Training Procedure for Preliminary Color Tests

1.0 Purpose – A chemical color test is a preliminary screening test in which a sample of an unknown substance is added to a chemical reagent in order to produce a color change. The color change that occurs is indicative of a class or type of drug that may or may not be present. Knowledge of the structure of controlled substances can often be used to predict the results of color tests. In this section, the trainee will learn how color test reagents are used to classify and narrow the possible controlled substances present in forensic drug samples.

2.0 Scope - This procedure applies to trainees in the Drug Chemistry Sections of the State Crime Laboratory.

3.0 Definitions – N/A

4.0 Procedure

4.1 Objectives

4.1.1 Review the Drug Chemistry Technical Procedure for Preliminary Color Tests and the Drug Chemistry Technical Procedure for Drug Analysis as it pertains to preliminary color tests.

4.1.2 Review the lab-wide Procedure for the Use of Forensic Advantage (FA) and complete an overview ofFA) with an FA administrator within the drug chemistry section. This will include (but is not limited to) case submission details, data entry, and drug chemistry worksheet information.

4.1.3 Be able to document a newly prepared reagent and perform quality control procedures as listed in the Drug Chemistry Administrative Policy for Quality Assurance. Documentation will be performed in the resource manager portion of FA.

4.1.4 Be able to presumptively identify/classify what controlled/non-controlled substances may be present based on the results of performing the color tests.

4.1.5 Successfully complete a practice exercise (separately given in handout) and a written exam.

4.2 Study Questions

4.2.1 Define the term reagent.

4.2.2 What comprises a positive reaction for the Marquis reagent? What type of reaction is occurring here?

4.2.3 For the sulfuric acid based reagents, how does the forensic scientist know that the color change is not due to dyes? For liquid submissions, how does the forensic scientist know that the color change is not due to solvent interaction?

4.2.4 What functional group is generally associated with the Cobalt Thiocyanate reagent turning blue?

4.2.5 Why do cocaine base and cocaine hydrochloride react to the Cobalt Thiocyanate reagent with different intensities?

4.2.6 What types of compounds give a positive reaction to pDMAB? Give some examples.

4.2.7 The Koppanyi and the Zwikker reagent generally test for what class of drugs?

4.2.8 The Duquenois-Levine reagent is used to test for what type of substance?

4.2.9 What causes the color change in the Duquenois-Levine reagent?

4.2.10 Are there any other substances (not controlled by CSA) that cause a positive reaction with the Duquenois-Levine reagent?

4.2.11 Explain why a color test cannot be used to identify a substance definitively.

4.2.12 How can you ensure that a color test reagent is actually working since some substances do not cause a color change? How does a Forensic Scientist avoid false positives and false negatives?

4.2.13 Why should unknowns be added in very small amounts (ex: what would happen if potassium cyanide was added to the spot well with Marquis Reagent?

4.2.14 How are primary and secondary reference materials obtained and documented for casework comparison purposes?

4.3 Practical/Laboratory Exercises

4.3.1 Prepare, label and properly document the following color test reagents: (See the Drug Chemistry Administrative Policy for Quality Assurance for assistance.)

- Marquis (Mecke and Froehde optional)
- Cobalt thiocyanate
- Secondary amine
- Koppanyi
- Zwikker
- p-Dimethylaminobenzaldehyde (PDMAB)
- Ferric Chloride
- Duqenois-Levine
- Liebermann's
- Chen-Kao

4.3.2 Test a set of known training standards provided to you by the Drug Chemistry Training Coordinator or designee and record the results. (Availability of standards may necessitate substitution of alternate substances. This is just a general guideline of common substances and subsequent presumptive testing.)
(**Note:** Standards listed for testing with the Marquis reagent should be also be tested with concentrated sulfuric acid so the Forensic Scientist Trainee can see how a strong acid may react with these compounds. Also, if not noted specifically, please test compounds

with both secondary amine #1 and #2)

4.3.2.1 Standard	Preliminary Color Test
Amphetamine HCl	Marquis, cobalt, secondary amine, Chen-Kao
Methamphetamine HCl	Marquis, cobalt, secondary amine, Chen-Kao
Dimethylsulfone ($DMSO_2$)	Marquis, cobalt
Phentermine	Marquis, cobalt, secondary amine, Chen-Kao
Pseudoephedrine HCl	Marquis, cobalt, Chen-Kao
Aspirin	Marquis, cobalt
Cocaine HCl	Marquis, cobalt, PDMAB, secondary amine #1
Cocaine base	Marquis, cobalt, PDMAB, secondary amine #1
Diphenhydramine	Marquis, cobalt
Fentanyl (or derivative of)	Marquis, secondary amine #1
Guaifenesin	Marquis, cobalt
Heroin base	Marquis, cobalt, secondary amine #1
Morphine base	Marquis, cobalt, secondary amine #1
Methadone HCl	Marquis, cobalt, secondary amine #1
MDA	Marquis, cobalt, secondary amine, Chen-Kao
MDMA	Marquis, cobalt, secondary amine, Chen-Kao
Inositol	Marquis, cobalt
Mannitol	Marquis, cobalt
Sodium bicarbonate	Marquis, cobalt
Toluene	Marquis, cobalt
GBL (if available)	Ferric Chloride, cobalt
GHB	Ferric Chloride, cobalt
BZP	Marquis, cobalt, secondary amine #1
TFMPP	Marquis, cobalt, secondary amine #1
Benzocaine	Marquis, cobalt, PDMAB, secondary amine #1
Lidocaine HCl	Marquis, cobalt, PDMAB
Procaine HCl	Marquis, cobalt, PDMAB
LSD	PDMAB, check for fluorescence with long wave UV light
LAMPA	PDMAB
Amobarbital	Marquis, Zwikker, Koppanyi
Pentobarbital	Marquis, Zwikker, Koppanyi
Secobarbital	Marquis, Zwikker, Koppanyi
Hashish	Duquenois-Levine, Liebermanns
Marijuana	Duquenois-Levine, Liebermanns
Patchouli oil	Duquenois-Levine, Liebermanns
Tobacco	Duquenois-Levine, Liebermanns
Synthetic cannabinoid (if available)	Duquenois-Levine, Liebermanns
3,4-Methylenedioxypyrovalerone (MDPV)	Marquis, Liebermanns, Chen-Kao
Cathinone (or substituted)	Marquis, secondary amine, Liebermanns, Chen-Kao

