



Accu-Chem Laboratories
990 North Bowser Road, Suite 800
Richardson, Texas 75081
1-800-747-2878
www.accuchem.com

Solvent Abuse Monitoring in Juveniles

Recent reports by health care, law enforcement and treatment center personnel generally agree that inhalant abuse, involving a variety of solvents and common substances rich in solvents, is a wide-spread and growing problem among the youth of Texas and the Southwest. Inhalant abuse is generally defined as the repeated, intentional inhalation of solvent vapors for the purpose of intoxication. Screening of body fluids such as blood and urine can supply valuable diagnostic information on frequency and extent of abuse by an individual and will provide the only unequivocal means of defining the agent(s) being used. Monitoring can provide a useful tool to assist in reducing dependence on a given solvent.

It is beyond the scope of this brief discussion to list all of the solvents that are readily available to the juvenile abuser. However, it will suffice to say that aerosols such as hair spray, frying pan lubricants and freon, along with volatile solvents such as gasoline and related petroleum-based fuels, lighter fluid, glue, paint thinners, paint strippers, marking pens, shoe polish, carburetor cleaners, octane booster, etc. would be high on any list of abused substances. Unfortunately, most of these substances are easy to obtain and conceal. Following an exposure to high concentrations of one of the above products will usually produce a sense of euphoria, often coupled with hallucinations, rapid disorientation in time and space, slurred speech, blurred vision, poor coordination, memory loss and aggressiveness. When hallucinations occur, they are mostly visual, occasionally auditory and many are very disturbing to the abuser. It has been established in cases of chronic industrial solvent exposures, that the patients often suffer from a condition known as "chronic brain syndrome". Once intellectual impairment and/or cerebral atrophy has developed from such a medical condition, little reversibility is observed.

The simple aromatic hydrocarbon toluene is one of the volatile solvents that is most frequently abused by juvenile. Therefore, in the remainder of this discussion, we will focus our attention on this common solvent. Although the purpose is to inhale this solvent, a small portion may be absorbed through the skin by direct contact. Depending upon the use pattern by the juvenile, toluene itself can be easily measured in the blood for three days or more following abuse. Toluene concentrations measured in the blood of some abusing juveniles have been found equal to that observed in samples of blood collected at autopsy following fatal industrial exposures. Such evidence suggests that prolonged exposure to toluene may result in an adaptive mechanism.

Once toluene has reached the blood, approximately 20 percent is recirculated to the lungs and expired. However, the remaining 80 percent undergoes a metabolic change in the liver to produce a product called hippuric acid. Hippuric acid is more water-soluble than toluene and is, therefore more easily excreted in the urine. Therein lies a second opportunity by which toluene exposures may be monitored-direct measurement of hippuric acid in the urine.



Accu-Chem Laboratories
990 North Bowser Road, Suite 800
Richardson, Texas 75081
1-800-747-2878
www.accuchem.com

Trace amounts of hippuric acid are excreted in human urine by most people. However, the levels observed in urine following inhalation of toluene are significantly elevated. In order to obtain an accurate estimate of the degree of exposure using hippuric acid measurement, it is necessary to establish the concentration of the urine. This is achieved by measuring a second compound always present in humane urine called creatinine. By using the ratio of creatinine concentration to the hippuric acid concentration, one can establish abuse. If the ratio of hippuric acid to creatinine is greater than 1.5 to 2.0, there is evidence of toluene exposure. Values greater than 2.5 are classified as excessive exposures such as those observed in juvenile abusers.

The advantage of using urine (hippuric acid) to screen for toluene inhalant abuse is that it is simple, cost-effective and non-invasive. Also, the same urine specimen collected for routine drug and alcohol abuse monitoring may be employed to test for toluene abuse. It should be pointed out that the analysis of blood is more accurate and sensitive in that the method measures the presence of toluene directly. Additionally, one may elect to search for a broad spectrum of commonly abused solvents in the same blood sample. However, this latter method is invasive and more costly, and the blood must be collected under medical supervision.

In summary, technology is available today to measure a wide variety of recognized inhalants including toluene in body fluids from solvent abusers. Although the diagnosis of abuse in some instances may be possible from direct clinical observation, laboratory measurement is critical in establishing the chemical identity and its frequency and extent of abuse.

by John L. Laseter, Ph.D. 1993
Copyright © 2002 Accu-Chem Laboratories, Ltd.
www.accuchem.com