Field Screening Test for Lysergic Acid Diethylamide

By JAMES LOOK

A rapid and sensitive field screening test for lysergic acid diethylamide (LSD), which requires little manipulation and equipment, is described. The method is only a presumptive test, and the sample must be taken back to the laboratory for confirmatory tests. (The method is also applicable as a screening test for other psychotomimetic drugs such as dimethyltryptamine, diethyltryptamine, bufotenin, serotonin, and psilocybin.)

THE CLASSICAL Van Urk test is specific for α- or β-unsubstituted indoles (1). In the presence of strong acid these indoles condense with *p*-dimethylaminobenzaldehyde to form colorless, violet-red, and blue compounds, the relative amounts depending on the concentration of reagents and the presence or absence of oxidizing agents (1–6).

This procedure has been modified to provide a sensitive rapid field screening test for LSD which requires no oxidizing agent other than air. In addition, several observations have been made which support the reaction scheme and structures previously proposed by other workers (2–4).

PROCEDURE

Reagents—Filter paper (*e.g.*, Whatman No. 1) saturated with a solution of 2% *p*-dimethylaminobenzaldehyde in 95% alcohol, then air-dried, cut into strips, and stored in a tightly capped amber glass bottle.

Screening Test—The amount of LSD found in a dosage form usually varies from 75 to 250 mcg. A quantity equivalent to one-tenth of the dosage gives a strong, rapid test.

Macerate a portion of the sample with sufficient alcohol to provide some liquid extract. Keep the volume of the liquid extract to a minimum in order to keep the presumed concentration of LSD high. Transfer the extract to a strip of the prepared filter paper and allow the alcohol to evaporate. Add 1 drop of concentrated hydrochloric acid and let the paper stand, supporting it in such a way that the acidified spot does not touch any surface. A violet-red or violet-blue spot develops if LSD or other psychotomimetic agents of indole derivatives are present; the color slowly diffuses to the edge of the spot to form a colored ring.

The test can be applied directly by placing a portion of the crushed suspected material directly on the prepared paper and then adding a drop of concentrated hydrochloric acid. A violet-red or violet-blue color will develop if LSD or other psychotomimetic indole derivative is present, but the color may or may not edge out to form a ring.

The test can be applied to aqueous solutions if several mcg. of LSD is present in a few drops of the solution. Apply a few drops of the liquid to the filter paper, let it air-dry, and proceed as above. The reaction occurs slowly if the paper is not allowed to dry thoroughly before the hydrochloric acid is added. If the suspected material is in a dilute aqueous solution, make a portion alkaline with a drop or two of concentrated ammonium hydroxide. Add 1–3 ml. chloroform (or enough to provide some liquid extract without greatly lowering the LSD concentration) and shake well in a stoppered vial. Place a tight wad of cotton on the mouth of the vial, quickly invert it, and let the chloroform extract settle into the cotton. Place a few drops of the chloroform extract on a piece of the prepared filter paper, let the paper dry, and add a drop of concentrated hydrochloric acid to the spot.

DISCUSSION

Screening Test—This test as given in the procedure is convenient, requires little equipment, is completed in a few minutes, and is sensitive to as little as 1 mcg. LSD. The *p*-dimethylaminobenzaldehyde-saturated paper is stable for several months.

Concentrated hydrochloric acid is found to give a rapid test and a clearly defined ring. However, 1:1 hydrochloric acid solutions in water or alcohol are also satisfactory developing agents. More dilute acid solutions are unsatisfactory. When they are used, the reaction is very slow, and the color remains diffused throughout the spot rather than migrating and concentrating on the edge of the spot to form a ring.

