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Mixed ligand gold(I) complexes of phosphines and thiourea and X-ray structure of (thiourea-κS)(tricyclohexylphosphine)gold(I)chloride

Anvarhusein A. Isab [a,*], Mohammed Fettouhi [a,*], Saeed Ahmad [a], Lahcène Ouahab [b]

[a] Department of Chemistry, King Fahd University of Petroleum and Minerals, Dhahran 31261, Saudi Arabia
[b] Laboratoire de Chimie du Solide et Inorganique Moléculaire, UMR 6511, CNRS-Université de Rennes1, Campus de Beaulieu, 35042, Rennes Cedex, France

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Abstract

A series of mixed ligand gold(I) complexes with thiourea (Tu) and various phosphines, $[R_3PAuTu]Cl$, have been prepared and characterized by elemental analysis, IR and NMR (^{13}C, ^{15}N and ^{31}P) spectroscopies and X-ray crystallography. The spectral data of all complexes are consistent with the sulfur coordination of thiourea to gold(I). The single crystal X-ray structure of the complex $[Cy_3P–Au–Tu]Cl$ revealed that the geometry is not perfectly linear at the gold(I) with a P–Au–S bond angle of 168.54(9)°. The Au–P and Au–S distances are 2.274(2) and 2.295(2) Å, respectively.

Keywords: Gold(I) complexes; X-ray structures; Thiourea

1. Introduction

Recent interest in gold(I) complexes with sulfur and phosphorus donor ligands was stimulated by the anti-arthritic properties exhibited by some gold compounds like myocrisin, solganol and auranofin [1,2].

Thiourea (Tu) and imidazolidine-2-thione and its derivatives are simple sulfur containing ligands and thus gold(I) complexes of thiourea are expected to form useful additional new compounds, which may serve as models for presently available therapeutic agents. The ability of thiourea (Tu) to form stable adducts with a variety of transition metals (Cu, Ag, Au and Pt) is well established and the structures of several such complexes have been determined [3–11].

We have been interested in the spectral and structural chemistry of gold–phosphorus and gold–sulfur interactions involving phosphines, heterocyclic thiones and thiolates [11–13]. We have also studied the solution equilibria of cyanogold(I) complexes for a series of phosphines, thiones and selenones [14,15]. As a part of our continuing research program in this area, here we report the synthesis and characterization of phosphine–gold(I) complexes of thiourea.

2. Experimental

2.1. Chemicals

Thiourea, MeOD, NH_4NO_3, Me_2S and all solvents were obtained from the Fluka–Aldrich Chemical Co., Germany. ^{13}C and ^{15}N labelled (~98% each atom) thiourea was obtained from Isotec Co, USA. $HAuCl_4 \cdot 3H_2O$ and all phosphines were obtained from the Strem Chemical Co.

2.2. Synthesis of the complexes

All $[R_3PAuTu]Cl$ complexes were prepared by the addition of thiourea to the corresponding precursor complexes, R_3PAuCl. The R_3PAuCl complexes were prepared by adding phosphines to the slurry of Me_2S–AuCl in acetone under N_2 and stirring for half an hour

* Corresponding authors. Tel.: +966-3-860-2645; fax: +966-3-860-4277.
E-mail addresses: aisab@kfupm.edu.sa (A.A. Isab), fettouhi@kfupm.edu.sa (M. Fettouhi).

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