Journal of Organometallic Chemistry, 190 (1980) C56–C58

Preliminary communication

ORGANOGOLD CHEMISTRY

IV*. QUINOLYL- AND PHENANTHRIDINYL-GOLD(I) COMPOUNDS

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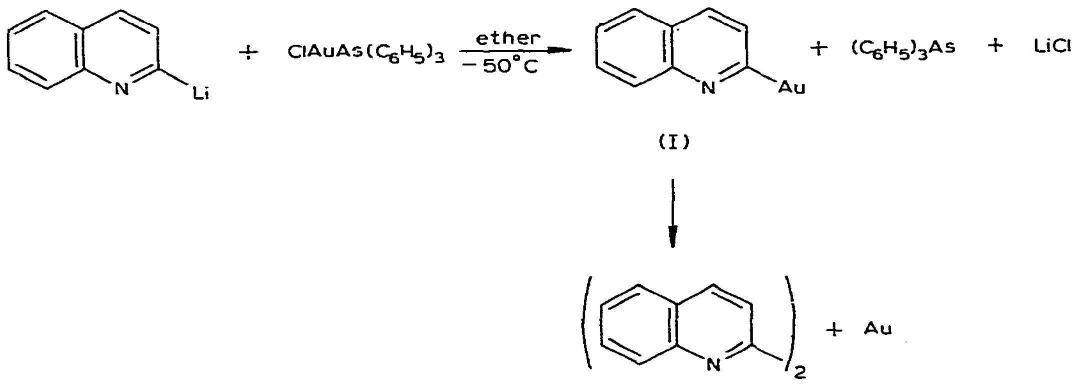
(Received December 14th, 1979)

In an earlier communication [1] the preparation of 2-pyridylgold(I) and five methyl-substituted derivatives was described. The stability of the compounds and their potential usefulness in synthetic reactions have prompted additional work with related quinoline and phenanthridine derivatives. These new compounds show that stable derivatives are not limited to those in which gold is bonded at the 2-position, and have considerably expanded the potential breadth of heterocyclic organogold chemistry [2,3].

All new compounds were prepared by the method described earlier, which is illustrated for the preparation of 2-quinolylgold(I) (I). Crude 2-quinolylgold(I), obtained in quantitative yield, was insoluble in all compounds tested as potential solvents, including the basic solvents used for recrystallization of 2-pyridylgold(I). However, a suspension of the compound in methanol did dissolve when



(I)

(II)

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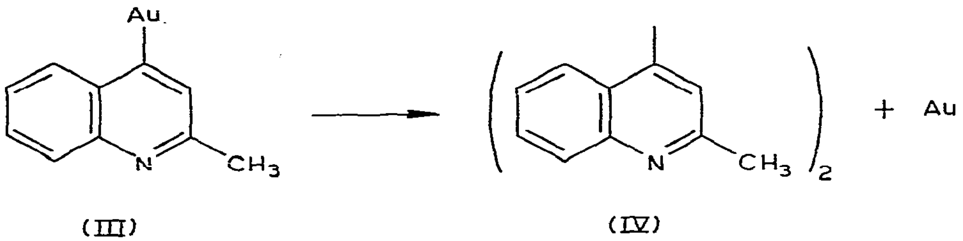
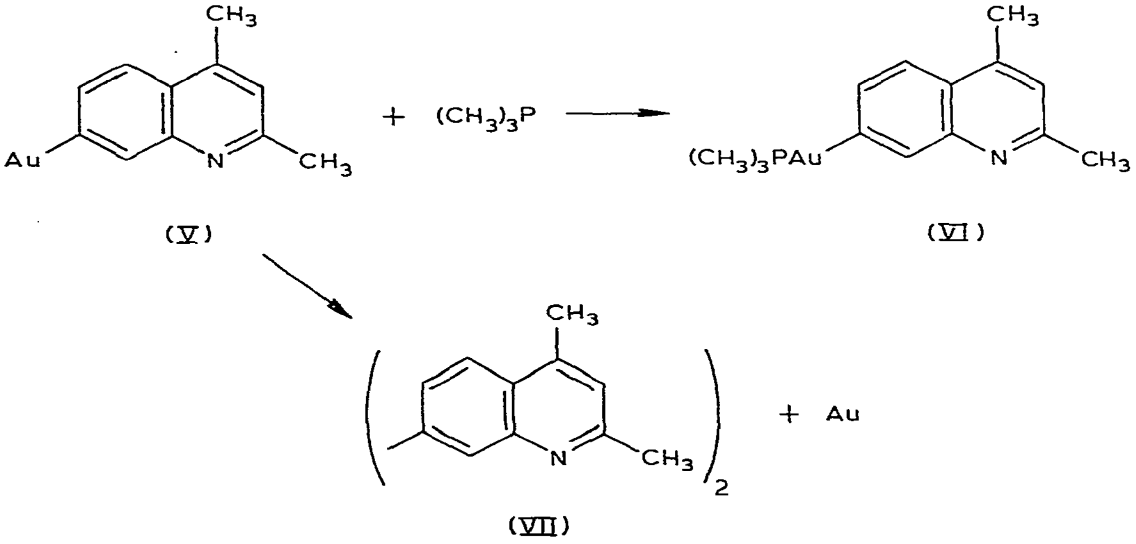
*For part III see ref. 1.

the mixture was treated with excess trimethylphosphine. On standing, an analytically pure yellow sample of I precipitated, which darkened about 135°C and decomposed about 195°C. Pyrolysis of a crude sample of I in a sublimator at 175°C furnished a 63% yield of 2,2'-biquinolyl (II).

