

Not My Urine!

Introduction

In the United States, more than 12 million individuals are subject to mandatory drug testing under the Department of Transportation (DOT) guidelines. These individuals are generally employed in safety-sensitive positions and include truck drivers, airline pilots, bus drivers, mass transit operators, railroad engineers, pipeline workers and mariners.

Human urine is frequently the sample of choice for drug screening tests. Because of the importance of drug testing and the significant consequences of a positive urinalysis test, the results are frequently disputed. A common allegation is that the laboratory mislabeled the urine specimen. DNA typing of a urine specimen is the only method with sufficient discrimination to be of value in matching or disproving the biological origin of a sample.



Mislabeling of Samples

Mislabeling of samples is a pre-analytical error that has plagued the laboratory testing industry as a whole for decades. While the mislabeling error rate from the drug testing laboratory is unknown, the Departments of Pathology and Emergency Medicine at the University Hospitals of Cleveland, Cleveland, OH conducted an internal study of their emergency and non-emergency accessions in 2004. The results of this study showed a 0.36% mislabeling rate in emergency samples and a 0.037% error in non-emergency samples.

A poignant example of the impact that mislabeling can have is illustrated in the Lazaro Sotolusson case. In 2002, Lazaro Sotolusson was scheduled to be tried in two sexual assaults involving juvenile victims. DNA evidence formed the heart of the prosecution's case, and Sotolusson faced multiple life terms if convicted. A sample labeling error was detected by an expert retained by Deputy Public Defenders. Authorities acknowledged that a clerical error at a Nevada forensics lab led to a man being jailed for a year for sex crimes he did not commit. Prosecutors dismissed the charges, acknowledging that the police lab accidentally had placed Sotolusson's name on another man's DNA sample.

DNA in Urine

Urine often contains very low numbers of nucleated cells such as epithelial cells and leukocytes. The presence of these cells makes DNA typing of urine possible, provided that the urine is properly stored after collection.

By comparing the DNA profile in the urine sample to that of a buccal reference sample collected from the claimant, accurate claim resolution can be made efficiently. Chromosomal Laboratories tests a minimum of

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Technical Bulletin 40-007.1

Setting the Standard for Quality DNA Identification

16 DNA markers in routine testing. The 16 marker technology can achieve a probability of identity of 1 in 40 quintillion, or 1 in 40,000,000,000,000,000,000.

DNA Stability in Urine

As urine samples are typically not sterile, coupled with the fact that they likely contain endogenous nucleases, DNA degradation can occur, if the sample is not properly stored or preserved. The following table shows the stability of DNA over time in various preservation systems. ¹

Storage (Weeks)	Storage and Preservation System										
	Room Temperature				Refrigeration (4°C)				Frozen (-30to -80°C)		
	None	NaN ₃	EDTA	NaN ₃ + EDTA	None	NaN ₃	EDTA	NaN ₃ + EDTA	None	NaN ₃	NaN ₃ + EDTA
0	+	+	+	+	+	+	+	+	+	+	+
1	-	+	-	+	+	+	+	+	+	+	+
2	-	+	-	+	+	+	+	+	+	+	+
3	-	-	-	-	+	+	+	+	+	+	+
4	-	-	-	-	-	+	-	+	+	+	+
5	-	-	-	-	-	+	-	+	+	+	+

+ = DNA present, - = no DNA present

Sample Collection and Handling

Urine should be kept frozen and shipped on dry-ice via priority overnight courier service during the week. Urine should not be shipped over a weekend. If possible, all of the available urine specimen should be sent because the volume of urine can be critical to the test outcome. The more urine available to test, the greater the likelihood that a DNA profile can be obtained.

Precautions and Limitations

- Prolonged storage of urine at room temperature or refrigerated temperature can result in DNA degradation.
- Urine is not a strong source of DNA. DNA profiles recovered from urine stained objects may or may not be attributable to the urine.

References

1. Yasuda, T, Iida, R, Takeshita, H, Ueki, M, Nalajima, T, Kaneko, Y, Mogi, K, Tsukahara, T, and Kishi, K. Journal of Forensic Science (2003). A Simple Method of DNA Extraction and STR Typing from Urine Samples Using a Commercially Available DNA/RNA Extraction Kit. 48, 1-3.



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Chromosomal Laboratories, Inc
 1825 W. Crest Lane
 Phoenix, Arizona 85027
 877-434-0292
 623-434-0292
www.chromosomal-labs.com