Orig Life Evol Biosph (2013) 43:1–17
DOI 10.1007/s11084-012-9319-9

PREBIOTIC CHEMISTRY

Possible Role of Metal(II) Octacyanomolybdate(IV) in Chemical Evolution: Interaction with Ribose Nucleotides

Anand Kumar · Kamaluddin

Received: 28 December 2011 / Accepted: 3 November 2012 /
Published online: 21 December 2012

Abstract We have proposed that double metal cyanide compounds (DMCs) might have played vital roles as catalysts in chemical evolution and the origin of life. We have synthesized a series of metal octacyanomolybdates (MOCMos) and studied their interactions with ribose nucleotides. MOCMos have been shown to be effective adsorbents for 5′-ribonucleotides. The maximum adsorption level was found to be about 50 % at neutral pH under the conditions studied. The zinc(II) octacyanomolybdate(IV) showed larger adsorption compared to other MOCMos. The surface area seems to important parameter for the adsorption of nucleotides. The adsorption followed a Langmuir adsorption isotherms with an overall adsorption trends of the order of 5′-GMP > 5′-AMP > 5′-CMP > 5′-UMP. Purine nucleotides were adsorbed more strongly than pyrimidine nucleotides on all MOCMos possibly because of the additional binding afforded by the imidazole ring in purines. Infrared spectral studies of adsorption adducts indicate that adsorption takes place through interaction between adsorbate molecules and outer divalent ions of MOCMos.

Keywords Chemical evolution · Double metal cyanides · Metal octacyanomolybdate (IV) · Interaction · Ribonucleotides

Introduction

There has been significant marked progress in recent years in studies related to chemical evolution and origin of life (Aldersley et al. 2011; Lilley and Sutherland 2011; Saladino et al. 2012). It is widely accepted that the origin of life began with the formation of important biomonomers from simple molecules present in the prebiotic environment and their subsequent condensation to biopolymers. It is well known that Ribonucleic acid (RNA) molecule is a polymer of ribonucleotides, linked through phosphodiester bonds. It is, therefore, a matter of

Electronic supplementary material The online version of this article (doi:10.1007/s11084-012-9319-9) contains supplementary material, which is available to authorized users.

A. Kumar · Kamaluddin (✉)
Department of Chemistry, Indian Institute of Technology Roorkee, Roorkee 247 667 U.K., India
e-mail: kamalfcy@gmail.com