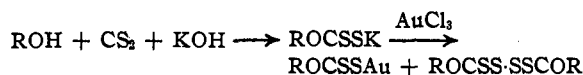


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## The Synthesis of Some Organic Compounds of Gold

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Several organic gold compounds were desired by us for a series of experiments on the physiological effects of gold compounds.<sup>2</sup> Two types of compounds, gold alkylxanthates ROCSSAu and aliphatic gold thio acids RCH(SAu)COOH, were synthesized by procedures based on the methods outlined by Zeise, Scala and Billman.<sup>3</sup> The gold alkylxanthates were prepared thus



The aliphatic gold thio acids were prepared as indicated

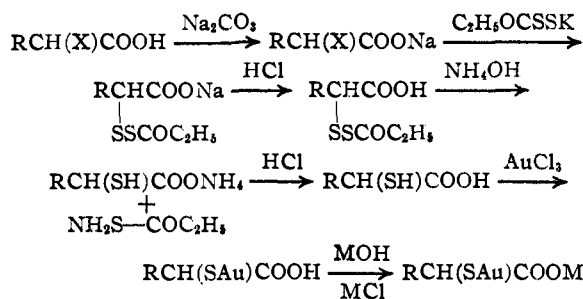


Table I lists the gold compounds prepared, together with their formulas, melting points and gold content, the gold content being an index of purity.

TABLE I  
PROPERTIES OF ORGANIC GOLD COMPOUNDS

Compound	Formula	M. p., °C.	Gold %	
			Found	Calcd.
<b>Gold alkylxanthates</b>				
1 Methyl	CH <sub>3</sub> OCSSAu	160 ca.	64.45	64.81
2 Ethyl	C <sub>2</sub> H <sub>5</sub> OCSSAu	165-168	61.64	61.94
3 <i>n</i> -Propyl	C <sub>3</sub> H <sub>7</sub> OCSSAu	165-167	59.16	59.29
4 <i>i</i> -Propyl	C <sub>3</sub> H <sub>7</sub> OCSSAu	163-165	59.42	59.29
5 <i>n</i> -Butyl	C <sub>4</sub> H <sub>9</sub> OCSSAu	162-164	57.78	56.92
6 <i>i</i> -Butyl	C <sub>4</sub> H <sub>9</sub> OCSSAu	162 ca.	56.89	56.92
<b>Gold thio acids</b>				
1 Strontium gold thioglycolate	(CH <sub>2</sub> SAuCOO) <sub>2</sub> Sr	240-280	60.61	59.53
2 $\alpha$ -Gold thiobutyric acid	CH <sub>3</sub> CH <sub>2</sub> CH(SAu)COOH	187-197	61.40	62.24

### Experimental

**Gold Alkylxanthates.**—These compounds were prepared according to methods of Zeise<sup>3a</sup> and Scala.<sup>3b</sup> Potassium alkylxanthates were prepared by dissolving potassium hydroxide in the appropriate alcohol and adding carbon disulfide. All have a characteristic odor and pale yellow color, decompose on heating, and are very soluble in water.

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(2) Denko and Anderson, *J. Lab. Clin. Med.*, **29**, 1168 (1944).

(3) (a) Zeise, *Ann. der Pharm.*, **16**, 178 (1835); (b) Scala, *Gazz. chim. ital.*, **17**, 78 (1887); (c) Billman, *Ann.*, **339**, 351 (1905); **348**, 120 (1906).

In preparing the gold alkylxanthate a 10% solution of auric chloride (as HCl·AuCl<sub>3</sub>·4H<sub>2</sub>O) was added dropwise to a 25% solution of potassium ethylxanthate with constant stirring. A three-fold excess by weight of ROCSSK was used. If an excess of auric chloride is used or if the C<sub>2</sub>H<sub>5</sub>OCSSK is added to auric chloride there is more difficulty in obtaining a pure product. The oily gold alkylxanthate was filtered off, washed several times with water and ether leaving a yellow powder with a slightly fruity odor. The product was kept in amber bottles to prevent fading due to light. The compounds are insoluble in water and the common organic solvents. Yields are practically quantitative (97-98% of theoretical).

**Aliphatic Gold Thio Acids.**—The appropriate  $\alpha$ -halogen acids were used to prepare  $\alpha$ -thiol acids using the method of Billman<sup>3c</sup> as outlined in the previous series of reactions. Forty eight grams of  $\alpha$ -bromobutyric acid yielded 16 g. of  $\alpha$ -thiobutyric acid, b. p. 120-123° at 18 mm. (53% theoretical yield). The acid had a somewhat unpleasant odor and solidified after standing in the refrigerator a few hours.

To a 10% solution of  $\alpha$ -thiobutyric acid was added dropwise with constant stirring, a 10% solution of auric chloride, forming a light yellow flocculent precipitate,  $\alpha$ -gold thiobutyric acid. If an excess of auric chloride is added the precipitate becomes dark brown. The yellow precipitate was washed several times with water and dried. Yields are practically quantitative.  $\alpha$ -Gold thiobutyric acid forms a soluble sodium salt and an insoluble calcium salt. The acid is soluble in absolute ethyl, *n*-propyl, *i*-propyl, *n*-butyl, *i*-butyl and 95% ethyl alcohol; insoluble in ether, carbon tetrachloride, petroleum ether and carbon disulfide. At 100°, 0.055 g. dissolved in 100 ml. of water.

By a similar method starting with monochloroacetic acid,  $\alpha$ -thioglycolic acid was prepared with some of its salts. The potassium, ammonium and sodium salts of gold thioglycolic acid are soluble in water whereas the calcium and strontium salts are insoluble.

### Summary

1. The following organic gold compounds have been prepared: gold alkylxanthates, methyl, ethyl, *n*-propyl, *i*-propyl, *n*-butyl, *i*-butyl; strontium gold thioglycolate and  $\alpha$ -gold thiobutyric acid.

2. Some reactions and physical properties of these gold compounds are noted.

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