K10 Training in Gas Chromatography

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The participants will know the training program for gas chromatography in the Forensic Toxicology Laboratory, Office of the Medical Examiner, Cook County.

The Office of the Medical Examiner, Cook County hired recent college graduates as analysts in the forensic toxicology laboratory.

Training began with quantitation of drugs using gas chromatography (GC) with nitrogen phosphorus detector (NPD) and/or flame ionization detector (FID). Each trainee was assigned to his/her own Agilent 6890 GC. Each trainee was trained initially on either GC/NPD or GC/FID. Diphenhydramine, with dexbrompheniramine as the internal standard, was used for the GC/NPD training. Acetaminophen, with aprobarbital as the internal standard, was used for the GC/FID training.

Our program is as follows:

(1) Overview of the laboratory procedures including specimens accession, limited access storage areas, chain of evidence, case assignment, batch number system, standard/control, specimen extraction, GC analysis, result reporting and review.

(2) Operation of the Eppendorf pipets.

(3) Operation of the analytical balance.

(4) Calibration of the Eppendorf pipets.

(5) Explanation of the extraction theory, the extraction procedure and the internal standard method.

(6) Observation of the performance of a liquid/liquid extraction.

(7) Preparation of trainee's standard and control solutions.

(8) Operation of the pH meter.

(9) Preparation of trainee's buffer solution.

(10) Math test, which covered the dilutions and the arrival of extraction final concentrations.

(11) Supervised extraction of the compound of interest, with the trainee's standard and with the laboratory's standard, each in triplicate spiked in water.

(12) Explanation of the GC theory.

(13) Demonstration and practice of the GC turn on procedure, the GC performance check and the GC turn off procedure.

(14) Instruction and practice on the creation of a GC method.

(15) Instruction and practice on the preparation and running of a GC sequence, using the batch previously extracted in step 11.

(16) If good recovery and good reproducibility were achieved, the trainee would learn how to complete the paper work, otherwise, the process was repeated until satisfactory.

(17) Trainee was required to duplicate the good recovery and good reproducibility from a second batch of step 11, with minimal supervision.

(18) To extract and load on GC a batch consisting of the compound of interest, with the trainee's standard and control, as well as the laboratory's standard and control, each in duplicate spiked in water, with no supervision. Good recovery and good reproducibility were the completion criteria.

(19) To extract and load on GC a batch consisting of the compound of interest, with the laboratory's standards as calibrators, and the trainee's standards as samples. Water was the matrix. Completion criteria were acceptable calibration and the results of the samples within
+/- 20% of the expected value.

(20) The trainee was required to duplicate step 19.

(21) To extract and load on GC a batch consisting of the compound of interest, with the trainee's standards and controls spiked in water. Completion criteria were acceptable calibration, acceptable positive control (+/- 20% of the expected value) and acceptable negative control (no presence of the compound of interest).

(22) The trainee was required to duplicate step 21.

(23) To extract and load on GC a batch consisting of the compound of interest, using the trainee's standards and controls spiked in water, as well as negative blood spiked with the trainee's standard in one concentration in triplicate, as samples. Completion criteria were acceptable calibration, acceptable positive control (+/- 20% of the expected value), acceptable negative control (no presence of the compound of interest), and 2 out of 3 bloods acceptable (+/- 30% of the expected value).

(24) The trainee was required to duplicate step 23.

(25) To extract and load on GC a batch consisting of the compound of interest, with the trainee's standards and controls spiked in water, as

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well as negative blood spiked with trainee's standards in three different concentrations, each in duplicate as samples. Completion criteria were acceptable calibration, acceptable positive control (+/- 20% of the expected value), acceptable negative control (no presence of the compound of interest), and all 3 bloods acceptable (duplicate results within +/- 10% of their average).

(26) The trainee was required to duplicate step 25.

(27) Successful completion of duplicate sets of 4 unknowns using the trainee's standards and controls spiked in water.

(28) To extract and load on GC a batch consisting of the compound of interest, with the trainee's standards and controls spiked in negative blood. Completion criteria were acceptable calibration, acceptable positive control (+/- 20% of the expected value) and acceptable negative control (no presence of compound of interest).

After successful completion of the above program, the trainee was certified to use the GC with the specific detector she/he was trained on. The newly certified analyst would be assigned to do case work. Initially, the assignment would consist of the quantitation of a single compound. Gradually, the difficulty of the quantitation would increase. All of their work was to be reviewed by themselves, a supervisor and the chief toxicologist.

Cross training between the two GC detectors involved step 13 and the successful completion of step 21, using laboratory standards and controls. The analyst was trained on GC trouble-shooting and maintenance as the situations presented themselves. They included, but not limited to, maintenance on injector port, column, detector, gas line trap, ChemStation disk, as well as handling chromatography separation problems.

After they gained more experience on the GC quantitation, they would be trained on how to do a dual column GC screening procedure. All GC analysts were trained, and their work reviewed by one person. This was intended for consistency and continuity.

Each GC analyst was paired with a GC/MS analyst. The GC/MS analyst would confirm/rule out the positive GC result quantitated by her/his partner. The GC/MS analyst would explain the GC/MS result, therefore, served as a mentor to her/his GC partner. This was intended for inspiration and possible GC/MS training in the future.

Gas Chromatography, Training, Toxicology

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