

Studies on the Chemistry of Metal Ion Binding by Natural Products as Environmental Monitors

メタデータ	言語: jpn 出版者: 公開日: 2022-06-17 キーワード (Ja): キーワード (En): 作成者: Takani, Masako メールアドレス: 所属:
URL	https://doi.org/10.24517/00066407

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1995 Fiscal Year Final Research Report Summary

Studies on the Chemistry of Metal Ion Binding by Natural Products as Environmental Monitors

Research Project

Project/Area Number

06640719

Research Category

Grant-in-Aid for General Scientific Research (C)

Allocation Type

Single-year Grants

Research Field

Inorganic chemistry

Research Institution

Kanazawa University

Principal Investigator

TAKANI Masako Kanazawa University, Pharmaceutical Sciences, Assistant Professor, 薬学部, 講師 (40019667)

Project Period (FY)

1994 – 1995

Keywords

Usnic acid / Copper (II) complexes / Palladium (II) complexes / Ternary complexes / Binary complexes / X-ray crystallography / Indole-3-acetic acid / Cyclopalladation

Research Abstract

Lichens are formed by a symbiotic association of a fungus and an algae. They absorb heavy metal ions and other pollutants from the environments and are thus regarded as an important biological monitor of pollution. The present study aimed at elucidating the complex formation between the beta-triketone moiety of a typical lichen substance usnic acid (UA) or its derivatives and various heavy metal ions by synthetic, spectroscopic, and X-ray diffraction methods.

The copper (II) and palladium (II) complexes of UA and the palladium (II) complexes of the enamine derivatives of UA were isolated as crystals. The metal binding sites have been inferred from various spectral data and confirmed by the X-ray structural analysis of the ternary copper (II) complexes containing UA and 2,2'-bipyridine (bpy), [Cu (bpy)(UA)(NO₃)] and [Cu₂ (bpy)₂ (UA)-(NO₃)₂], and two binary palladium (II) complexes of the

enamine derivatives of UA. From the pH dependence of the copper (II) complex formation of UA, the complex was found to be completely formed at pH > 7. The binary UA complexes of Fe (III), Zn (II), Pb (II), Cd (II), Ni (II), Mn (II), Mg (II), and Ca (II) were prepared, and their metal binding site has been concluded to be beta-triketone moiety.


Since lichens contain UA and similar polyphenol compounds, the present findings strongly indicate that they can bind a number of metal ions and serve as an efficient biological monitor of air and water pollution.


As a further example of the complex formation of natural organic compounds, indole-3-acetate, which is known as a plant hormone, has been established to react with palladium (II) to form a complex with a unique cyclopalladation.

Research Products (2 results)

All Other

All Publications (2 results)

[Publications] Masako Takani: "Palladium (II) complex formation by indole-3-acetate. Mixed ligand complexes involving a unique spiro-ring formed by cylopalladation" *Inorg.Chim.Acta.* 235. 367-374 (1995) 

[Publications] Masako, Takani: "Palladium (II) complex formation by indole-3-acetate. Mixed ligand complexes involving a unique spiro-ring formed by cylopalladation" *Inorg. Chim. Acta.* 235. 367-374 (1995) 

URL: https://kaken.nii.ac.jp/report/KAKENHI-PROJECT-06640719/066407191995kenkyu_seika_hokoku_

Published: 1997-03-03