2-Methyl-4-quinolylgold(I) (III) was also obtained in quantitative yield and is of unusual structural interest since the compound can exist only as a linear polymer. The compound is slightly soluble in hot pyridine, undoubtedly due to formation of monomeric units in which the gold atom is coordinated by pyridine. A recrystallized sample, bright yellow in color, had m.p. 215°C (dec.). Pyrolysis of III furnished a 95% yield of 2,2'-dimethyl-4,4'-biquinolyl (IV), m.p. 245–247°C.



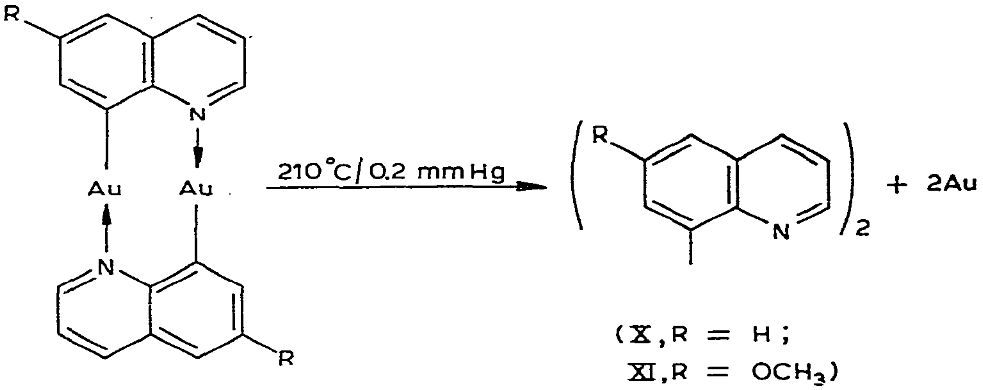
Attempted recrystallization of crude 2,4-dimethyl-7-quinolylgold(I) (V) was frustrated by decomposition in solution. However, treatment of the compound with excess trimethylphosphine in THF gave a 26% yield of adduct VI, m.p. 160°C (dec.). Compound VI was prepared independently in 15% yield by reaction of 2,4-dimethyl-7-quinolyllithium with chloro(trimethylphosphine)gold(I).



Pyrolysis of V furnished a 61% yield of 2,2',4,4'-tetramethyl-7,7'-biquinolyl (VII), m.p. 186–188°C.

Crude 8-quinolylgold(I) (VIII) was obtained in 89% yield. Recrystallization from hot DMSO gave a bright red analytical product with m.p. 268–271°C (dec.).

The illustrated dimer is the simplest structure which satisfies the coordination requirements of gold. Such a structure rigidly holds the non-bonded gold atoms in very close proximity (ca. 2.4 Å), and may result in a novel metal—metal interaction. Very poor solubility has prevented molecular weight determinations, and more complex polymeric structures cannot be excluded.

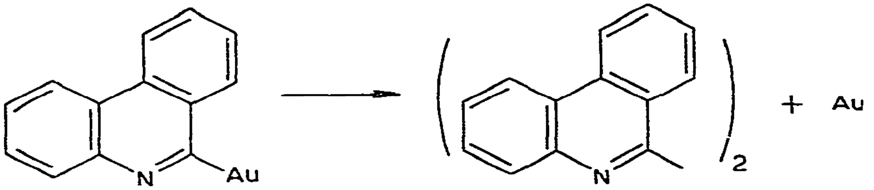


(X, R = H;
XI, R = OCH_3)

(VIII, R = H;
IX, R = OCH_3)

The yellow 6-methoxy derivative (IX), m.p. 270°C (dec.), was also prepared, but showed no better solubility properties than the parent compound. Pyrolysis of VIII at 210°C and IX at 275°C at 0.2 mmHg furnished 8,8′-biquinolyls (X, m.p. 209—211°C) and XI (m.p. 300—302°C) in yields of 85 and 94%.

6-Phenanthridinylgold(I) (XII) was obtained in 90% yield. The compound, after purification via its trimethylphosphine adduct in ethanol, darkened at 275°C and decomposed at 345°C. Pyrolysis at 370°C at 0.2 mmHg for 4 h furnished a quantitative yield of 6,6′-biphenanthridyl (XIII), m.p. 344—346°C.



(XII)

(XIII)

References

1 L.G. Vaughan and W.A. Sheppard, J. Amer. Chem. Soc., 92 (1970) 730.
2 For a recent review of arylgold compounds see: R. Uson, A. Laguna and J. Vicente, Synth. React. Inorg. Met.-Org. Chem., Vol. 7 (1977) 463—496.
3 For a general review of gold chemistry, see: R.J. Puddephatt, The Chemistry of Gold, Elsevier, Amsterdam, 1978.