

Matrix Cup

Plus Optional Adulterant Strip(s)

FOR THE QUALITATIVE ASSESSMENT OF DRUGS AND/OR THEIR METABOLITES IN HUMAN URINE

and

URINE ALCOHOL (Optional)

FOR THE SEMI-QUANTITATIVE ASSESSMENT OF ETHYL ALCOHOL IN HUMAN URINE

Plus

URINE CHECK (Optional)

FOR THE VALIDATION OF URINE SPECIMEN EXAMINED

For in vitro Diagnostic and Forensic Use



Optional: Alcohol & Adulteration	
REF	Urine Alcohol Strip can be optionally integrated into this Matrix Cup Urine check adulteration strip can also be optionally integrated into Drugs Of Matrix Cup with custom parameters. pH and/or creatinine are the optional standard parameters whereas five other parameters are offered as options for custom made test devices. The currently available Adulteration parameters offered by Matrix Diagnostics Ltd. are Creatinine (C), pH (P), Specific Gravity (G), Nitrite (N), Glutaraldehyde (U), Bleach(B), and Pyridinium Chlorochromate (P).

INTENDED USE

Matrix Cup, hereinafter referred to as Matrix Cup is an immunochromatography based one step in vitro test. It is designed for qualitative determination of drug substances in human urine specimens. This assay may be used in the point of care setting. Below is a list of cut-off concentrations for each drug.

Amphetamine	1000	ng/ml of d-amphetamine
Barbiturate	300	ng/ml of secobarbital
Benzodiazepine	300	ng/ml of oxazepam
Buprenorphine	10	ng/ml of Buprenorphine-3-β-d-glucuronide
Cocaine	300	ng/ml of benzoylecgonine
EDDP	100	ng/ml of EDDP
Ketamine	1000	ng/ml of Ketamine
Methadone	300	ng/ml of methadone
Methamphetamine (includes Ecstasy)	1000	ng/ml of (+)methamphetamine
MDMA (Ecstasy specific)	500	ng/ml of MDMA
Opiate*	300	ng/ml of morphine
Opiate II*	2000	ng/ml of morphine
Oxycodone	100	ng/ml of oxycodone
Phencyclidine	25	ng/ml of phencyclidine
Cannabinoid (THC)	50	ng/ml of 11-nor-Δ ⁹ -THC-9-COOH
Propoxyphene	300	ng/ml of Norpropoxyphene
Tramadol	200	ng/ml of Tramadol
Tricyclic antidepressant (TCA)	1000	ng/ml of Nortriptyline
6-MAM	10	ng/ml of 6-Acetylmorphine
ZOL	50	ng/ml of Zolpidem Phenyl-4-carboxylic acid
LSD	20	ng/ml of Lysergic acid diethylamide
7-ACL	300	ng/ml of 7-Aminoclonazepam
PGB	500	ng/ml of Pregabalin
MES	300	ng/ml of Mescaline
MDPV	500	ng/ml of 3,4-Methylenedioxypropylvalerone
MCAT	500	ng/ml of Methcathinone
MEP	500	ng/ml of Mephedrone
GAB	2000	ng/ml of Gabapentin
ETG	500	ng/ml of Ethyl Glucuronide
ETG II*	1000	ng/ml of Ethyl Glucuronide
CFYL	500	ng/ml of Carfentanil
K2-AB	2500	ng/ml of AB-PINACA
CAF	8000	ng/ml of Caffeine
K2	50	ng/ml of JWH-018 and JWH-073
FYL	10	ng/ml of Fentanyl

COT	200	ng/ml of Cotinine
MQL	300	ng/ml Methaqualone
Alcohol	40	mg/dl (0.04% BAC) of Alcohol
Oxidants/ Specific Gravity / pH/Nitrite / Glutaraldehyde/Creatinine		

This assay provides only a preliminary analytical test result. A more specific alternative chemical method must be used in order to obtain a confirmed analytical result. Gas chromatography/ mass spectrometry (GC/MS) has been established as the preferred confirmatory method by the Substance Abuse Mental Health Services Administration (SAMHSA). Clinical consideration and professional judgement should be applied to any drug of abuse test result, particularly when preliminary positive results are indicated. The optional built-in Adulteration Test is for validation of urine specimen's integrity and must not be used for In Vitro diagnostic use.

* SAMHSA recommends a cut-off concentration of 2000 ng/ml for Opiates Test, a cut-off concentration of 1000 ng/ml for Amphetamine Test, a cut-off concentration of 10 ng/ml for Buprenorphine Test, a cut-off concentration of 100 ng/ml for EDDP Test, a cut-off concentration of 1000 ng/ml for Methamphetamine Test.

SUMMARY AND EXPLANATION

Drugs of Abuse

Amphetamines are a class of potent sympathomimetic agents with therapeutic applications. The most common amphetamines are d-amphetamine and d,l-amphetamine. Amphetamines are central nervous stimulants that cause the neurotransmitters epinephrine, norepinephrine and dopamine to be released into the brain and body giving users feelings of euphoria, alertness, and increased energy. Chronic abuse of amphetamine leads to tolerance and drug reinforcement effect. Cardiovascular responses to amphetamine include i ncreased blood pressure and cardiac arrhythmias. More acute responses produce anxiety, paranoia, hallucinations and psychotic behavior. Amphetamine is metabolized by a number of pathways. In general, acid urine promotes excretion whereas alkaline urine retards it. In 24 hours, approximately 79% of the amphetamine dose is excreted in acid urine and about 46% in alkaline urine. Typically, about 20% is excreted as unchanged amphetamine. Unchanged amphetamine can be detected up to 1-2 days after use.

Barbiturates are a class of drugs that are frequently abused. They can depress the central nervous system. Acute high dose induces exhilaration, sedation and respiratory depression. More acute responses produce respiratory collapse and coma. The effects of short-acting barbiturates, such as secobarbital last 3 to 6 hours. The effects of long-acting barbiturates such as phenobarbital last 10 to 20 hours. Short-acting barbiturates normally remain detectable in urine for 4 to 6 days, while long-acting barbiturates can be detected for up to 30 days. Barbiturates are excreted in the urine in unchanged forms, hydroxylated derivatives, carboxylated derivatives and glucuronide conjugates

Benzodiazepines are a class of widely prescribed central nervous system depressants which have anxiolytic, hypnotic, anticonvulsant and muscle relaxant effects. Chronic abuse can result in addiction and tardive dyskinesia. Acute higher doses lead to drowsiness, dizziness, muscle relaxation, lethargy, coma and possible death. The effects of benzodiazepines use last 4 – 8 hours. Many of the benzodiazepines share a common metabolic route, and are excreted as oxazepam and its glucuronide in urine. Oxazepam is detectable in the urine for up to 7 days after drug use.

Buprenorphine A derivative of thebaine, is an opioid that has been marketed in the United States as the Schedule V parenteral analgesic buprenex in 2003. It is used for the treatment of pain and potential for abuse, addiction, and side effect. DEA reclassified buprenorphine from a Schedule V to a Schedule III narcotic. Buprenorphine resembles morphine structurally but has a longer duration of action than morphine and can be administered sublingually as an analgesic. In October 2002, FDA approved the use of a buprenorphine monotherapy product, Subutex, and a buprenorphine/naloxone combination product, Suboxone, for the treatment of opioid addiction. Subutex and Suboxone are the first narcotic drugs available under the US Drug Act (DATA) of 2003 for the treatment of opiate dependence that can be prescribed in the US in a physician's work place. It has also been shown that buprenorphine has abuse potential and may itself cause dependency. In addition, a number of deaths have been recorded as a result of overdose with intravenously injected buprenorphine in conjunction with other psychotropic drugs such as benzodiazepines. Buprenorphine is metabolized primarily by n-dealkylation to form glucuronide-buprenorphine and glucuronide-norbuprenorphine.

Cocaine Derived from the leaves of coca plant, cocaine is a potent central nervous system stimulant as well as a local anesthetic. Some of the psychological effects induced by cocaine are: euphoria, confidence and a sense of increased energy, accompanied by increased heart rate, dilation of the pupils, fever, tremors and sweating. Continued ingestion of cocaine could induce tolerances and physiological dependency which leads to its abuse. Cocaine is used by smoking, intravenous, intranasal or oral administration and excreted in the urine primarily as benzoylecgonine in a short period. Benzoylecgonine has a biological half-life of 5 – 8 hours, which is much longer than that of cocaine (0.5 – 1.5 hours), and can be generally detected for 12 – 72 hours after cocaine use or exposure.

Clonazepam is a short-acting derivative of nitrazepam having anticonvulsant, muscle relaxant and very potent anxiolytic properties. It is marketed as the prescription drug under the names of Klonopin, Ravotril, Trovotril or Rivatril. Clonazepam has an unusually long half-life of 18-50 hours in human body, making it generally considered to be among long-acting benzodiazepines. Clonazepam has a fast onset of action and high effectiveness rate and low toxicity in overdose, but have drawbacks due to adverse reactions including paradoxical effects, drowsiness, and cognitive impairment. Cognitive impairment can persist for at least 6 months after withdrawal of clonazepam. Clonazepam is largely bound to plasma proteins. Clonazepam is rapidly and completely absorbed after oral administration. Maximum plasma concentration of clonazepam are reached within 1 to 4 hours after oral administration. Clonazepam is highly metabolized with less than 2% unchanged in urine. The metabolites include 7-aminoclonazepam and 3-acetyroclonazepam.

