYSIS

Kinetics of Acid Hydrolysis and Reactivity of Some Antibacterial Hydrophilic Iron(II) Imino-Complexes¹

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Abstract—Kinetic study of acid hydrolysis of some hydrophilic Fe(II) Schiff base amino acid complexes with antibacterial properties was performed using spectrophotometry. The Schiff base ligands were derived from sodium 2-hydroxybenzaldehyde-5-sulfonate and glycine, L-alanine, L-leucine, L-isoleucine, DL-methionine, DL-serine, or L-phenylalanine. The reaction was studied in aqueous media under conditions of pseudo-first order kinetics. Moreover, the acid hydrolysis was studied at different temperatures and the activation parameters were calculated. The general rate equation was suggested as follows: rate = k_{obs} [Complex], where $k_{\text{obs}} = k_2 [\text{H}^+]$. The evaluated rate constants and activation parameters are consistent with the hydrophilicity of the investigated complexes.

Keywords: kinetics, Fe(II), acid hydrolysis, Schiff base, antibacterial compounds.

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INTRODUCTION

This paper discuss the velocity of reaction between antibacterial Fe(II) Schiff base complexes and hydronium ion. The pH of stomach is acidic so, it's very important to study any bio-active compound in acid medium kinetically. Schiff base complexes possess a wide variety of activities against malaria plasmodium [1], bacteria [1, 2], fungi [1, 3] and certain types of tumors [4–6], and they have been used as drugs. Some drugs show increased activity when administered as metal chelates and inhibit the growth of tumors [7, 8]. Moreover, Schiff bases were studied as antitumor agents [9]. The development in the field of bio-inorganic chemistry has increased the interest in Schiff base complexes, since it has been recognized that many of these complexes may serve as models for biologically important species [10–13]. Schiff base amino acid complexes act as good chelating agents [14, 15] and behave as efficient biologically active [9, 16] and cytotoxic agents [17]. It is clear that Schiff base transition metal complexes are very important chelates because of their cheap and easy synthesis and their chemical and thermal stability. The central metal in these complexes acts as an active site and thus effectively catalyzes chemical reactions [18].

Salicylaldehyde–amino acid Schiff base complexes are used as non-enzymatic models for the metal-pyridoxal (vitamin B6) amino acid Schiff base systems which are the key intermediates in many metabolic reactions of amino acids catalyzed by enzymes, which require pyridoxal as a cofactor (transamination, decarboxylation, elimination, racemization, etc.) [19]. Some research groups found that the Schiff base metal complexes derived from salicylaldehyde can specially cleave the DNA [20–22]. Water soluble complexes of sulfonato-substituted Schiff base ligands used as catalytic antioxidants [23, 24] and as a catalyst in ionic liquid media for cyclooctene epoxidation [25]. Comparatively very little effort has been expended to study Fe(II) Schiff base amino acid complexes despite their importance as complexes containing a metal in an unstable, low oxidation state, as well as involving unstable ligands that are coordinated to Fe(II) metal ion. Iron Schiff base complexes provide useful structural and electronic models for the similarly coordinated sites found in the heme containing enzymes. Moreover, these complexes are also important for the asymmetric oxidation of organic substrates, since their structure and catalytic activity are analogous with those of iron porphyrins [26]. Despite the importance of iron Schiff base complexes, little work has been devoted to the acid hydrolysis of these complexes [27]. More kinetic data concerning the acid hydrolysis of the hydro-

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