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DETECTION OF G AGENTS

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The invention described herein may be manufactured and used by or for the Government of the United States

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ethylamino) benzophenone oxime, which we designate EMK-O, respectively. Of these EMK-O appears to be the most sensitive and constitutes our presently preferred species.

The preferred activating agents are metallic cyanides, sodium cyanide being preferred. Other cyanides that have been used successfully are mercuric cyanide, potassium cyanide, silver cyanide and cadmium cyanide. The oxime and cyanide may be mixed in the dry state in about equal proportions and exposed to air suspected of containing vapors of the G agents.

Table I shows the characteristic color produced by different combinations of oxime, cyanide and G agent in spot tests using the liquid G agent and on exposure to very dilute concentrations of vapors, 44 gamma (micrograms) per liter of air.

Table I

Oxime	Cyanide	G Agent	Color Spot Test	Color Dilute Vapors
EMK-O	none	GA	red	red.
	do.	GB	none	none.
	sodium	GA	red orange	orange or red.
	do.	GB	do.	pink in one second, orange on longer exposure, orange or red, reddish orange.
MMK-O	potassium	GA	light orange	
	do.	GB	red orange	
	mercuric	GA	purple	
	silver	GA	red purple	
4-Dimethylamino-benzaldehyde	cadmium	GA	red orange	
	none	GA	red	red.
	sodium	GA	red orange	red orange.
	sodium	GB	slightly yellow	
4-Dimethylamino-acetophenone oxime	do.	GB	none	
	sodium	GA	slightly yellow	
	do.	GB	yellow	
	sodium	GA	orange	
4-Dimethylamino-benzophenone oxime	do.	GB	do.	
	sodium	GA	do.	
	do.	GB	do.	
	sodium	GA	dark red	
4,4'-Tetramethyldiamino benzil monoxime	do.	GB	do.	
	sodium	GA	do.	
	do.	GB	do.	
	sodium	GA	do.	

of America for governmental purposes without the payment to us of any royalty thereon.

This invention is directed to the detection of toxic chemical warfare agents of the class known as "G agents." Important members of this class are GB or sarin (isopropyl methylphosphonofluoridate), GA or tabun (ethyl dimethylphosphoroamidocyanidate), GD (pinacolyl methylphosphonofluoridate), and GF (cyclohexyl methylphosphonofluoridate).

Our method consists in contacting a fluid suspected of containing the agent with oximes of certain aromatic ketones containing at least one paradialkylamine substituent. These reagents show several important characteristics as detecting agents. When used alone, some of them show a color change with GA, but not with the other G agents listed above. With certain additives, however, they respond to the other agents as well. Thus, they may be used to distinguish between the phosphoroamidocyanidate, GA, and the phosphonofluoridates GB, GD and GF. Others give color reactions only in the presence of the additives, even with GA.

The compounds which we find most effective, and which give the reaction with GA in the absence of additives, are the oximes of Michler's ketone and its ethyl homologue, i.e., 4,4'-bis(dimethylamino) benzophenone oxime, which we designate MMK-O, and 4,4'-bis (di-

The oximes of 4-dimethylaminobenzaldehyde and 4-dimethylaminoacetophenone did not give a sufficiently positive color change to be satisfactory for our purposes. The remaining compounds listed in the table are satisfactory, EMK-O and MMK-O being preferred, and EMK-O being presently regarded as the best.

The sensitivity of colorimetric detectors for chemical warfare agents is commonly expressed in terms of "CT value," i.e., the product of the concentration (C) of the agent in the air expressed in gamma (micrograms) per liter of air multiplied by the time (T) in minutes to produce the change in color. The CT value for the blend of EMK-O with sodium cyanide was less than 1 gamma minute per liter, which is a very low value, indicating very high sensitivity.

The oxime detecting compositions may be utilized in the form of crayons. A typical crayon formulation is:

Component	Percent
Blanc fixe (barium sulfate)	80
EMK-O	10
Sodium Cyanide	10

This mixture is compressed under high pressure into a stick. It has rather poor marking characteristics, but

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the mark on a wall, for instance, is extremely sensitive, having a CT value for GB of less than 1 gamma minute per liter.

We claim:

1. A method for the detection of the presence in a fluid of a compound selected from the class consisting of ethyl dimethylphosphoroamidocyanidate, isopropyl methylphosphonofluoridate, pinacolyl methylphosphonofluoridate and cyclohexyl methylphosphonofluoridate, which comprises contacting said fluid with a compound selected from the class consisting of 4,4'-bis (dimethylamino) benzophenone oxime, 4,4'-bis (diethylamino) benzophenone oxime, 4-dimethylamino-4'-nitrobenzophenone oxime and 4,4'-tetramethyl diaminobenzil monoxime in admixture with a compound selected from the class consisting of sodium cyanide, potassium cyanide, mercuric cyanide and silver cyanide.

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2. A method for detecting the presence of ethyl dimethylphosphoroamidocyanidate in a fluid which comprises contacting said fluid with a compound selected from the class consisting of 4,4'-bis (dimethylamino) benzophenone oxime and 4,4'-bis (diethylamino) benzophenone oxime.

3. A crayon for use in the detection of G agents comprising a compressed stick consisting essentially of a mixture of about 80 percent blanc fixe, 10 percent sodium cyanide and 10 percent 4,4'-bis (diethylamino) benzophenone oxime.

References Cited in the file of this patent

- Young et al.: "Anal. Chem." 30, 1236-39 (1958).
Cherry et al.: "Anal. Chem." 30, 1239-47 (1958).