Cotinine is an alkaloid found in tobacco and is also a major metabolite of nicotine. Cotinine is used as a biomarker for exposure to tobacco smoke and has also been sold as an anti-depressant under the brand name of Scotine. Cotinine has an in vivo half-life of approximately 20 hours, and is typically detectable for several days after the use of tobacco. The level of cotinine is proportionate to the amount of exposure to tobacco smoke. In urine, values between 11 ng/ml and 30 ng/ml may be associated with light smoking or passive exposure. The cotinine levels in active smokers typically reach 500 ng/ml or more.

EDDP 2-Ethylidene-1,5-dimethyl-3,3-diphenylpyrrolidine, is the primary metabolite of methadone. Methadone is a controlled substance and is used for detoxification and maintenance of opiate dependent patients. Patients on methadone maintenance may exhibit methadone (parent) levels that account for 5-50% of the dosage and 3-25% of EDDP in urinary excretion during the first 24 hours. The detection of EDDP is more beneficial than traditional methadone screening, in that EDDP exists only in urine from individuals that ingested methadone. The tampering of specimens by spiking the urine with methadone can be prevented. Secondly, renal clearance of EDDP is not affected by urinary pH, therefore the EDDP test provides a more accurate result of methadone ingestion than the methadone parent screen.

Fentanyl is a synthetic opioid. It has the brand names of Sublimaze, Actiq, Durogestic, Fentora and others. Fentanyl is approximately 100 times more potent than morphine, with 100 micrograms of fentanyl approximately equivalent to 10 mg of morphine or 75 mg of meperidine in analgesic activity. Fentanyl is a potent narcotic analgesic with rapid onset and short duration of action. Historically, it has been used to treat chronic breakthrough pain and is commonly used pre-procedures. Illicit use of pharmaceutical fentanyl first appeared in the mid-1970s. Because the effects of fentanyl last for only a very short time, it is even more addictive than heroin. The regular uses may become addicted very quickly. Fentanyl is more potent than heroin, and tends to produce significantly worse respiratory depression, making it somewhat more dangerous than heroin to users. The overdose of fentanyl has caused death. In the United States, fentanyl is classified as a Schedule II controlled substance.

K2 Synthetic cannabis is a psychoactive herbal and chemical product that, when consumed, mimics the effects of cannabis. It is best known by the brand name K2 and Spice, both of which have largely become genericized trademarks used for refer to any synthetic cannabis product. The studies suggest that synthetic cannabinoid intoxication is associated with acute psychosis, worsening of previously stable psychotic disorders, and also may have the ability to trigger a chronic (long-term) psychotic disorder among vulnerable individuals such as those with a family history of mental illness. A large and complex variety of synthetic cannabinoids, most often cannabicyclohexanol, JWH-018, JWH-073, HU-210, and HU-210, are used. As of March 1, 2011, five cannabinoids, JWH-018, JWH-073, CP-47, JWH-200 and cannabicyclohexanol are illegal in US because these substances have the potential to be extremely harmful and, therefore, pose an imminent hazard to the public safety.

Methadone is a synthetic opioid, clinically available. It is used clinically for the treatment of severe pain and in maintenance programs for morphine and heroine addicts. Methadone acts on the central nervous and cardiovascular systems to produce respiratory and circulatory depression. Methadone also produces miosis and increases the tone of smooth muscle in the lower gastrointestinal tract while decreasing the amplitude of contractions. Acute higher doses induce analgesia, sedation, respiratory depression and coma. After methadone administration, the major urinary excretion products are methadone and its metabolites, EDDP and EMDP. Large individual variations in the urine excretion of methadone are output of methadone from 5-22%. Typically, following a 5 mg oral dose, methadone and EDDP account for 5% of the dose in the 24-hour urine. In those individuals on maintenance therapy, methadone may account for 5 to 50% of the dose in the 24-hour urine and EDDP may account for 3 to 25% of the dose

Methamphetamine is the most popular synthetic derivative of the amphetamines. It is a potent sympathomimetic agent with therapeutic applications. Acute large doses lead to enhanced stimulation of the central nervous system and induce euphoria, alertness, reduced appetite, and a sense of increased energy and power. More acute response produces anxiety, paranoia, psychotic behavior, and cardiac dysrhythmias. Methamphetamine is excreted in the urine as amphetamine and oxidized and deaminated derivatives. However, 10-40% of methamphetamine is excreted unchanged. Methamphetamine is generally detectable in the urine for 3 to 5 days after use.

MDMA Methylenedioxy-methamphetamine (Ecstasy) is a designer drug first synthesized in 1914 by a German drug company for the treatment of obesity. Those who take the drug frequently report adverse effects, such as increased muscle tension and sweating. MDMA is not clearly a stimulant, although it has, in common with amphetamine drugs, a capacity to increase blood pressure and heart rate. MDMA does produce some perceptual changes in the form of increased sensitivity to light, difficulty in focusing, and blurred vision in some users. Its mechanism of action is thought to be via release of the neurotransmitter serotonin. MDMA may also release dopamine, although the general opinion is that this is a secondary effect of the drug. The most pervasive effect of MDMA, occurring in almost all people who have taken a reasonable dose of the drug, is to produce a denching of the jaws. The MDMA Ecstasy Test Strip yields a positive result when Methylenedioxy-methamphetamine in urine exceeds 500ng/ml.

Methylphenidate is most commonly known by the Novartis trademark name Ritalin, which is an instant-release racemic mixture. There are also a variety of formulations and generic brand names exist. Methylphenidate is a psychostimulant drug for the treatment of attention-deficit hyperactivity disorder, Postural Orthostatic Tachycardia Syndrome, and narcolepsy. It may also be prescribed for

off-label use in treatment-resistant cases of lethargy, depression, neutral insulin, obesity, and rarely other psychiatric disorders such as Obsessive-Compulsive Disorder. Methylphenidate like other stimulants increases dopamine levels. The abuse potential is increased when methylphenidate is crushed and snored or when it is injected producing effects almost identical to cocaine. Cocaine-like effects can also occur with very large doses taken orally. Methylphenidate has a high potential for drug dependence and additive abuse due to its similar pharmacology to cocaine and amphetamines. Internationally, methylphenidate is a Schedule II drug under the Convention on Psychotropic Substances. In the United States, methylphenidate is classified as a Schedule II controlled substance, the designation used for substances that have a recognized medical value but present a high likelihood for abuse because of their addictive potential.

Ketamine is a derivative of phencyclidine. It is used medically as a veterinary and human anesthetic. Certain doses of ketamine can cause dream-like states and hallucinations. In high doses, ketamine can cause delirium, amnesia, impaired motor function, high blood pressure, depression, and potentially fatal respiratory problems. Ketamine is metabolized in the liver and excreted through the kidney. The half-life of ketamine in the body is around three hours.

Opiate Opioid analgesics comprised of a large group of substances that control pain by depressing the central nervous system. Acute high dose used by abusers or addicts can cause depressed coordination, disrupted decision, decreased respiration, hypothermia and coma. Morphine is excreted unmetabolized and is the marker metabolic product of opiates. Morphine and morphine glucuronide is detectable in urine for several days after opiates dose.

Oxycodone is known as Oxycotin, Roxicodone and is an ingredient of Percodan, Percocet, Roxicet and Tylox. Oxycodone is a semi-synthetic opiates derived from opium. Like other opiates, oxycodone is characterized by its analgesic properties, and the tendency for users to form a physical dependency and develop tolerance with extended use. Oxycodone is usually administered in combination with non-opiate analgesics such as acetaminophen and salicylates for the relief of moderate to severe pain. Oxycodone is a central nervous system depressant that may cause drowsiness, dizziness, lethargy, weakness and confusion. Toxicity in an overdose of oxycodone can lead to stupor, coma, muscle flaccidity, severe respiratory depression, hypotension, and striptic arrest. Oxycodone is metabolized by N- and O-demethylation. One of the metabolites, oxymorphone, is a potent narcotic analgesic, while the other, noroxycodone, is relatively inactive. Between 33 to 61% of a single dose of oxycodone is excreted in a 24 hour urine collection and consists of 13-19% free oxycodone, 7-29% glucuronide conjugated oxycodone, 13-14% glucuronide conjugated oxymorphone and an unknown amount of noroxycodone. The detection time window of oxycodone is 1-3 days following use.

Phencyclidine commonly known as PCP, is a hallucinogen which interacts with dopamine, cholinergic and adrenergic systems. It has dose dependent stimulant, depressant, hallucinogenic and psychological effects. PCP is mostly administered by oral or intravenously. Even moderate amount of PCP, from 5 to 100 ng/ml, can result in psychotic, violent and self-destruction. At high doses, from 100 to 500 ng/ml, PCP can cause convulsions, hypertension, prolonged coma, absent peripheral sensation, and even death. PCP is metabolized via hydroxylation, oxidation, and conjugation with glucuronic acid in the liver. About 10% of the does is excreted in urine as unchanged drug. For chronic users, PCP can be detected in the urine for 7 to 8 days after drug administration

Propoxyphene Propoxyphene is a prescription drug for the relief of pain. Although slightly less selective than morphine, Propoxyphene binds primarily to opioid receptors and produces analgesia and other CNS effects that are similar to those seen with morphine-like opioids. It is likely that at equianalgesic doses the incidence of side effects such as nausea, anorexia, constipation, abdominal pain, and drowsiness are similar to those of codeine. After oral administration, concentrations of Propoxyphene in plasma reach their highest values at 1 to 2 hours. There is great variability between subjects in the rate of clearance and the plasma concentrations that are achieved. The percentage of excreted unchanged Propoxyphene in urine is less than 1%. In humans, the major route of the metabolism is N-demethylation to yield norpropoxyphene. Norpropoxyphene has a longer half-life (30 to 36 hours) than parent Propoxyphene (6 to 12 hours), and its accumulation with repeated doses may be responsible for some of the observed toxicity

THC The agents of Marijuana that cause various biological effects in humans are called cannabinoid. Cannabinoid is a central nervous stimulant that alters mood and sensory perceptions, produces loss of coordination, impairs short term memory, and produces symptoms of anxiety, paranoia, depression, confusion, hallucination, and increased heart rate. Large doses of cannabinoid could cause the development of tolerances and physiological dependency and lead to abuse. A tolerance to the cardiac and psychotropic effects can occur and withdrawal syndrome produces restlessness, insomnia, anorexia and nausea. Δ⁹-THC is the primary active ingredient in cannabinoids. The main metabolite excreted in the urine is 11-nor-Δ⁹-THC-9-COOH, which are found within hours of exposure and remain detectable in the urine for 3-10 days after smoking.

