TABLE I.—(*Continued from page 575*).

Hyoscyamine	"	"		Evap. to dryness	93.04
"	"	"		Heated 30 min. after evap'n.	92.29
"	"	"		Heated 60 min. after evap'n.	87.60
"	"	"		Heated 120 min. after evap'n.	83.45
Atropine	"	"	Dry**	Evap. to dryness	93.01
"	"	"	"	Heated 30 min. after evap'n.	93.00
"	"	"	"	Heated 180 min. after evap'n.	83.09
Hyoscyamine	"	"	"	Evap. to dryness	97.39
"	"	"	"	Heated 30 min. after evap'n.	94.38
"	"	"	"	Heated 60 min. after evap'n.	91.92
"	"	"	"	Heated 120 min. after evap'n.	90.22

* Calculations based on largest amount returned (0.03127 Gm.) as 100%.

** Dried over calcium chloride.

SUMMARY AND CONCLUSIONS.

1. Hyoscyamine and atropine are more stable in ether than in chloroform solutions.

2. Continued heating of these alkaloids on a water-bath causes their partial disappearance. This confirms the work of Schaller and Baldinger, Ewe and Scoville.

3. The results obtained show that heat is definitely a factor in the disappearance of the alkaloids from their ether solutions.

4. When chloroform is used as the solvent, some other form of destruction must also occur, as the dried chloroform gives higher results than the U. S. P. grade.

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DIAZO COLOR REACTIONS.*

BY KIRBY E. JACKSON AND WILLIAM M. DEHN.

This reaction, commonly named Ehrlich's diazo reaction, has been used to detect bile pigments in blood or in urine; also, ureoresin, urochromogen (1) and an unknown compound found in urine in cases of typhoid and measles (2). It is known that administered alcohol (3), phenols and opium bases (4) and other drugs (5) give positive Ehrlich's test with urine. It seemed important to investigate a range of other medicinals to ascertain possible fallacies when this test is applied for clinical purposes.

* From the Chemistry Laboratory, University of Washington.

The compounds to be tested, in mg. quantities, were placed in small beakers with 5 cc. of water, a few drops of acetic acid and small squares of silk cloth. A few drops of 10% sodium *nitrite* solution were added and the developed colors were read. Next ammonia was added to make alkaline solutions and these mixtures were boiled for three minutes; the developed colors were read. Finally the silk was removed, washed with water and pasted on cardboard, so that these colors could be read and preserved. The colors developed on silk gave variety and permanent records for comparisons.

In the paragraphs of the following table, the first reading is the color in acetic acid solution; the second, in ammoniacal solution; the third, on silk.

TABLE.

Colorless. Colorless. Colorless. Acetanilid, aconitine, agaricin, allonal, alypin, apothesine, aspirin, stophan, atropine, barbital, beta-eucaine, caffeine, chloral hydrate, cinchonine, cinchophen, cumarin, cuminol, exalgin, gelseminine, geraniol, homatropine, neocinchophen, numoquin, alpha-picoline, phenacetin, quinine, saccharine (6), stovaine, sugars (simple), strychnine, sulfonal, trional, tropocaine, urotropin.

Colorless. Colorless. Ivory or buff. Amygdalin, cadaverine, convallarin, elaterin, holocaine, hyoscyamine, papain, phenolphthalein, picrotoxin, quinaldine, salol, santonin, sapotoxin.

Colorless. Yellow. Ivory or buff. Anisole, convallamarin, digitalin, podophyllotoxin, salicin, saponin, salicylic acid, tannic acid, vanillin, veratrole.

Colorless. Yellow or orange. Yellow or yellow orange. Anesthesin, butyn, ethyl acetoacetate, procaine, tutocaine. *Colorless. Yellow. Colorless.* Isatin, thymol (7). *Colorless. Red. Orange-red.* Alpha-naphthylamine. *Colorless. Orange. Light brown.* Phenylhydrazine.

Yellow or orange. Yellow or orange. Buff, yellow, brown, orange. Aniline, *o*-anisidine, apomorphine, arbutin, benzidine, catechol, colchicine, *m*-cresol, *o*-cresol, *p*-cresol, eugenol, guaiacol alpha-naphthol, beta-naphthol (8), nicotine, nux vomica, phenetole, phenol (9), phloridzin (10), pyridine, pyrogallol, quinol, resorcinal (7). *Brown. Brown. Brown.* Beechwood creosote, phlorglucinol. *Orange. Green. Green.* Methylethylaniline, propylaniline. *Yellow. Red. Gray-ivory, orange or red.* Gallic acid, morphine, beta-naphthylamine. *Blue. Blue. Orange-yellow.* Antipyrine (11). *Blue. Blue. Black.* Methylargyl. *Green. Yellow. Buff.* Strophanthin. *Pink. Red. Violet-red.* Aloin. *Brown. Green. Green.* Dimethylaniline. *Red. Orange. Gray-ivory.* Diphenylhydrazine. *Orange. Brown. Gray-ivory.* Diresorcinol. *Colorless. Rose Buff.* Isoquinoline.

SUMMARY.

Diazo color reactions are very useful for identifying many compounds. Its use, for a single compound, may lead to fallacy, because many other compounds may give the same colors. Its use for detection of pathological components of urine is rendered unreliable when certain drugs have been administered. The use of silk to fix colors renders the use of the diazo reaction more accurate because the color can be kept as a permanent record.

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METHENAMINE AS A QUALITATIVE REAGENT.*

BY KIRBY E. JACKSON AND WILLIAM M. DEHN.

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, coniine, 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,

* From the Chemistry Laboratory, University of Washington.

[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*.