

# Screening for Drug Residues with the Smiths Detection IONSCAN

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# Screening for Drug Residues with the Smiths Detection IONSCAN

## 1 INTRODUCTION

This procedure is used for items suspected of containing controlled substances that may not contain sufficient sample for analysis solely by GENCHEM-501.

## 2 SCOPE

Items are sampled for introduction to the IONSCAN instrument, which is programmed to detect the following substances:

- Acetylfentanyl
- Amphetamine
- Butyrylfentanyl
- Carfentanil
- Cocaine
- Fentanyl
- Furanylfentanyl
- Heroin
- Ketamine
- 3,4-Methylenedioxymethamphetamine (MDMA)
- Methamphetamine
- Methylfentanyl [e.g., (+ -)-cis-3-methyl Fentanyl; 4'-methyl Fentanyl]
- Delta-9-tetrahydrocannabinol ( $\Delta^9$ -THC)
- W-18

This procedure applies to Chemistry Unit (CU) personnel who are qualified and authorized to examine General Chemistry evidence by Ion Mobility Spectrometry (IMS).

## 3 EQUIPMENT

- General laboratory supplies
- IONSCAN 600 swabs (i.e., IMS swabs) (Smiths Detection, see Figure 1)
- IONSCAN Teflon filters (i.e., IMS filters) (Smiths Detection, see Figure 2)
- Toothpicks (wooden)
- Evaporator
- Acetonitrile
- Chloroform
- Methanol (MeOH)
- Verific Pen (Smiths Detection)
- IONSCAN 600 IMS (Smiths Detection)
- Reference material solutions of compounds indicated in Section 2 Scope (typically 50 or 100 ug/mL solutions; solvent is not critical as it is evaporated before analysis)

## 4 STANDARDS AND CONTROLS

### 4.1 Negative Control

A blank IMS swab is analyzed as a Negative Control prior to the analysis of sampled items. Additional Negative Control approaches are described in Section 6.

### 4.2 Daily Check

Prepared by evaporating  $\geq 50$  ng of cocaine, fentanyl, or methamphetamine (e.g., 1 uL of a 50 ug/mL methanol solution); or  $\geq 100$  ng of heroin (e.g., 1 uL of a 100 ug/mL methanol solution) onto the sampling area of an IMS swab. Other amounts may be used for the daily check, however use caution to not overload the IONSCAN as multiple cleaning cycles or a bakeout may be necessary.

### 4.3 Positive Controls

If an item alarms for a programmed substance, a Positive Control for that substance can be prepared by evaporating  $\geq 50$  ng of the substance onto an IMS swab (e.g., 1 uL of a 50 ug/mL methanol solution). Other amounts may be used for a Positive Control, however use caution to not overload the IONSCAN as multiple cleaning cycles or a bakeout may be necessary.

Note- Heroin has a higher limit of detection, aim for  $\geq 100$  ng on the IMS swab.

## 5 SAMPLING

Multiple items that are packaged together or otherwise in contact with each other will be sampled and analyzed as one collective item. Statistical sampling is performed according to GENCHEM-301.

## 6 PROCEDURE

### 6.1 Setup

- A. Typically the IONSCAN is powered off and unplugged when not in use.
- B. Plug the IONSCAN into the silver electrical outlet that is labeled "4U26 SEC 2 #77". Start the IONSCAN by touching the power button for several seconds (the button is touch sensitive, not pressure sensitive).
- C. Enter the IONSCAN login credentials via the touchscreen.
- D. Conduct a Manual Regeneration to clear out water and hydrocarbons from the molecular sieves if a Manual Regeneration has not been completed in the past 3 days.
  1. Enter the Maintenance menu via the touchscreen.
  2. Select "Manual Regeneration" and "Start". The regeneration process takes approximately 4.5 hrs.
- E. Optional Bakeout- if the IONSCAN requires multiple cleaning cycles to be ready for the next sample analysis, it may need to be baked out.
  1. Enter the Maintenance menu via the touchscreen.
  2. Select "Manual Bakeout" and "Start". The bakeout process takes approximately 4.5 hrs.

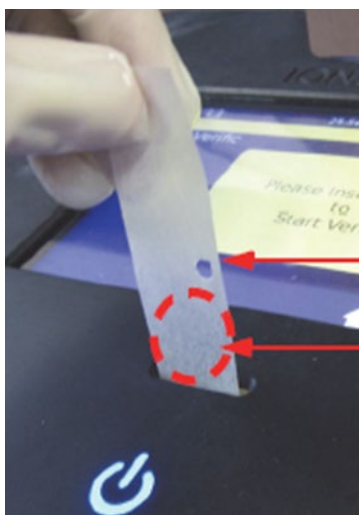
## 6.2 Sampling Area Preparation

Prior to the preparation of each Verification, Negative Control, evidentiary item, and/or Positive Control sample: clean the stainless steel table and any utensils that will be used with methanol, and place a new piece of craft paper down.