Tramadol is a quasi-narcotic analgesic used in the treatment of moderate to severe pain. It is a synthetic analog of codeine, but has a low binding affinity to the mu-opioid receptors. Large doses of tramadol can develop tolerance and physiological dependency and lead to its abuse. Tramadol is extensively metabolized after oral administration. Approximately 30% of the dose is excreted in the urine as unchanged drug, whereas 60% is excreted as metabolites. The major pathways appear to be N- and O- demethylation, glucuronidation or sulfation in the liver.

TCA Tricyclic antidepressants, commonly known as TCA, are a group of antidepressant drugs. TCA are mostly administered by oral or intramuscularly. The progressive symptomatology of TCA includes agitation, confusion, hallucinations, hypertonicity, seizures and EKG changes. Nortriptyline, Desipramine (Pertoran) and Imipramine (Tofranil) are the most often used TCA. TCA's half life varies from a few hours to a few days. TCA are excreted with less than 1% of the unchanged drug.

Alcohol Acute alcohol intoxication can lead to loss of alertness, coma, and even death. Long term effects include internal organ damage and birth defects. The blood alcohol concentration (BAC) at which a person becomes impaired is variable. The United States Department of Transportation (DOT) has established a BAC of 0.02% (0.02g/dL) as the cut-off level at which an individual is considered positive for the presence of alcohol. Since urine alcohol concentration is normally higher than that in saliva and blood, the cutoff concentration for alcohol in urine is set at 0.04%

6-MAM 6-Monoacetylmorphine (6-MAM) or 6-acetylmorphine is one of three active metabolites of heroin (diacetylmorphine), the others being morphine and the much less active 3-monoacetylmorphine (3-MAM).6-MAM is rapidly created from heroin in the body, and then is either metabolized into morphine or excreted in the urine. Since 6-MAM is a unique metabolite to heroin, its presence in the urine confirms that heroin was the opioid used. This is significant because on a urine immunoassay drug screen, the test typically tests for morphine, which is a metabolite of a number of legal and illegal opiates/opioids such as codeine, morphine sulfate, and heroin. 6-MAM remains in the urine for no more than 24 hours so a urine specimen must be collected soon after the last heroin use, but the presence of 6-MAM guarantees that heroin was in fact used as recently as within the last day. 6-MAM is naturally found in the brain, but in such small quantities that detection of this compound in urine virtually guarantees that heroin has recently been consumed.

ZOL Zolpidem is a prescription medication used for the treatment of insomnia and some brain disorders. It is a short-acting nonbenzodiazepine hypnotic of the imidazopyridine class that potentiates GABA, an inhibitory neurotransmitter, by binding to GABA_A receptors at the same location as benzodiazepines. It works quickly, usually within 15 minutes, and has a short half-life of two to three hours. Zolpidem has not adequately demonstrated effectiveness in maintaining sleep, unless delivered in a controlled-release (CR) form. However, it is effective in initiating sleep. Its hypnotic effects are similar to those of the benzodiazepine class of drugs, but it is molecularly distinct from the classical benzodiazepine molecule and is classified as an imidazopyridine. Flumazenil, a benzodiazepine receptor antagonist, which is used for benzodiazepine overdose, can also reverse zolpidem's sedative/hypnotic and memory-impairing effects.

LSD Lysergic acid diethylamide, abbreviated LSD or LSD-25, also known as lysergide and colloquially as acid, is a semisynthetic psychedelic drug of the ergoline family, well known for its psychological effects which can include altered thinking processes, closed and open eye visuals, synaesthesia, an altered sense of time and spiritual experiences, as well as for its key role in 1960s counterculture. It is used mainly as an entheogen, recreational drug, and as an agent in psychedelic therapy. LSD is non-addictive, is not known to cause brain damage, and has extremely low toxicity relative to dose, although in rare cases adverse psychiatric reactions such as anxiety or delusions are possible.

7-ACL 7-aminoclonazepam is the major metabolite of clonazepam. Clonazepam sold under the brandname Klonopin among others, is a medication used to prevent and treat seizures, panic disorder, and for the movement disorder known as akathisia. It is a type of benzodiazepine. As a major metabolite, 7-aminoclonazepam may be used to monitor use of the parent drug, clonazepam. Clonazepam, marketed as Klonopin and Rivotril, is a long-acting benzodiazepine with anxiolytic, anticonvulsant, muscle relaxant, and hypnotic properties.

PGB Pregabalin is a medication primarily used for epilepsy, neuropathic pain, and fibromyalgia. Its use for epilepsy is as an add-on therapy for partial seizures with or without secondary generalization in adults. It is also considered useful for generalized anxiety disorder.Pregabalin is a lipophilic structural analogue of γ-Aminobutyric acid (GABA) and classified as a depressant by the Drug Enforcement Agency. It is a neurotransmitter modulator that has analgesic, anticonvulsant, anxiolytic, and sleep-modulating properties.Pregabalin is a potent gabapentinoid and a close structural analogue of GABOB (β-hydroxy-GABA), baclofen (β-(4-chlorophenyl)-GABA) and phenibut (β-phenyl-GABA). Common side effects include: sleepiness, confusion, trouble with memory, poor coordination, dry mouth, problem with vision, and weight gain. Potentially serious side effects include angioedema, drug misuse, and an increasedsuicide risk.

MES Mescaline or 3,4,5-trimethoxyphenethylamine is a naturally occurring psychedelic alkaloid of the phenethylamineclass, known for its hallucinogenic effects similar to those of LSD and psilocybin. It shares strong structural similarities with the catecholamine dopamine.It occurs naturally in the peyote cactus (Lophophora williamsii), the San Pedro cactus (Echinopsis pachanoi) and in the Peruvian torch (Echinopsis peruviana), and as well in a number of other members of the Cactaceae plant family. It is also found in small amounts in certain members of the Fabaceae (bean) family, including Acacia berlandieri. Tolerance builds with repeated usage, lasting for a few days. Mescaline causes cross-tolerance with other serotonergic psychedelics such as LSD andpsilocybin. About half the initial dosage is excreted after 6 hours, but some studies suggest that it is not metabolized at all before excretion. Mescaline appears to not be subject to metabolism by CYP2D6and between 20% and 50% of mescaline is excreted in the urine unchanged, and the rest being excreted as the carboxylic acid form of mescaline, a likely result of MAO degradation.

MDPV Methylenedioxypropylvalerone (MDPV) is a psychoactive drug with stimulant properties which acts as a norepinephrine-dopamine reuptake inhibitor. The primary psychological effects have a duration of roughly 3 to 4 hours, with after effects such as tachycardia, hypertension, and mild stimulation lasting from 6 to 8 hours.

MCAT Methcathinone, is a monoamine alkaloid and psychoactive stimulant, a substituted cathinone. Methcathinone is a highly addictive drug, primarily psychologically addicting and most of the signs of addiction to the drug are emotional or psychological. It has been popularized and continues to be sold under misleading names such as "bath salts", "plant fertilizers" or "research chemicals", but it is actually a powerful

psycho-stimulant used as a recreational drug. Effects of this drug typically last 4 to 6 hours. It is used as a recreational drug due to its potent stimulant and euphoric effects and is considered to be addictive, with both physical and psychological withdrawal occurring if its use is discontinued after prolonged or high-dosage administration . It is usually snorted, but can be smoked, injected, or taken orally. Methcathinone is listed as a Schedule I controlled substance by the Convention on Psychotropic Substances and the United States' Controlled Substances Act, and as such it is not considered to be safe or effective in the treatment, diagnosis, prevention, or cure of any disease, and has no approved medical use. Methcathinone has very strong affinities for the dopamine transporter and the norepinephrine (noradrenaline) transporter. Its affinity for the serotonin transporter is less than that of methamphetamine.

MEP Mephedrone, also known as 4-methylmethcathinone (4-MMC) or 4-methylphedrone is a synthetic stimulant drug of the amphetamine and cathinone classes. Slang names include drone, M-CAT, White Magic and meow meow. It is chemically similar to the cathinone compounds found in the khat plant of eastern Africa. Mephedrone comes in the form of tablets or a powder, which users can swallow, snort or inject, producing similar effects to MDMA, amphetamines and cocaine. In addition to its stimulant effects, Mephedrone produces side effects, of which teeth grinding are the most common. A number of metabolites are possible, however the n-demethyl metabolite of Mephedrone will be 4-Methylcathinone. This metabolite appears to be nearly inactive as a Monoamine Oxydase Inhibitor .On further metabolism of this metabolite one of the possible metabolites is 4-Methylnorephedrine, caused by the reduction of the Keto.A dose of 150mg-250mg is the average, giving a duration of around 2 hours.the duration will lengthen in larger 250mg+ dosages .

