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METHENAMINE AS A QUALITATIVE REAGENT.*

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The use of methenamine in sulfuric acid for color reactions has been limited to tests for hordenin (1), opium alkaloids (2) and antipyrin (3). Because it yields brilliant colors with these compounds, it was thought to be of interest to test its applicability and reliability in connection with other compounds. This was done and, whereas the list of compounds giving colors with the reagent can easily be extended, enough were tested to show the formation of a variety of colors and to show the possibility of confusion of one compound with another, especially in toxicological analyses. For example, each color given by the several alkaloids is duplicated by some totally unrelated compound. Therefore, color reactions, if limited to a single test for the purpose of identification, may lead to error. However, when the material is carried through the proper methods of separation, then color tests are of great value, especially when identity is confirmed by other chemical and physiological properties.

Since methenamine is used in medicine and in certain embalming fluids, or it may be formed in the cadaver from embalming fluids containing formaldehyde or trioxymethylene and ammonia resulting from putrefaction, it is obvious that materials separated in toxicological analysis and treated with concentrated sulfuric acid can give apparent tests for alkaloids (4).

In the following tests we have used a more diluted reagent than recommended by the earlier investigators. We dissolved 0.1 Gm. in 80 cc. concentrated sulfuric acid in the cold. To a few mg. of the substance to be tested and contained in a vial, 2-3 cc. of the reagent were added. With many compounds colors are produced immediately; many colors deepen on standing. Since time, concentration and temperature can vary the colors, the shade of color reported may vary with repetition of the test. For certainty of identity of unknowns, a check on pure suspected compounds should be made.

ALKALOIDS AND OTHER COMPOUNDS.¹

The colors observed on using the indicated reagent are described as follows:

Colorless: brucine, caffeine, cocaine, conine, duboisine, physostigmine, pilocarpine, sparteine, strychnine, theobromine, tropacocaine (alypin, anesthesin, antipyrin, barbitol, beta-eucaine, butyn, cadaverine, cumarin, exalgine, holocain, procaine, stovaine, sulfonal, trional, tutocaine, uric acid). *Colorless, yellow*: aconitine, atropine, cinchonine, cinchonidine, daturine,

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¹ Compounds in parenthesis are non-alkaloidal compounds matching the colors of the indicated alkaloids. The use of the comma between colors means *changing to*.

hyoscine, quinidine, quinine (allonal, acetanilide, 2,4-dinitrophenol). *Colorless, red or violet:* gelseminine, hydrastine, hyoscyamine, narcotine (phenacetin). *Yellow:* cephaeline, hydrastine, nicotine, stypticin (apothan, cinchopen, edinol, numoquin, papain). *Yellow, orange or red:* agaricine, colchicine, emetine, pelletterine, solanine (*o*-nitrophenol, orcinol, phlorglucinol, resorcinol). *Colorless or yellow, dark brownish red or black:* apocodeine, aspidospermine, berberine, cannabine, chelidonine, codeine, delphine, dionin, heroin, homatropine, narceine, sanguinarine (agaricin, capsicin, elasterin, podophyllotoxin, santonin, styptol, thiophenol, tyrosine). *Purple, black:* apomorphine. *Blue, purplish red:* boldine. *Purple, indigo:* morphine. *Yellow, deep purple:* veratrine. *Rose, black:* yohimbine.

OTHER MEDICINALS.

Green darkening on standing: methargyl. *Pink, red, brownish red:* apothesine. *Violet, purplish black:* eikonogen. *Pink, carmine:* aspirin. *Orange red, carmine:* phenolphthalein. *Yellowish green, dark greenish yellow, finally olive-green:* gallic acid. *Greenish yellow, red brown:* vanillin. *Permanganate red:* veratrole. *Brownish red, purplish black:* guaiacol. *Brownish yellow deepening on standing:* thymol. *Cherry-red, deepening on standing:* carvacrol, salol. *Deep purplish red:* catechol. *Cherry-red:* phenol, phenetole. *Deep cherry-red:* *o*-cresol, *m*-cresol, eugenol. *Violet brown, deep purplish blue:* beechwood creosote. *Brownish red:* anisole, *p*-cresol, diresorcinol, pyrogallol.

PHENOLS, THEIR DERIVATIVES AND OTHER COMPOUNDS.

Colorless, developing turbidity: *p*-hydroxybenzoic acid. *Greenish yellow, yellow:* 3,5-dinitro-*o*-cresol, 8-hydroxyquinoline. *Turbid light pink, cloudy violet:* 2,4-dichlorophenol. *Light green, greenish yellow:* *m*-hydroxybenzoic acid. *Carmine, pink, colorless, turbid:* *o*-hydroxybenzoic acid. *Grass green, dark olive green:* 2-hydroxy-3-naphthoic acid. *Brownish black:* quinol, alpha-naphthol. *Deep reddish brown:* tricresol, isoeugenol, nitroso-beta-naphthol, apiol. *Deep brownish red:* *o*-cresylacetate, eugenolmethylether. *Reddish brown:* alizarin, cuminol. *Violet black:* *o*-hydroxydiphenyl. *Greenish black:* beta-naphthol.

SUMMARY.

Manseau's reagent is very useful in testing for alkaloids, medicinals and other compounds. For toxicological purposes its use may lead to fallacies. Many closely related compounds, for example, the hydroxybenzoic acids, the cresols, etc., can be differentiated.

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- (3) Mannich, *Arch. Pharm.*, 250, 647 (1912); *Apoth. Ztg.*, 27, 535 (1912). Antipyrin gives a white precipitate.
- (4) For a court case in which strychnine and codeine with embalming fluid were confused, see *J. Chem. Education*, 7, 559 (1930).

CHRISTOPHER KILMER MARRIES.

Christopher Kilmer, son of Joyce Kilmer, the poet, famous as the author of "Trees," and grandson of Dr. Frederick B. Kilmer, member of the A. P. H. A., was married on July 29th to Miss Alberta Taylor Daniel, of Arlington County, Virginia.