## 6.3 Verification

Perform an IONSCAN Verification.

- A. Apply a short, ~ 1 cm line of material from the Verific pen to the sample area of a new IMS swab (see Figure 1). Note- if the Verific pen did not apply material to the swab, prime the pen by pressing the tip to the backside of the pen cap.



**Figure 1:** The red dashed circle indicates the sample area of the IMS swab. Note- the sample area is only on one side of the swab as indicated by the rounded edges on the bottom and the hole oriented on the right side. This is also the proper orientation for inserting the swab into the IONSCAN (sample area facing the user).

- B. Allow the solvent to completely evaporate (~10 to 15 seconds) then insert the IMS swab into the IONSCAN.
- C. Print a copy of the successful Verification and place it in the IONSCAN binder (see Section 6.9). If the Verification was unsuccessful, follow the prompts on the touchscreen. If the Verification is unsuccessful after 3 attempts, run the Manual Regeneration and/or Manual Bakeout procedures (see Sections 6.1 D. and E.).

## 6.4 Daily Check

- A. Apply  $\geq 50$  ng of cocaine, fentanyl, or methamphetamine; or  $\geq 100$  ng of heroin to the sample area of an IMS swab. For example, apply 1  $\mu$ L of a 50  $\mu$ g/mL methanol solution to the sample area and allow the solvent to evaporate.
- B. Insert the IMS swab into the IONSCAN.
- C. The IONSCAN should ALARM for the applicable substance. Follow the touchscreen prompts. Print a copy of the successful ALARM response and place it in the IONSCAN binder (see Section 6.9).
- D. If the IONSCAN did not ALARM for the applicable substance, repeat the process. If the IONSCAN does not ALARM for the second sampling, run the Manual Regeneration and/or Manual Bakeout procedures (see Sections 6.1 D. and E.). Record the details and any procedures performed in the IONSCAN binder.

## 6.5 Visual Examination

Visually examine the item to be sampled for IONSCAN analysis, then proceed to the appropriate sampling method below. If unsure, start with the Toothpick Method (least sensitive) to avoid overloading the IONSCAN.

## 6.6 Sampling Technique

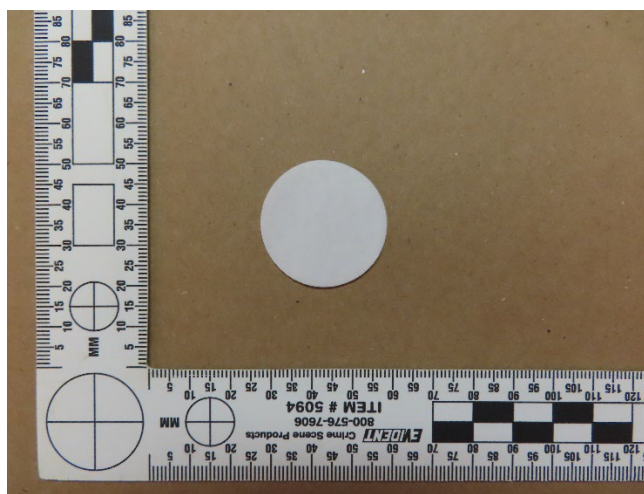
### 6.6.1 Toothpick Method

- A. Touch the tip of a toothpick to the sample area of a new IMS swab as a Negative Control and analyze the IMS swab. The IONSCAN should result in a PASS for the Negative Control. If the IONSCAN results in an ALARM, follow the prompts on the touchscreen and repeat the analysis for a new Negative Control when the IONSCAN is ready.
- B. Using the same toothpick, touch the tip to the portion of the item to be sampled, then scrape the tip of the toothpick to the sample area of a new IMS swab and analyze the IMS swab.

### 6.6.2 Teflon IMS Filter Method

Note- Volumes other than 5 uL can be used in steps 2 and 3 of C. below. The Negative Control volume should match that of the item extract. If in doubt, start with a lower volume and work up to 5 uL.

- A. Place a blank Teflon IMS filter in a labeled test tube as a Negative Control. One Negative Control IMS filter is sufficient if multiple items are sampled that day.



**Figure 2: Teflon IMS Filter**

- B. Directly sample the item(s) by rubbing with a Teflon IMS filter and place the Teflon IMS filter in a labeled test tube.

- C. Extract the Teflon IMS filters with ~1 mL methanol or other appropriate solvent (e.g., acetonitrile, chloroform). Transfer the extracts to new, labeled test tubes.
  1. Concentrate the extracts under N<sub>2</sub> (g) at ~60 °C.
  2. Transfer 5 uL of the Negative Control extract onto an IMS swab, allow it to completely evaporate, and analyze the IMS swab. The IONSCAN should result in a PASS for the Negative Control. If the IONSCAN results in an ALARM, follow the prompts on the touchscreen and repeat the analysis for a new Negative Control when the IONSCAN is ready.
  3. Transfer 5 uL of the item extract onto an IMS swab, allow it to completely evaporate, and analyze the IMS swab.