GAB Gabapentin (GAB) marketed under the brand name Neurontin among others, is a medication used to treat epilepsy,neuropathic pain, hot flashes, and restless leg syndrome. In epilepsy it may be used for those with partial seizures. It is recommended as one of a number of first line medications for the treatment of neuropathic pain idiopathic neuropathy, post-herpetic neuralgia, and central neuropathic pain. The mechanism of the anticonvulsant action of gabapentin has not been fully described. Several possible mechanisms for pain improvement have been discussed. Though similar in structure to the endogenous neurotransmitter GABA, gabapentin has not been shown to bind to GABA receptors at concentrations at or below 1 mM. Gabapentin modulates the action of glutamate decarboxylase (GAD) and branched chain aminotransferase (BCAT), two enzymes involved in GABA biosynthesis. In human and rat studies, gabapentin was found to increase GABA biosynthesis, and to increase non-synaptic GABA neurotransmission in vitro.Common side effects include sleepiness and dizziness. Serious side effects may include an increased risk of suicide, aggressive behaviour, and drug reaction with eosinophilia and systemic symptoms. It is unclear if it is safe duringpregnancyor breastfeeding. Lower doses should be used in people with kidney problems. Gabapentin affects the inhibitory neurotransmitter γ-aminobutyric acid (GABA).

CFYL Carfentanyl is an analog of the synthetic opioid analgesic fentanyl. It is 10,000 times more potent than morphine, making it among the most potent commercially used opioids. Carfentanyl was first synthesized in 1974. It is marketed under the trade name Wildin as a general anaesthetic agent for large animals. Side effects of carfentanil are similar to those of fentanyl, which include itching, nausea and respiratory depression, which can be life-threatening. Carfentanil is classified as Schedule II under the Controlled Substances Act in the United States with a DEA ACSCN of 9743.

K2-AB AB-PINACA is a synthetic cannabinoid usually sold as a herbal smoking mixture designed to mimic THC, the active chemical of cannabis. Synthetic cannabinoids are classed as 'New Psychoactive Substances' (NPS) which are unregulated substances that have become newly available on the market as an alternative to illegal drugs. As a reaction to prohibition, synthetic cannabinoid producers change the compounds found in designer drugs and create new generations of synthetic drugs, such as AB-PINACA. As a result, accidental overdose and severe psychiatric complications may be more likely to occur because the type and amount of active compound may vary considerably from batch to batch. Other effects may include agitation, rapid heart rate, confusion, dizziness and nausea.

CAF Caffeine is a central nervous system (CNS) stimulant of the methylxanthine class. It is the world's most widely consumed psychoactive drug. It is found in the seeds, nuts, or leaves of a number of plants native to South America and East Asia and confers on them several survival and reproductive benefits. Caffeine can produce a mild form of drug dependence-associated with withdrawal symptoms such as sleepiness, headache, and irritability – when an individual stops using caffeine after repeated daily intake. After intravenous administration of caffeine the urine level of the drug is approximately the same in each of the first 4 hourly specimens. Blood samples taken 10 and 70 minutes after injection of the drug were analyzed and showed 0.29 and 0.28mg. per 100 cc. respectively. There are to be contrasted with the 1st hour urine which contained 0.73mg.per 100 cc., essentially 3 times that in the blood. After oral administration of caffeine to the horse the concentration of caffeine in the urine rose progressively during the first 3 hours, remained relatively constant through the 8th hours. At 48 hours, a urine specimen contained approximately 0.17mg. per 100 cc. of caffeine. In addition, flu-like symptoms, nausea/vomiting, and muscle pain/stiffness were judged likely to represent valid symptom categories. In experimental studies, the incidence of headache was 50% and the incidence of clinically significant distress or functional impairment was 13%. Typically, onset of symptoms occurred 12–24 h after abstinence, with peak intensity at 20–51 h, and for a duration of 2–9 days. 1% to 3% of caffeine is excreted unchanged in the urine. The rate of caffeine metabolism is variable, with a half-life of 4 to 6h.

ETG Ethyl glucuronide (ETG) is a minor non-oxidative metabolite of ethyl alcohol formed by the in vivo conjugation of ethanol with glucuronic acid with UDP glucuronosyl transferase.ETG is a product of metabolic process about of Ingested alcohol (ethanol) rapidly metabolized in the body, which is excreted in the blood, hair and urine. By using The ETG Rapid Test Device (Urine), can detect ETG in urine, confirming the consumption of alcohol. The ETG metabolite remains in the body longer and therefore has a more useful window of detection of 8 to 80 hours. ETG testing is an excellent option for zero-tolerance alcohol consumption or rehabilitation programs

K2 Synthetic cannabis is a psychoactive designer drug derived from natural herbs sprayed with synthetic chemicals that, when consumed, allegedly mimic the effects of cannabis. It is best known by the brand names K2 and Spice, both of which have largely become genericized trademarks used to refer to any synthetic cannabis product. Studies suggest that synthetic cannabinoid intoxication is associated with acute psychosis, worsening of previously stable psychotic disorders, and also may have the ability to trigger a chronic (long-term) psychotic disorder among vulnerable individuals such as those with a family history of mental illness. When synthetic cannabis blends first went on sale in the early 2000s (decade), it was thought that they achieved an effect through a mixture of legal herbs. Laboratory analysis in 2008 showed that this is not the case, and that they in fact contain synthetic cannabinoids that act on the body in a similar way to cannabinoids naturally found in cannabis, such as THC. A large and complex variety of synthetic cannabinoids, most often cannabicyclohexanol, JWH-018, JWH-073, or HU-210, are used in an attempt to avoid the laws that make cannabis illegal, making synthetic cannabis a designer drug. It has been sold under various brand names, online, in head shops, and at some gas stations.

gravity tests. UrineCheck detects whether the sample contains available adulterants including nitrite, Glutaraldehyde, and other oxidizing agents. UrineCheck can also assess whether the sample is possibly contaminated by acidic (vinegar) or basic (ammonia solution) adulterants as indicated by the pH test.

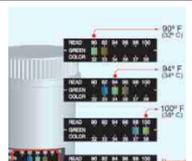
PRINCIPLE
Drugs of Abuse
 Each component strip of the Matrix Cup is based on the principle of specific immunochemical reaction between antibodies and antigen to analyze particular compound in human urine specimen. The assay relies on the competition for binding antibody. When drug is present in the urine specimen, it competes with drug conjugate for the limited amount of antibody-dye conjugate. When the amount of drug is equal or more than the cut-off, it will prevent the binding of drug conjugate to the antibody. Therefore, a positive urine specimen will not show a colored band on the test line zone, indicating a positive result, while the presence of a colored band indicates a negative result.

A control line is present in the test window to work as procedural control. This colored band should always appear on the control line zone if the test device is stored in good condition and the test is performed appropriately.

Alcohol
 Alcohol Test is based on the high specificity of alcohol oxidase (ALOX) for ethyl alcohol in the presence of peroxidase and enzyme substrate such as tetramethylbenzidine (TMB) as shown in the following:

EIOH + TMB CH CHO + Colored TMB
 The distinct color on reactive pad could be observed in less than 20 seconds after the urine samples migrates over the reaction pad with the ethyl alcohol concentration greater than 0.04%. It should be pointed out that other alcohols such as methyl, propanyl and allyl alcohol would develop the similar color on the reactive pad. However, these alcohols are not normally present in urine.

UrineCheck: Adulteration Tests
 In general, all UrineCheck Tests are based on the chemical reactions of the indicator reagents on the pads with components in the urine sample effecting color changes. Results are obtained by comparing the color on each of the test pads with the corresponding pad on the color chart provided.

1	
Bring all materials and specimens to room temperature.	
2	
Remove the Matrix Cup from sealed foil pouch	
3	
Label the device with patient ID.	
4	5
Remove the lid	Collect the sample and ensure that the sample is above the minimum fill line
	
6	7
Replace the lid and screw the lid tightly and place the urine test cup on a flat surface.	Use the temperature Validator to verify the freshly collected urine. Green indicator shows the temperature detected.
	
8	9
Read the results at 5 minutes.	Remove the result window cover and read the results.
	

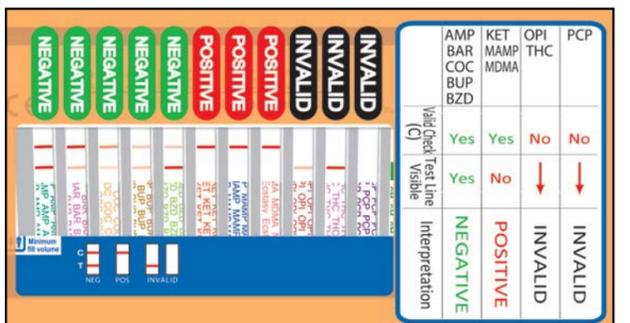
Creatinine: Testing for sample dilution. In this assay, Creatinine reacts with a Creatinine indicator in an alkaline condition to form a purplish-brown color complex. The concentration of Creatinine is directly proportional to the color intensity of the test pad.
Specific Gravity: Testing for sample dilution. This test is based on the apparent pKa change of certain pretreated polyelectrolytes in relation to ionic concentration. In the presence of an indicator, the colors range from dark blue or blue-green in urine of low ionic concentration to green and yellow in urine of higher ionic concentration.
pH: Testing for the presence of acidic or alkaline adulterant. This test is based on the well-known double pH indicator method that gives distinguishable colors over wide pH range. The colors range from orange (low pH) to yellow and green to blue (high pH).
Nitrite: Testing for the presence of exogenous nitrite. Nitrite reacts with an aromatic amine to form a diazonium compound in an acid medium. The diazonium compound in turn couples with an indicator to produce a pink-red/purple color.
Oxidants: Testing for presence of oxidizing reagents. In this reaction, a color indicator reacts with oxidants such as hydrogen peroxide, ferricyanide, persulfate, or pyridinium chlorochromate to form a blue color complex. Other colors may indicate the presence of other oxidants.
Glutaraldehyde: Testing for the presence of exogenous aldehyde. In this assay, the aldehyde group on the Glutaraldehyde reacts with an indicator to form a pink/purple color complex.
Bleach: Testing for the presence of bleach in urine. In this test, the presence of bleach forms a blue-green, brown, or orange color complex.
Pyridinium Chlorochromate: Testing for the presence of Pyridinium Chlorochromate in urine. In this test, the presence of chromate forms a blue-green color complex.
MATERIALS PROVIDED
1. Instructions for use
2. One Matrix Cup, including Temperature Strip (with optional Alcohol and /or Adulteration Test)
Drugs Of Abuse
 The amount of each coated antigen and/or antibody on the strip is less than 1.0 mg for antigen conjugate and is less than 1.0 mg for antibody.