4.3.3 Be able to give an oral explanation of color testing in a manner that would be applicable to a jury trial.

5.0 Required Reading

O'Neal, C. L. et al. "Validation of twelve chemical spot tests for the detection of drugs of abuse." *Forensic Science International*, 109 (2000): 189-201.

Toole, K.E. et al. "Color Tests for the Preliminary Identification of Methcathinone and Analogues of Methcathinone." *Microgram Journal*, Volume 9, Number 1 (Jan. 1999): 27-32.

Tsumura, Y. et al. "False positives and false negatives with a cocaine-specific field test and modification of test protocol to reduce false decision." *Forensic Science International*, 155 (2005): 158-164.

6.0 References

Clarke, E.G.C. *Isolation and Identification of Drugs*. London: The Pharmaceutical Press, 1969.

M. Windholz, ed. *The Merck Index*. 9th Ed. Rahway: Merck & Co., 1976.

O'Neal, C. L. et al. "Validation of twelve chemical spot tests for the detection of drugs of abuse." *Forensic Science International*, 109 (2000): 189-201.

Pitt, Coltin G. *Investigation of problems Involving Chemical Analysis of The Duquenois Levine Color Reaction.* Research Triangle Institute: RTI Project 31U-628. November 1971.

Poyner, B. et al. "Presumptive Color Test for Synthetic Cannabinoids Containing an Indole Substructure." *Journal of the Clandestine Laboratory Investigating Chemists Association*. Volume 22 Number 4 (Oct. 2012): 27-31.

Toole, K.E. et al. "Color Tests for the Preliminary Identification of Methcathinone and Analogues of Methcathinone." *Microgram Journal*, Volume 9, Number 1 (Jan. 1999): 27-32.

Tsumura, Y. et al. "False positives and false negatives with a cocaine-specific field test and modification of test protocol to reduce false decision." *Forensic Science International*, 155 (2005): 158-164.

7.0 Records

- Drug Chemistry Training Checklist
- Section Completion Summary

8.0 Attachments - N/A

Revision History		
Effective Date	Version Number	Reason
09/17/2012	1	Original Document
05/03/2013	2	**Scope** – Reworded to match other ISO documents. **4.1.1** – Preliminary added to technical procedure name; added Drug Chemistry Technical Procedure for Drug Analysis, as it pertains to preliminary color tests. **4.1.2** – Name of Administrative Policy for Quality Assurance updated. **4.3.1** – Name of Administrative Policy for Quality Assurance updated. Bullet list – (Mecke and Froehde optional) added with Marquis. Added Ferric Chloride and Liebermann's to list. **4.3.2** – Added (Availability of standards may necessitate substitution of alternate substances.) Added note reference use of

		sulfuric acid for standards tested with Marquis reagent. **4.3.2.1** bullet list – Added GHB and GBL with Ferric Chloride and cobalt tests, added Liebermann's to Synthetic cannabinoid, and added MDPV with Liebermann's. Added check for fluorescence with long wave UV light to LSD. **References** – Added Poyner and Toole references for Liebermann's Reagent.
12/06/2013	3	Added issuing authority to header
10/19/2015	4	**Header –** Revised issuing authority **4.1.3** – Added new objective reference primary and secondary standards **4.2.3** – Added new study question reference sulfuric acid based reagents and dyes **4.2.11, 4.2.13** – Edited study questions **4.2.19** – Added study question reference primary and secondary reference standards. **Required Reading** – Added new section **References** – Added additional references
08/30/2016	5	**4.2.7** – updated coloring to yellow **4.2.10 –** fix typo
08/17/2018	6	**4.1.2 –** added objective; objective numbers changed **4.1.3, 4.1.5, 4.1.6** – updated wording **4.1.4 -** removed **4.2** – updated study questions **4.2.12, 4.2.14, 4.2.15** – removed these questions **4.3.1** – added Chen-Kao **4.3.2** – updated with new testing/wording **4.3.3** - added **7.0** – removed reagent log (paper copy)