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Potassium Ethylxanthate as an Extractant

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NOTE

Potassium Ethylxanthate as an Extractant

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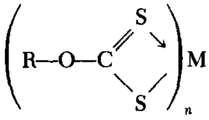
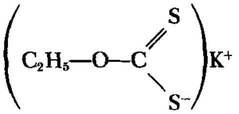
Xanthates, in general, react with metals to give extractable chelates of the type



$$\left(R{-}O{-}C\begin{matrix} {=}S \rightarrow \\ {-}S{-} \end{matrix} \right)_{n} M$$

Ethyl, isopropyl, isoamyl, and benzylxanthates have been used extensively as organic reagents, but ethylxanthates have been proved to be the most generally applicable.

Potassium ethylxanthate is a pale yellow crystalline solid,



$$\left(C_2H_5{-}O{-}C\begin{matrix} {=}S \\ {-}S^{-} \end{matrix} \right) K^{+}$$

soluble in both water and alcohol. It can be easily prepared by reaction of alcohol with carbon disulfide in alkaline medium (*1*). The solid and its solution should be stored in a stoppered bottle protected from the light. The reagent is commonly used as a 0.1% aqueous solution and should be prepared freshly before use.

Potassium ethylxanthate has been employed for the extraction of iron(III), cobalt(II), nickel, copper(II), vanadium(V), molybdenum(VI), uranium(VI), and also of arsenic(III), antimony(III),

TABLE 1

Summary of Extraction Data of Metals with Potassium Ethylxanthate

Metal	Extraction profile
As(III)	Extraction occurs from acid medium. Arsenic is isolated and determined in foods (2). Arsenic is also isolated from natural water; the method is applicable to silicates and biological materials (3). It is coprecipitated with $Fe(OH)_3$, digested with HNO_3, and extracted with xanthate in carbon tetrachloride. Applications are also found in the zinc and lead industries (*4*) and in the separation of As(III) from pyrites (5). Recent studies have shown quantitative extraction from 0.1 *N* HCl with potassium ethylxanthate-carbon tetrachloride (*6*).
Bi	A yellow precipitate is formed with the reagent at pH ~ 4 (*7*). A spectrophotometric method has been reported for mg amounts of Bi on the basis of its color reaction with potassium ethylxanthate in carbon tetrachloride. The bright yellow chelate solution in carbon tetrachloride follows Beer's law at 400 mμ over the range of 5 to 50 γ of Bi per ml. The optimum pH range is 1 to 4.6 for ≥ 98% extraction of Bi from an aqueous solution. The separation of Bi from As(III) is also described (*8*).
Co(II)	A dark green chelate with the reagent, formed at pH 4–9, can be extracted by carbon tetrachloride. Ni is coextracted but can be removed by scrubbing the organic layer with ammonia (*7*).
Cu(II)	The complex of Cu(II) with the reagent can be extracted at pH 7–8.5 by diethyl ether (*9*).
Fe(III)	A brown precipitate is formed with the reagent, extractable into chloroform. K_i (instability const.) = 4.36×10^{-9} (by Job's method) indicating high stability of the chelate system (*10*).
Mo(VI)	A method of separation of Mo(VI) from W(VI) consists of the extraction of Mo-xanthate from slightly acidic solution by chloroform, amyl alcohol, or other solvents (*11*). Separation from Re (*12*) and isolation from steel are reported (*13,14*).
Ni	At pH 4–7 a yellow-brown precipitate is formed which is extractable into chloroform (*7*). The reagent (in alcohol) can be used for the spectrophotometric determination of Ni at 428 and 465 mμ. Beer's law is obeyed for 5 to 50 γ Ni/ml (*15*).
Sb(III)	Extraction occurs from acid medium into carbon tetrachloride (2). Quantitative extraction is carried out from 2 *N* HCl by potassium ethylxanthate–carbon tetrachloride (*16*).
U(VI)	The colored complex with the reagent is extractable into chloroform (*7*).
V(V)	A yellow chelate is formed in weakly acid medium, extractable into chloroform or carbon tetrachloride and measured at 375 mμ (*17*).

and bismuth. A survey of the extraction data is given in Table 1, which covers the literature reports up to early 1967.

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