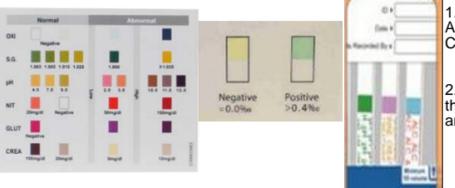
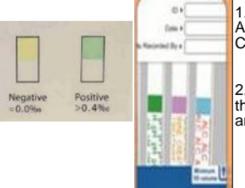
Test zone: contains nitrite antigen conjugates
 Control zone: contains antibody
 Conjugate pad: contains antibody.
Temperature Strip
 Use the temperature validator to verify the freshly collected urine. A visible green indicator shows the temperature detected and indicates the specimen is in the normal temperature range. Conversely, if no green indicator appears within the temperature strip, the temperature is either lower or higher than the normal temperature range (90°F-100°F / 32°C -38°C).
Alcohol (optional)
 Each Alcohol test contains these materials:
 Tetramethylbenzidine (TMB) 0.12 mg
 Alcohol oxidase (EC) 0.5IU
 Peroxidase(EC) 35 IU
 Proteins 0.15mg
Adulteration Test (optional)

3. Alcohol /Adulteration Test Color Chart (When order Alcohol and/or Adulteration Tests)
MATERIAL REQUIRED BUT NOT PROVIDED
 Timer or clock.
STORAGE AND STABILITY
 The Matrix Cup should be stored at 4 to 30°C and will be effective until the expiration date stated on the package. The product is humidity-sensitive and should be used immediately after being open. Any improperly sealed product should be discarded.
PRECAUTIONS
 1. For in vitro diagnostic and forensic use only.
 2. Do not use the product beyond the expiration date.
 3. Handle all specimens as potentially infectious.
 4. Humidity sensitive product. Do not open foil pouch until it is ready to be tested.
 5. Use a new urine specimen cup for each sample to avoid cross contamination.
SPECIMEN COLLECTION AND PREPARATION
 Fresh urine does not require any special handling or pretreatment. Specimen should be collected in a clean, dry, plastic or glass container. If the assay is not performed immediately, urine specimen may be refrigerated at 2-8 °C or frozen up to 7 days. Specimens should be brought to room temperature before testing. Urine specimens exhibiting a large amount of precipitate or turbidity should be centrifuged or allowed to settle before testing. Avoid contact with skin by wearing gloves and proper laboratory attire.

QUALITY CONTROL
 Good Laboratory practice recommends the daily use of control materials to validate the reliability of device. Control materials should be assayed as clinical specimen and challenging to the assay cutoff concentration, e.g., 50% above and below cutoff concentration. If control values do not fall within establish range, assay results are invalid. Control materials which are not provided with this test kit are commercially available.
Drugs of Abuse
 The Matrix Cup provides a built-in process control with a different antigen/antibody reaction at the control region (C). This control line should always appear regardless the presence of drug or metabolite. If the control line does not appear, the test device should be discarded and the obtained result is invalid. The presence of this control band in the control region serve as 1) verification that sufficient volume is added, 2) that proper flow is obtained.
Alcohol
 Alcohol test may be qualitatively verified by using a test solution prepared by adding 0.75 ml of ethanol alcohol into 240 ml of distilled water or negative urine control.
UrineCheck: Adulteration Test(s)
 For best results, performance of UrineCheck test should be confirmed by testing known negative and positive specimens
PROCEDURE

Caution: Results after 10 minutes may not be accurate.
INTERPRETATION OF RESULTS
 Names of drugs on the test could be different depending on the various combination of drugs select

INTERPRETATION OF RESULTS	
DRUGS OF ABUSE	
	Colored bands show on both test line zone and control line zone (top line). This is an indication of negative result for that (those) particular test(s). The negative result does not indicate the absence of drug(s) in the specimen; it only indicates the level of tested drug in the specimen is less than cut-off level.
	One colored band forms in control line zone (top lines) and no colored band forms in test line zone (bottom lines). This is an indication the level of tested drug(s) in the specimen is above cut-off level.
ALCOHOL & ADULTERATION	If there is no colored band in control line zone (top lines), the test result is invalid. Retest the sample with a new device.

ALCOHOL & ADULTERATION		1. Read Reaction Pads against the Alcohol /Adulteration Test Color Chart provided.
		2. Refer to supplied color chart for the level of each index to be tested and check if it is in the normal range.

Note: A borderline(+/-) in test line zone should be considered negative result.

LIMITATION OF PROCEDURE
 The assay is designed for use with human urine only. A positive result with any of the tests indicates only the presence of a drug/metabolite and does not indicate or measure intoxication. There is a possibility that technical or procedural error as well other substances in certain foods and medicines may interfere with the test and cause false results. Please refer "SPECIFICITY" section for lists of substances that will produce either positive results, or that do not interfere with test performance. If a drug/metabolite is found present in the urine specimen, the assay does not indicate frequency of drug use or distinguish between drug of abuse and certain foods and medicines.

EXPECTED RESULTS
 The Matrix Cup is a qualitative assay. It identifies the drug(s) in human urine at its cut-off concentration or higher. The concentration of the drug(s) can not be determined by this assay. The test is intended to distinguish negative result from presumptive positive result. All positive results must be confirmed using an alternate method, preferably GC/MS