The color changes observed in the usual air atmosphere depend on which reagent is present in excess (Scheme I). Usually, *p*-dimethylaminobenzaldehyde is in excess and in less than 1 min. a violet-red or violet-blue color develops; however, on standing, the initially formed ring loses its violet tinge and the color becomes less intense but bluer; then it gradually fades through a series of color changes: pale blue, pale blue-gray, and pale green. Another drop of hydrochloric acid regenerates the violet-blue color; upon standing, this fades again through the same sequence of colors. This observation is consistent with the expected dependence of acid concentration on the interconversion of IV and V. The color can be restored many times by the addition of more acid, but it is fainter each time. The color changing phenomena observed depend on the concentration of LSD, proportion of reagents, temperature, and other variables.

Since positive tests are obtained for any compound containing an indole ring with an open α or β position, any positive results should be tested for possible confirmation in the laboratory by thin-layer (7–9) or paper (10) chromatography or by ultraviolet and infrared spectrophotometry.

Chemistry of the Test—The reaction scheme and color assignments given in Scheme I have been generally agreed upon by previous workers (2–4), and we have made certain qualitative observations with lysergic acid which support the reaction sequence. In the first step of the scheme, the reagents condense in a 1:1 mole ratio to form a base

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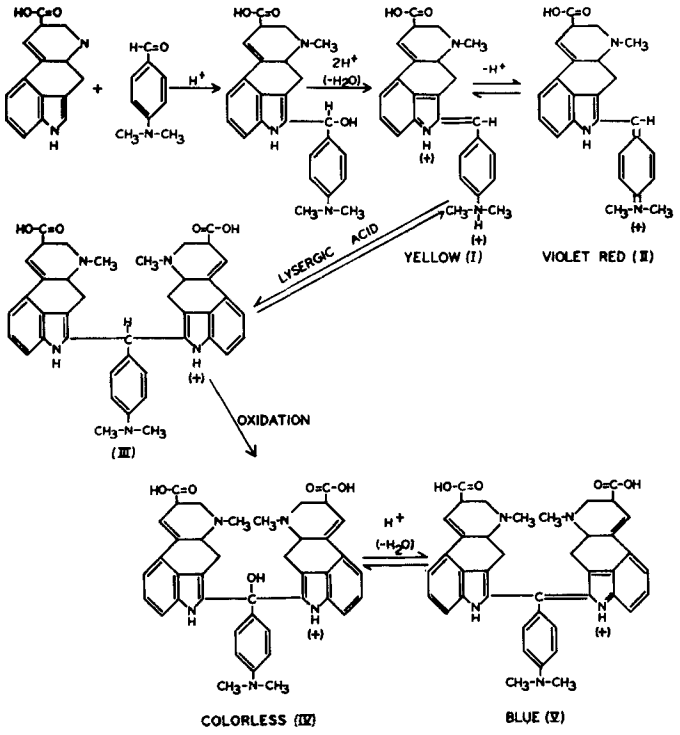

Scheme I

which has a protonated yellow form (I) and a violet form (II). If excess lysergic acid is present, further condensation occurs to give III which is colorless. However, III is oxidized very readily to yield IV (colorless) or its ionic form (V) (intense blue) depending on acid concentration.

Under a helium atmosphere (nonoxidative conditions), the following observations were made.

(*a*) In the presence of excess *p*-dimethylaminobenzaldehyde, a strong violet color is instantly obtained, which is in accord with the expected formation of II under these conditions.

(*b*) With excess lysergic acid, the reaction mixture is initially colorless but slowly turns slightly violet, which supports the postulated predominant formation of III under these conditions.

(*c*) The observed colors are consistent with the proposal that regardless of which reagent is present in excess, compound II is formed and not V. The formation of II is rapid with an excess of aldehyde and slow with an excess of lysergic acid.

On addition of NH_4OH to compounds II and V, the intense colors disappear. These colors can be restored by adding excess concentrated HCl to the compounds.

Interferences—In the present procedure, any α- or β-unsubstituted indole gives a color reaction. The psychotomimetic drugs dimethyltryptamine, diethyltryptamine, bufotenin, serotonin, and psilocybin also give a color reaction, but the color which develops is more red than violet-red or violet-blue. Experience with this test procedure allows one to tentatively distinguish these compounds from LSD.

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