#### 6.6.3 Direct IMS Swab Method

- A. Analyze a blank IMS swab as a Negative Control. One Negative Control IMS swab is sufficient if multiple items are sampled that day. The IONSCAN should result in a PASS for the Negative Control. If the IONSCAN results in an ALARM, follow the prompts on the touchscreen and repeat the analysis for a new Negative Control when the IONSCAN is ready.
- B. Directly sample the item by rubbing with an IMS swab. Be sure to have the IMS swab correctly oriented (see Figure 1) and only move in one direction. Avoid bending or warping the swab.
- C. Analyze the IMS swab.

#### 6.6.4 Liquids (Rinses, Extracts, Dilutions)

Note- Volumes other than 5 uL can be used in B. and C. below. The Negative Control volume should match that of the item extract. If in doubt, start with a lower volume and work up to 5 uL.

- A. Prepare samples as described in GENCHEM-501.
- B. Transfer 5 uL of the Negative Control onto an IMS swab, allow it to completely evaporate, and analyze the IMS swab. The IONSCAN should result in a PASS for the Negative Control. If the IONSCAN results in an ALARM, follow the prompts on the touchscreen and repeat the analysis for a new Negative Control when the IONSCAN is ready.
- C. Transfer 5 uL of the item rinse/extract/dilution onto a new IMS swab, allow it to completely evaporate, and analyze the IMS swab.

### 6.7 IONSCAN Alarm

If the IONSCAN alarms for a substance, follow the touchscreen prompts. Analyze a blank IMS swab when the instrument indicates it is ready for a new sample. Introduction of a large amount of substance will require multiple, automatic cleaning cycles by the instrument.

### 6.8 Further Analysis

Samples are prepared (if necessary) and examined by one or more approaches described within GENCHEM-501 (typically GC/MS) to confirm any IONSCAN alarms and to test for controlled substances that the IONSCAN is not programmed to detect.

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## 6.9 Data Processing

- A. Open the “Detector Controller” software. If necessary, login to the software via File-Connect and choose “Connect to checked detectors”, then click “IS600” and enter the login information.
- B. Download plasmagrams by completing the appropriate fields under the “IS600”, “Plasma Download” tabs.
- C. Open each plasmagram via File-Open. If plasmagram labels appear to be cut-off in the window, manually click on the maximum value on the y-axis and enter a larger value to reach a desired format.
- D. Sample information, laboratory number, etc. can be added by editing the data file name and/or entering information in the “Sample ID” field under the “User Data” tab.
- E. The typical printout is achieved by checking the following boxes after choosing File-Print Plasmagram:

Print	
<input type="checkbox"/> Print Positive Plasmagram	<input type="checkbox"/> Print Comments
	<input type="checkbox"/> Print Channel List

Status	
<input type="checkbox"/> Print General Status	
<input type="checkbox"/> Print Sensor Status	

## 6.10 IONSCAN Shutdown

When analyses are complete, power the IONSCAN off by touching the power button for several seconds and then press “Shutdown” on the touchscreen. Unplug the electrical cord from the outlet.

## 7 INSTRUMENTAL CONDITIONS

The following instrumental conditions are the default IONSCAN settings and should not be adjusted.

Mode:	Narcotics
PositiveHV (Active):	2400 V
NegativeHV:	2400 V
Drift Tube Temperature:	170 °C
Inlet Temperature:	180 °C
Flash Heater Temperature:	130 °C
OVG 1 Temperature:	80 °C
OVG 2 Temperature:	50 °C
OVG 3 Temperature:	100 °C
OVG 4 Temperature:	90 °C
Collector Temperature:	170 °C
Tower 1 Temperature:	21 °C
Tower 2 Temperature:	24 °C
Front Temperature:	140 °C
Drift Flow:	200 cc/min
Absolute Pressure:	100 kPa
Heater Current:	2-5 A
OVG Current:	0.01 A

## 8 LIMITATIONS

IMS is a screening technique for the programmed substances listed in Section 2. The limit of detection for most compounds is approximately  $\leq 50$  ng. Heroin has a higher limit of detection of approximately  $\leq 100$  ng. The IMS response when analyzing mixtures is affected by the relative proton affinities and concentrations of the components in the mixture, which may impact the detection of programmed compounds.

Refer to GENCHEM-501 for limitations that apply to the analysis of drugs.

## 9 REVISION HISTORY

Revision	Issued	Changes
02	07/15/2024	Entire procedure was revised to address the new IMS instrument (IONSCAN 600) which changed the sample collection and sample introduction approaches.
03	11/01/2024	<ul style="list-style-type: none"><li>Added flexibility to section 4.2 regarding amount of substance to be evaporated</li><li>Added <math>\geq</math> symbol throughout sections 4.2, 4.3, 6.4</li><li>Fixed two typo instances (references to section 6.8 changed to section 6.9)</li></ul>