PERFORMANCE CHARACTERISTICS
A. Accuracy
 The accuracy of the Matrix Cup was evaluated in each component strip and in comparison to GC/MS method at the following concentration: d-amphetamine 1000ng/ml (AMP), d-amphetamine 500ng/ml (AMP II), secobarbital 300 ng/ml (BAR), oxazepam, 300 ng/ml (BZO), buprenorphine-3-β-d-glucuronide 10ng/ml (BUP), buprenorphine-3-β-d-glucuronide 5ng/ml (BUP II), benzylecgonine 300ng/ml (COC), 7-aminoclonazepam 300 ng/ml (7-ACL), cotinine 100 ng/ml (COT), EDDP 100ng/ml (EDDP), EDDP 300ng/ml (EDDP II), Fentanyl 10ng/ml (FTL), synthetic cannabis 50 ng/ml (K2), Ketamine 1000ng/ml (KET), methadone 300 ng/ml (MTD), (+)methamphetamine 1000 ng/ml (MAMP), (+)methamphetamine 500 ng/ml (MAMP II), MDMA 500ng/ml (MDMA), Methylphenidate 300 ng/ml (MPD), morphine 300 ng/ml (OPI), morphine 2000 ng/ml (OPI II), oxycodone 100ng/ml (OXY), phencyclidine 25 ng/ml (PCP), nor-propoxyphene 300 ng/ml (PPX), 11-nor-Δ⁹-THC-9-COOH 50ng/ml (THC), Tramadol 200 ng/ml (TRA), Nortriptyline 200 ng/ml (TCA), 6-Acetylmorphine 10 ng/ml (6-MAM), Zolpidem Phenyl-4-carboxylic acid 50 ng/ml (ZOL), Lysergic acid diethylamide 20 ng/ml (LSD), 7-Aminoclonazepam 300 ng/ml (7-ACL), Pregabalin 500 ng/ml (PGB), Mescaline 300 ng/ml (MES), 3,4-Methylenedioxypropylvalerone 500 ng/ml (MDPV), Methcathinone 500 ng/ml (MCAT), Mephedrone 500 ng/ml (MEP), Gabapentin 2000 ng/ml (GAB), Carfentanil 500 ng/ml (CFYL), AB-PINACA 25 ng/ml (K2-AB), Caffeine 8000 ng/ml (CAF) Ethyl Glucuronide 500/1000 ng/ml(ETG), JWH-018 and JWH-073 50 ng/ml(K2) Cotinine 200ng/ml(COT), Fentanyl 10 ng/ml(FYL) and Methaqualone 300 ng/ml(MQL) The results of each component strip are listed below:
1.Amphetamine The accuracy of the amphetamine test was evaluated in comparison to GC/MS method and commercial kits at a cut-off of 1000 ng/ml. Three hundred and forty five (345) urine specimens which composed of one hundred and thirty three (133) d-amphetamine positive samples and two hundred and twelve (121) negative samples were evaluated in this study. The results are summarised and presented below: Positive % agreement:98.5, Negative % agreement: 100
2.Amphetamine II The accuracy of the amphetamine test was evaluated in comparison to GC/MS method and commercial kits at a cut-off of 500 ng/ml. Three hundred and forty five (345) urine specimens which composed of one hundred and thirty (130) d-amphetamine positive samples and two hundred and fifteen (215) negative samples were evaluated in this study. The results are summarised and presented below: Positive % agreement: 98, Negative % agreement: 100
3.Barbiturate The accuracy of the barbiturate test was evaluated in comparison to GC/MS method and commercial kits at a cut-off of 300 ng/ml of secobarbital. One hundred and thirteen (113) urine specimens which composed of sixty four (64) barbiturate positive samples and forty nine (49) negative samples were evaluated in this study. The results are summarised as below: Positive % agreement: 100, Negative % agreement: 100.
4.Benzodiazepine The accuracy of the benzodiazepine test was evaluated in comparison to GC/MS method and commercial kits at a cut-off of 300 ng/ml of oxazepam. Three hundred and forty four (344) urine specimens which composed of one hundred and eleven (111) benzodiazepine positive samples and two hundred and thirty three (233) negative samples were evaluated in this study. The results are summarised as below: Positive % agreement: 98, Negative % agreement: 100
5.Buprenorphine The accuracy of the buprenorphine test was evaluated in comparison to GC/MS at a cut-off of 10 ng/ml of buprenorphine-3-β-d-glucuronide. One hundred and one (101) urine specimens which composed of forty nine (49) buprenorphine-3-β-d-glucuronide positive samples and fifty two (52) negative samples were evaluated in this study. The results are summarised as below:Positive % agreement: 96, Negative % agreement: 100.
6.Buprenorphine II The accuracy of the buprenorphine test was evaluated in comparison to GC/MS at a cut-off of 5 ng/ml of buprenorphine-3-β-d-glucuronide. One hundred (100) urine specimens which composed of fifty (50) buprenorphine-3-β-d-glucuronide positive samples and fifty (50) negative samples were evaluated in this study. The results are summarized as below:
 Positive % agreement: 97, Negative % agreement: 99.
7.Cocaine The accuracy of the cocaine test was evaluated in comparison to GC/MS method and commercial kits at a cut-off of 300 ng/ml of benzylecgonine. Three hundred and forty four (344) urine specimens which composed of one hundred and twenty one (121) benzylecgonine positive samples and two hundred and twenty three (223) negative samples were evaluated in this study. The results are summarised as below:Positive % agreement: 99, Negative % agreement: 99
8.Clonazepam The accuracy of the clonazepam test was evaluated in forty (40) drug free urine samples and forty (40) 7-aminoclonazepam spiked urine specimens. Forty (40) urine specimens were spiked with 7-aminoclonazepam from 50 to 2500 ng/ml. Thirty (30) samples with 7-aminoclonazepam concentration between 450 and 2500 ng/mL were all found positive. Forty (40) clonazepam free urine sampels and ten (10) samples with 7-aminoclonazepam concentration between 50 and 150 ng/mL were all found negative. The results are summarized as below: Positive agreement: 100%, Negative agreement: 100%
9.Cotinine The accuracy of the Cotinine Test was evaluated in forty (40) drug free urine samples and forty (40) cotinine spiked urine specimens. Forty (40) urine specimens were spiked with cotinine from 10 to 2000 ng/ml. 30 samples with cotinine concentration between 300 and 2000 ng/mL were all found positive. Forty (40) cotinine free urine samples and 10 samples with cotinine concentration between 10 and 50 ng/mL were all found negative. The results are summarized as below: Positive agreement: 100%, Negative agreement: 100%
10.EDDP The accuracy of the methadone metabolite (EDDP) test was evaluated in comparison to GC/MS method at a cut-off of 100 ng/mL EDDP. Ninety nine (99) specimens which composed of forty four (44) positive samples and forty five (45) negative samples were evaluated in this study. The results are summarised as below: Positive % agreement: 98, Negative % agreement: 100
11.EDDP II The accuracy of the methadone metabolite (EDDP) test was evaluated in comparison to GC/MS method at a cut-off of 300 ng/mL EDDP. Ninety nine (99) specimens which composed of forty three (43) positive samples and forty six (46) negative samples were evaluated in this study. The results are summarised as below: Positive % agreement: 98, Negative % agreement:100
12.Fentanyl The accuracy of the Fentanyl (FTL) Test was evaluated in forty (40) drug free urine samples and forty (40) fentanyl spiked urine specimens. Forty (40) fentanyl urine specimens were spiked with norfentanyl from 2 to 200 ng/ml. 35 samples with norfentanyl concentration between 15 and 200 ng/mL were all found positive. Forty (40) fentanyl free urine samples and 5 samples with norfentanyl concentration between 2 and 5 ng/mL were found negative. The results are summarized as below:
 Positive agreement: 100%, Negative agreement: 100%
13.K2 The accuracy of the K2 Test was evaluated in forty (40) drug free urine specimens and forty (40) K2 spiked urine specimens. Forty (40) K2 urine specimens were spiked with JWH-018 pentanoic acid or JWH-713 butanoic acid from 10 to 150 ng/ml. 30 samples with JWH-018 pentanoic acid or JWH-073 butanoic acid concentration between 50 and 150 ng/mL were all found positive, 10 samples with JWH-018 pentanoic acid or JWH-073 butanoic acid concentration between 10 and 37.5 ng/mL and 40 drug free urine specimens were all found negative. The results are summarized as below: Positive agreement: 100%, Negative agreement: 100%
Ketamine The accuracy of the ketamine test was evaluated in comparison to GC/MS method and commercial kits at a cut-off of 1000 ng/ml of ketamine. Three hundred and forty four (344) urine specimens which composed one hundred and twenty seven (127) ketamine positive samples and two hundred and seventeen (217) negative samples were evaluated in this study. The results are summarised as below: Positive % agreement: 99, Negative % agreement: 100
MDMA The accuracy of the MDMA test was evaluated in comparison to GC/MS at a cut-off of 500 ng/ml of (+)methylenedioxyamphetamine. Eighty (80) urine specimens with GC/MS confirmed MDMA concentration were evaluated in this study. The results are summarised and presented below: Positive % agreement: 96, Negative % agreement: 95
Methadone The accuracy of the methadone test was evaluated in comparison to GC/MS method and commercial kits at a cut-off of 300 ng/ml of methadone. Three hundred and forty four (344) urine specimens which composed of one hundred and eighty seven (187) methadone positive samples and one hundred and fifty seven (157) negative samples were evaluated in this study. The results are summarised as below: Positive % agreement: 100, Negative % agreement: 100.
Methamphetamine The accuracy of the methamphetamine test was evaluated in comparison to GC/MS method and commercial kits at a cut-off of 1000 ng/ml of (+)methamphetamine. Three hundred and forty four (344) urine specimens which composed of one hundred and twenty eight (128) methamphetamine positive samples and two hundred and sixteen (216) negative samples were evaluated in this study. The results are summarised as below: Positive % agreement: 98, Negative % agreement: 100
Methamphetamine II The accuracy of the methamphetamine test was evaluated in comparison to GC/MS method and commercial kits at a cut-off of 500 ng/ml of (+) methamphetamine. Three hundred and forty four (344) urine specimens which composed of one hundred and twenty five (125) methamphetamine positive samples and two hundred and nineteen (219) negative samples were evaluated in this study. The results are summarised as below: Positive % agreement: 98, Negative % agreement: 99
Methylphenidate The accuracy of the Methylphenidate (MPD) Test was evaluated in forty (40) drug free urine specimens and forty (40) MPD spiked urine specimens. Forty (40) MPD urine specimens were spiked with methylphenidate from 50 to 1500 ng/ml. Thirty (30) samples with MPD concentration between 450 and 1500 ng/mL were all found positive. Ten (10) samples with MPD concentration between 50 and 150 ng/mL and forty (40) drug free negative urine specimens were all found negative. The results are summarized as below:
 Positive agreement: 100%, Negative agreement: 100%
Opiate The accuracy of the opiate test was evaluated in comparison to GC/MS method and commercial kits at a cut-off of 300 ng/ml of morphine. Three hundred and forty four (344) urine specimens which composed of one hundred and fifty nine (159) opiate positive samples

