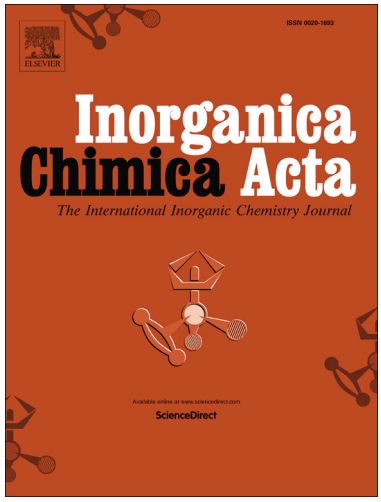

Research paper

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Research Paper

Synthesis, Crystal Structures, and Superoxide Dismutase Activity of Two New Multinuclear Manganese(III)-Salen-4,4'-Bipyridine Complexes

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Manganese(III)-salen complexes have been reported as superoxide dismutase mimics (mSOD) that can scavenge superoxide anion radicals. They are mononuclear complexes with a variety of salen ligands. Here, two new multinuclear manganese(III)-salen complexes with 4,4'-bipyridine (4,4'-bpy) as bridging ligand and ClO_4^- as axial ligand or PF_6^- as counter anion, respectively, are reported. The dimeric complex [{Mn(ClO_4)(salen)}$_2$(μ-4,4'-bpy)] (**1**) was obtained from [MnCl(salen)]·2H_2O and 4,4'-bipyridine which followed by addition of $NaClO_4$. While the polymeric complex {[Mn(salen)(4,4'-bpy)]PF_6}$_n$ (**2**) was prepared by the same procedure of **1**, followed by addition of KPF_6 replacing $NaClO_4$. Compounds **1** and **2** were characterized by elemental analysis, conductometry, infrared spectroscopy, electrospray-ionization mass spectrometry, and room temperature/variable temperature magnetic susceptibility measurements. The crystal structures of compounds **1** and **2** were determined by single crystal X-ray crystallography. Furthermore, in indirect SOD tests using riboflavin photoreduction, the polymeric compound **2** shows the slightly higher SOD activity with an IC_{50} of 1.6 ± 0.2 μM than the dimeric compounds **1** with an IC_{50} of 2.0 ± 0.3 μM.

Keywords: manganese-salen-4,4'-bipyridine, dimeric, polymeric, superoxide dismutase, SOD, mimic, riboflavin, photoreduction

Introduction

Superoxide radical is a highly dangerous reactive oxygen species [1]. It may cause damage to human tissues that are often associated with various diseases, such as rheumatoid arthritis, cancer, neurodegenerative disorder, diabetic complication, stroke, inflammation, and reperfusion injuries [2, 3].

Normally, the enzyme superoxide dismutase (SOD) acts as a catalyst in the conversion of superoxide radicals to hydrogen peroxide and oxygen [4, 5]. However, if large amounts of superoxide radicals are present, the amount of SOD will not be adequate; therefore, uptake of an exogenous SOD is required. It was observed that the use of natural SOD was not effective, caused immunogenicity and was also rather expensive, while the use of SOD mimics instead showed many advantages [3, 6].

Several manganese(III)-salen complexes (salen = N,N'-bis(salicylidene)-1,2-ethylenediamine) have been reported as SOD mimics with low toxicity [7]. They were obtained as mononuclear complexes with a variety of salen ligands. Several monomeric manganese(III)-salen complexes had been modified through substitution of their salen ring, such as [Mn(OMe-salen)(OAc)], [Mn(OEt-salen)(OAc)], [Mn(OMe-salen)Cl], [Mn(OEt-salen)Cl], were showed similar activity of SOD mimic to the normal (unsubstituted) one, i.e. [Mn(salen)OAc] and