G104 A Comparison Study on the Performance of STR Typing Kits With Improved Buffer Systems

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After attending this presentation, attendees will gain information regarding STR typing kits with improved buffer systems which offer better tolerance to inhibitors commonly encountered in forensic casework samples.

This presentation will impact the forensic science community by discussing how studies showed the improved buffer systems in these newly developed kits are promising and could be employed for DNA typing of challenging samples.

DNA fingerprinting, since its introduction in the 1980s, has frequently been employed by forensic scientists to assist in the identification of individuals. Analysis of Short Tandem Repeats (STR) using Polymerase Chain Reaction (PCR) technique, which enables minute quantities of DNA to be detected, has replaced the Restricted Fragment Length Analysis (RFLP) technique since the mid 1990s. Though powerful in assisting forensic investigations, DNA fingerprinting is not straightforward.

One of the challenges of DNA fingerprinting is that, in many forensic cases, the DNA samples are far from pristine. Amplification of compromised samples can result in poor or no genotyping results, whereas amplification in the presence of inhibitors can even lead to loss in signals. The first issue has been overcome by the introduction of the analysis of STR with shortened amplicons, which are optimized for genotyping degraded samples. Meanwhile, several new STR typing kits with modified buffer systems claiming improved tolerance to inhibitors commonly encountered in forensic casework samples have been introduced to the market in recent years.

To study if these newly developed kits will perform better than the one currently being used in the laboratory (which has been on the market since 2001), three newly developed kits, A, B, and C from three companies,were selected and their performance compared in the following aspects: (1) detection sensitivity; (2) PHR, (3) stutter ratio; (4) intra-/inter-color balance; (5) concordance of typing results; (6) tolerance to inhibition by hematin and humic acid; and, (7) performance for challenging samples. A total of 35 samples were employed in this study, and were amplified according to the conditions as suggested by the respective manufacturers. The amplified products were injected into a genetic analyzer commonly used in forensic DNA analysis, and the data were analyzed with the software provided.

In summary, as compared to the STR kit currently used in the laboratory, all three tested kits demonstrated improved detection sensitivity with comparable PHR in various amounts of input DNA (0.125, 0.25, 0.5, and 1ng). They exhibited better tolerance to inhibition by hematin and humic acid, and showed obvious improvement in the analysis of challenging samples. In addition, full concordance was observed in a total of 375 STR allele calls in the analyses. Among the three kits, kit A displayed the best intra-/inter-color balance, the highest tolerance to inhibition by hematin and humic acid, and the greatest improvement in the analysis of challenging samples. It is noteworthy to mention that, although kits B and C (with increased PCR cycle numbers) showed greater enhancement in sensitivity, the stutter ratios of these kits were also elevated as compared with kit A. To conclude, studies showed that with the modified buffer systems, the performance of all these newly developed kits are comparable and even better than the currently used STR typing kit. In addition, they demonstrated improved performance in the analysis of challenging samples. Therefore, all are suitable candidates for the selection of the next generation STR typing kit in the laboratory.

STR, Inhibition, Tolerance

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