and one hundred and eighty five (185) negative samples were evaluated in this study. The results are summarised as below:
 Positive % agreement: 99, Negative % agreement: 99
Opiate II The accuracy of the opiate II test was evaluated in comparison to GC/MS method and commercial kits at a cut-off of 2000 ng/ml of morphine. One hundred and eight (108) urine specimens which composed of fifty three (53) opiate positive samples and fifty five (55) negative samples were evaluated in this study. The results are summarised as below:
 Positive % agreement: 94, Negative % agreement: 100.0.
Oxycodone The accuracy of the oxycodone test was evaluated in comparison to GC/MS method and commercial kits at a cut-off of 100 ng/ml of oxycodone. One hundred and forty four (140) urine specimens which composed of fifty eight (58) oxycodone positive samples and eighty two (82) negative samples were evaluated in this study. The results are summarized as below:
 Positive % agreement: 100, Negative % agreement: 95
Phencyclidine The accuracy of the PCP test was evaluated in comparison to GC/MS method and commercial kits at a cut-off of 25 ng/ml of phencyclidine. Eighty (80) urine specimens which composed of thirty five (35) phencyclidine positive samples and forty five (45) negative samples were evaluated in this study. The results are summarised as below: Positive % agreement: 98, Negative % agreement:95
Propoxyphene The accuracy of the propoxyphene test was evaluated in comparison to GC/MS method at a cut-off of 300 ng/ml of nor-propoxyphene. Ninety one (91) propoxyphene positive specimens with GC/MS confirmed nor-Propoxyphene concentration and forty (40) were evaluated in this study. The results are summarised as below: Positive % agreement: 100, Negative % agreement:100
THC The accuracy of the THC test was evaluated in comparison to GC/MS method and commercial kits at a cut-off of 50 ng/ml of 11-nor-Δ⁹-THC-9-COOH. Three hundred and forty four (344) urine specimens which composed of seventy eight (78) THC positive samples and two hundred sixty six (266) negative samples were evaluated in this study. The results are summarised as below:
 Positive % agreement: 100, Negative % agreement: 99
Tramadol The accuracy of the tramadol test was evaluated in comparison to GC/MS at a cut-off of 200 ng/ml of tramadol Eighty one (81) urine specimens with GC/MS confirmed tramadol concentration were evaluated in this study. The results are summarised and presented below: Positive % agreement: 95, Negative % agreement: 98
TCA The accuracy of the TCA test was evaluated in comparison to GC/MS at a cut-off of 1000 ng/ml of Nortriptyline. One hundred (100) urine specimens with GC/MS confirmed Nortriptyline concentration were evaluated in this study. The results are summarised and presented below: Positive % agreement: 98, Negative % agreement: 95
19. 6-MAM The accuracy of the 6-MAM test was evaluated in comparison to GC/MS at a cut-off of 10 ng/ml of 6-Acetylmorphine. One hundred and twenty one (121) urine specimens with GC/MS confirmed 6-Acetylmorphine concentration were evaluated in this study. The results are summarised and presented below: Positive % agreement: 97, Negative % agreement: 100
20. ZOL The accuracy of the ZOL test was evaluated in comparison to GC/MS at a cut-off of 50 ng/ml of Zolpidem Phenyl-4-carboxylic acid. Ninety six (96) urine specimens with GC/MS confirmed Zolpidem Phenyl-4-carboxylic acid concentration were evaluated in this study. The results are summarised and presented below:
 Positive % agreement: 98, Negative % agreement: 99
21. LSD The accuracy of the LSD test was evaluated in comparison to GC/MS at a cut-off of 20 ng/ml of Lysergic acid diethylamide. Ninety five (95) urine specimens with GC/MS confirmed Lysergic acid diethylamide concentration were evaluated in this study. The results are summarised and presented below:
 Positive % agreement: 96, Negative % agreement: 98
22. 7-ACL The accuracy of the 7-ACL test was evaluated in comparison to GC/MS at a cut-off of 300 ng/ml of 7-Aminoclonazepam. One hundred (100) urine specimens with GC/MS confirmed 7-Aminoclonazepam concentration were evaluated in this study. The results are summarised and presented below:
 Positive % agreement: 99, Negative % agreement: 100
23. PGB The accuracy of the PGB test was evaluated in comparison to GC/MS at a cut-off of 500 ng/ml of Pregabalin. One hundred and thirty two (132) urine specimens with GC/MS confirmed Pregabalin concentration were evaluated in this study. The results are summarised and presented below:
 Positive % agreement: 96, Negative % agreement: 98
24. MES The accuracy of the MES test was evaluated in comparison to GC/MS at a cut-off of 300 ng/ml of Mescaline. One hundred and nine (109) urine specimens with GC/MS confirmed Mescaline concentration were evaluated in this study. The results are summarised and presented below:
 Positive % agreement: 98, Negative % agreement: 100
25. MDPV The accuracy of the MDPV test was evaluated in comparison to GC/MS at a cut-off of 500 ng/ml of 3,4-Methylenedioxypropylvalerone. One hundred and six (106) urine specimens with GC/MS confirmed 3,4-Methylenedioxypropylvalerone concentration were evaluated in this study. The results are summarised and presented below:
 Positive % agreement: 99, Negative % agreement: 100
26. MCAT The accuracy of the MCAT test was evaluated in comparison to GC/MS at a cut-off of 500 ng/ml of Methcathinone. Eighty eight (88) urine specimens with GC/MS confirmed Methcathinone concentration were evaluated in this study. The results are summarised and presented below:
 Positive % agreement: 100, Negative % agreement: 97
27. MEP The accuracy of the MEP test was evaluated in comparison to GC/MS at a cut-off of 500 ng/ml of Mephedrone. Two hundred and three (203) urine specimens with GC/MS confirmed Mephedrone concentration were evaluated in this study. The results are summarised and presented below:
 Positive % agreement: 97, Negative % agreement: 99
28. GAB The accuracy of the GAB test was evaluated in comparison to GC/MS at a cut-off of 2000 ng/ml of Gabapentin. One hundred and fifty nine (159) urine specimens with GC/MS confirmed Gabapentin concentration were evaluated in this study. The results are summarised and presented below:
 Positive % agreement: 97, Negative % agreement: 100
29. CFYL The accuracy of the CFYL test was evaluated in comparison to GC/MS at a cut-off of 500 ng/ml of Carfentanil. One hundred and seventy eight (178) urine specimens with GC/MS confirmed Carfentanil concentration were evaluated in this study. The results are summarised and presented below:
 Positive % agreement: 98, Negative % agreement: 100
30. K2-AB The accuracy of the K2-AB test was evaluated in comparison to GC/MS at a cut-off of 25 ng/ml of AB-PINACA. Two hundred and twenty five (225) urine specimens with GC/MS confirmed AB-PINACA concentration were evaluated in this study. The results are summarised and presented below:
 Positive % agreement: 99, Negative % agreement: 98
31. CAF The accuracy of the CAF test was evaluated in comparison to GC/MS at a cut-off of 8000 ng/ml of Caffeine. One hundred and ninety four (194) urine specimens with GC/MS confirmed Caffeine concentration were evaluated in this study. The results are summarised and presented below:
 Positive % agreement: 95, Negative % agreement: 100
32. ETG The accuracy of the ETG test was evaluated in comparison to GC/MS at a cut-off of 500/1000 ng/ml of Ethyl-β-D-glucuronide. One hundred and eighty (180) urine specimens with GC/MS confirmed Ethyl-β-D-glucuronide concentration were evaluated in this study. The results are summarised and presented below:
 ETG500 Positive % agreement: 97, Negative % agreement: 100 ETG1000 Positive % agreement: 97, Negative % agreement: 100
33. K2 The accuracy of the K2 test was evaluated in comparison to GC/MS at a cut-off of 50 ng/ml of JWH-018-5 pentanoic. One hundred and fifty-five (155) urine specimens with GC/MS confirmed JWH-018-5 pentanoic concentration were evaluated in this study. The results are summarised and presented below:
 Positive % agreement: 98, Negative % agreement: 98
34. COT The accuracy of the COT test was evaluated in comparison to GC/MS at a cut-off of 200 ng/ml of (-)-Cotinine. One hundred and sixty (160) urine specimens with GC/MS confirmed (-)-Cotinine concentration were evaluated in this study. The results are summarised and presented below:
 Positive % agreement: 99, Negative % agreement: 100
35. FYL The accuracy of the FYL test was evaluated in comparison to GC/MS at a cut-off of 200 ng/ml of Fentanyl. One hundred and seventy-five (175) urine specimens with GC/MS confirmed Fentanyl concentration were evaluated in this study. The results are summarised and presented below:
 Positive % agreement: 99, Negative % agreement: 100
36. MQL The accuracy of the MQL test was evaluated in comparison to GC/MS at a cut-off of 300 ng/ml of Methaqualone. Two hundred and five (205) urine specimens with GC/MS confirmed Methaqualone concentration were evaluated in this study. The results are summarised and presented below:
 Positive % agreement: 100, Negative % agreement: 98

B. Sensitivity
The cut-off concentrations (sensitivity level) of the DOA/Alcohol Panel Test Device are determined to be: AMP 1000 ng/ml, BAR, 300 ng/ml, BZO 300 ng/ml, BUP 10 ng/ml, COC 300 ng/ml, EDDP 100 ng/ml, KET 1000 ng/ml, MET 1000 ng/ml, MDMA 500 ng/ml, OPI 300 ng/ml, OPI II 2000 ng/ml, OXY 100 ng/ml, PCP 25 ng/ml, PPX 300 ng/ml, THC 50 ng/ml, 200ng/ml of TRA and TCA 1000 ng/ml. 6-MAM 10 ng/ml, ZOL 50 ng/ml, LSD 20 ng/ml, 7-ACL 300 ng/ml, PGB 500 ng/ml, MES 300 ng/ml, MDPV 500 ng/ml, MCAT 500 ng/ml, MEP 500 ng/ml, GAB 2000 ng/ml, CFYL 500 ng/ml, K2-AB 25 ng/ml and CAF 8000 ng/ml. ETG 500/1000 ng/ml, K2 50 ng/ml, COT 200 ng/ml, FYL 10 ng/ml and MQL 300 ng/ml.

C. Precision
The precision of the Matrix Cup was determined by conducting the test with spiked controls and interpreted the results by three individuals to verify the random error of visual interpretation. The results of 40 samples each of 50% above and 50% below cut-off specimens are 100% agreed by three observers. The test results were found to have no significant differences between these three observers.

D. Specificity
The specificity for the Matrix Cup was tested by adding various drugs, drug metabolites, and other compounds that are likely to be present in urine. All compounds were prepared in drug-free normal human urine.

1. Interference testing

The performance of the Matrix Cup at cut-off level is not affected when pH and Specific Gravity ranges of urine specimen are at 4.5 to 9.0 and 1.005 to 1.035.

The following substances were tested and confirmed did not interfere with the Matrix Cup at the concentrations listed below.

Glucose	2000mg/ml	Human albumin	2000mg/dl
Human hemoglobin	10mg/dl	Urea	4000mg/dl
Uric acid	10mg/dl		

2. Specificity

The following table lists compounds that are detected by the Matrix Cup which produced positive results when tested at levels equal or greater than the concentrations listed below

Tests	Compounds	Cut-off (ng/ml)	
Amphetamine	D-Amphetamine	1,000	
	l-Amphetamine	>100,000	
	d-methamphetamine	>100,000	
	l-methamphetamine	>100,000	
	3,4-Methylenedioxyamphetamine	1,250	
	3,4-Methylenedioxy-methamphetamine	>100,000	
	3,4-Methylenedioxyethylamphetamine	>100,000	
	Paramethoxyamphetamine	625	
	Phentermine	1250	
	Tyramine	>100,000	
	Barbiturate	Secobarbital	300
		Allobarbitol	1250
		Alphenal	625
Amobarbital		625	
Aprobarbital		188	
Butabarbital		94	
Butalbital		2500	
Butethal		200	
Cyclopentobarbital		400	
Pentobarbital		1,000	
Phenobarbital		300	
Buprenorphine		Buprenorphine	5
		Buprenorphine-3-β-D-Glucuronide	5
	Norbuprenorphine	25	
	Norbuprenorphine-3-β-D-Glucuronide	50	
	Benzoxiazepines	Oxazepam	300
Alprazolam		125	
Bromazepam		625	
Chlordiazepoxide		2500	
Clobazam		63	
Clonazepam		2500	
Clorazepate		3330	
Desalkylurazepam		250	
Diazepam		250	
Estazolam		5000	
Fentanyl		>100,000	
Flunitrazepam		375	
Flurazepam		>100,000	
Lorazepam		1250	
Lormetazepam		1250	
Medazepam		>100,000	
Midazolam		>100,000	
Nitrazepam		25000	
Norchlordiazepoxide		250	
Nordiazepam		500	
Prazepam		>100,000	
Temazepam	63		
Triazolam	5000		
Cocaine	Benzoyllecgonine	300	
	Cocaine	1,000	
	Ecgonine	100,000	
	Ecgonine Methyl Ester	>100,000	
	EDDP	100	
EDDP	Meperidine	>100,000	
	Methadone	>100,000	
	Norfentanyl	>100,000	
	Phencyclidine	>100,000	

Ketamine	Promazine	50000	
	Promethazine	25000	
	Prothipendyl	50,000	
	Prozine	12500	
	Ketamine	1,000	
MDMA	Norketamine	1,000	
	Dextromethorphan	500	
	3,4-Methylenedioxy-methamphetamine	500	
	d-Amphetamine	>100,000	
	l-Amphetamine	>100,000	
	d-methamphetamine	>100,000	
	l-methamphetamine	>100,000	
	3,4-Methylenedioxyamphetamine	2,500	
	3,4-Methylenedioxyethylamphetamine	156	
	Paramethoxyamphetamine	50,000	
	Paramethoxymethamphetamine	>100,000	
	Methamphetamine	d-Methamphetamine	1,000
		Chloroquine	25,000
Fenfluramine		12,500	
l-Methamphetamine		1,000	
Mephentermine hemisulfate salt		31250	
3,4-Methylenedioxyethylamphetamine		50000	
3,4-Methylenedioxy-methamphetamine		313	
Paramethoxymethamphetamine		625	
(-) Ephedrine		4000	
Methadone		300	
(-)-alpha-methadol		2,000	
Methadone		Morphine	300
		Acetylcodeine	150
	Buprenorphine	>10000	
	Codeine	250	
	Diacetyl Morphin	250	
	Dihydrocodeine	586	
	Ethylmorphine	200	
	Hydrocodone	12500	
	Hydromorphone	12500	
	6-Monoacetylmorphine	250	
	Morphine-3-glucuronid	2500	
	Nalorphine	25000	
	Thebaine	25000	
Opiate	Morphine	1000	
	Acetylcodeine	1000	
	Buprenorphine	>10000	
	Codeine	1000	
	Diacetylmorphine (Heroin)	3000	
	Dihydrocodeine	1000	
	Ethylmorphine	200	
	Hydromorphone	25000	
	Hydrocodone	50000	
	Merperidine	>100,000	
	6-Monoacetylmorphine (6-MAM)	3000	
	Morphine-3-β-d-glucuronide	10000	
	Nalorphine Hydrochloride	>100,000	
	Oxycodone	>100,000	
	Oxymorphone	>100,000	
	Rifampicine	>100,000	
	Thebaine	50000	
	Opiate II	Morphine	1000
		Acetylcodeine	1000
		Buprenorphine	>10000
		Codeine	1000
Diacetylmorphine (Heroin)		3000	
Dihydrocodeine		1000	
Ethylmorphine		200	
OXY100	Hydromorphone	25000	
	Hydrocodone	50000	
	Merperidine	>100,000	
	6-Monoacetylmorphine (6-MAM)	3000	
	Morphine-3-β-d-glucuronide	10000	
	Nalorphine Hydrochloride	>100,000	
	Oxycodone	>100,000	
	Oxymorphone	>100,000	
	Rifampicine	>100,000	
	Thebaine	50000	
	PCP	Oxycodone	100
		Hydrocodone	6250
		Hydromorphone	50000
Naloxone		50000	
Oxymorphone		250	
Propoxyphene	Phencyclidine	25	
	Hydrocodone	>100,000	
	Hydromorphone	>100,000	
	4-hydroxyphencyclidine	75	
	D-Propoxyphene	300	
TCA	D-Norpropoxyphene	5000	
	Nortriptyline HCl	1000	
	Amitriptyline	150	
	Clomipramine	>100000	
	Cyclobenzaprine	12500	
	Desipramine	188	
	Doxepin	2000	
	Imipramine	2500	
	Maprotiline	750	
	Nortriptyline	3125	
	Nordoxepin	500	

THC	Opipramol	1563	
	Promazine	1000	
	Promethazine	6250	
	Prothipendyl	25000	
	Protroptiline	6250	
	Prozine	1250	
	Trimipramine	>100,000	
	11-nor-Δ9-THC-9-COOH	25	
	11-nor-Δ8-THC-9-COOH	15	
	Δ 8-Tetrahydrocannabinol	7500	
Tramadol	Δ 9-Tetrahydrocannabinol	7500	
	Cannabinol	10000	
	Cis-Tramadol	200	
	N-Desmethyl-cis tramadol	500	
	O-Desmethyl-cis tramadol	20,000	
	Netrexone	10,000	
	Tetrahydrozoline	10,000	
	Dihydrocodeine	50,000	
	6-MAM	6-Monoacetylmorphine	10
	Acetylcodeine	>10,000	
Buprenorphine	>10,000		
Codeine	>10,000		
Diacetylmorphine	1000		
Dihydrocodeine	>10,000		
Ethylmorphine	>10,000		
Hydrocodone	>10,000		
Hydromorphone	5000		
Morphine	10000		
Morphine-3-glucuronide	>10,000		
Nalorphine	5000		
Thebaine	>20,000		
ZOL	Zolpidem Phenyl-4-carboxylic	50	
	Zolpidem	>10,000	
LSD	Lysergic acid diethylamide	20	
7-ACL	7-amine-clonazepam	300	
	Oxazepam	>10,000	
	Alprazolam	>10,000	
	Bromazepam	>10,000	
	Chlordiazepoxide	>10,000	
	Clobazam	>10,000	
	Clonazepam	10,000	
	Clorazepate dipotassium	>10,000	
	Desalkylflurazepam	>10,000	
	Diazepam	>10,000	
	Estazolam	>10,000	
	Flunitrazepam	>50,000	
	(±) Lorazepam	10,000	
	Midazolam	>100,000	
	Nitrazepam	>10,000	
	Norchlordiazepoxide	>100,000	
	Nordiazepam	>100,000	
	Temazepam	>10,000	
	PGB	Pregabalin	500
	MES	Mescaline	300
	MDPV	MDPV	500
MCAT	Methcathinone	500	
	4-MMC (Mephedrone)	520	
	3-MMC (3-methylmethcathinone)	500	
	4-MEC (4-methylethcathinone)	550	
	Cathinone	>100,000	
MEP	Mephedrone	500	
	Methcathinone	500	
GAB	Gabapentin	2000	
	Pregabalin	>100000	
	CarFentanyl	500	
CFYL	Fentanyl	100	
	AB- PINACA	25	
	AB-Fubinaca	40	
	UR-144 5-Pentanoic acid metabolite	5,000	
	UR-144	>10,000	
K2-AB	AKB48	>10,000	
	Caffeine	8,000	
	Theophylline	100,000	

ETG	Ethyl Glucuronide	500
	Ethanol	>100,000
	D-Glucuronic Acid	>100,000
	Morphine-3-b-D-glucuronide	>100,000
ETG II*	Ethyl Glucuronide	1000
FYL	Fentanyl and Fentanyl metabolites	10
	Fentanyl	100
	Norfentanyl	>10,000
COT	(-)-Cotinine	200
	(-)-Nicotine	6250
MQL	Methaqualone	300
	Amitriptyline	50,000
	Carbamazepine	20,000
	Nortriptyline	50,000
	Phenytoin	40,000
	Theophylline	40,000

1. Interference testing

The performance of the DOA/Alcohol Panel Test Device at cut-off level is not affected when pH and Specific Gravity ranges of urine specimen are at 4.5 to 9.0 and 1.005 to 1.035.

The following substances were tested and confirmed did not interfere with the DOA/Alcohol Panel Test Device at the concentrations listed below.

Glucose	2000 mg/dl
Human albumin	2000 mg/dl
Human hemoglobin	10 mg/dl
Urea	4000 mg/dl
Uric acid	10 mg/dl

2. Specificity

The following table lists compounds that are detected by the DOA/Alcohol Panel Test Device which produced positive results when tested at levels equal or greater than the concentrations listed below:

The following compounds show no cross-reactivity at concentrations up to 100 ug/mL unless specified in the table above.

REFERENCES

- Urine testing for drugs of abuse, NIDA Research Monograph 73 (1986)
- Steven B. Karch, Drugs of abuse hand book, CRC Press, 1st. Ed. (1998)
- Ray H. Liu and Bruce A. Goldberger, Handbook of workplace drug testing, AACC Press, Washington DC (1995)



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