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Extraction and Quantification of DNA from Touched Cell Phones Surfaces

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Abstract: Touched mobile surfaces became part of crime scene evidences which analyzed by forensic scientists. The minimal amount of DNA required for full STR profile is 0.2-0.5ng. The aim of this work is to quantitate the amount of DNA isolated from three touched mobiles brands (iPhone, Samsung, and Sony) surfaces using Organic and Chelex DNA extraction methods. The results showed that organic method extract more DNA than Chelex from Samsung mobile surface and fewer amounts from iPhone and Sony. Quantification of DNA by Real time PCR was more accurate with quantities near the minimal amount required for full profile analysis. STR analysis showed a partial DNA profile recovered from all cell phones brands. The results indicate the possibility of obtain suitable quantities of DNA from cell phone surface.

Keywords: Forensic, DNA, STR, Mobile, Scene.

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Introduction

Touched surfaces became part of crime scene (1). Small amount of DNA usually extracted from touched surfaces which sometimes produce no or partial STR profile. The minimal amounts of DNA required for full STR profile are 1-2.5ng (2). Mobiles a now part of personal stuff and became part of crime scene. Previous studies showed that partial or full STR profile may or may not generated during analysis of touched mobile surfaces (3). Analysis of touched surfaces involve steps should be optimized to generate full STR profile (4). This work aim is to study DNA recovery from touched cell phones which may be have a different surface materials.

Material and Methods

Sample collection

Cell phones [Sony, iPhone, Samsung] were cleaned with 10% bleach and ethanol, and then touched with clean hands (not washed for at least two hours) for 1 and 5 min. Touched cell phones samples were collected by wetted and dry swabs (5).

DNA extraction

All samples were extracted using organic phenol-chloroform method (6) and Chelex method (7).

Real- Time PCR Amplification

Touch mobile samples were measured using multiplex Real-time PCR assay, Amplification reactions

were performed on a 7500 fast Real-Time PCR System and the data were analyzed with the 7500 fast System SDS software v2.0.5 (Applied Biosystems, Foster City, CA).The specific gene detection (Taq man technique) with the commercial kit (Quntifiler human DNA quantification Kit) in 7500 fast Real time PCR system. A multiplexed TaqMan ® was assembled that amplifies SRY (FAM™-labeled probe), RPPH1 (VIC®-labeled probe) and an Internal Positive Control-IPC (NED™-labeled probe). Assays were designed using the TaqMan® Gene Expression.

Amplification for STRs:

Fifteen autosomal STR markers or loci were genotyped along with the amelogenin locus on the X and Y chromosomes using the Applied Biosystems AmpFlSTR® Identifiler™ kit which amplifies the loci (D8S1179, D21S11, D7S820, CSF1PO, D3S1358, TH01, D13S317, D16S539, D2S1338. D19S433. VWA, TPOX, D18S51, D5S818, FGA) by genetic analyzer (ABI).

Results and discussion

In this work two extraction methods were used for recovery of DNA from touched cell phone brands. Quantification of DNA recovered from Cell phone (Sony) using real time PCR showed in table 1. The results showed that there is a difference between the quantification methods (Spectrophotometer and real time PCR). The range of recovered DNA concentration (0.02-0.1ng). In addition there is no a big difference between the times of touching the surfaces, one or five minutes.

Table (1): Quantification of human DNA concentration from touch mobile (Sony) samples.

Samples with Touching time (5 min)	Organic method			Chelex method		
	Q-PCR	Nano drop	Purity	Q-PCR	Nano drop	Purity
1	0.08	38.5	1.7	0.01	4.3	0.8
2	0.1	73.7	1.7	0.02	6.9	1
3	0.05	35.1	1.5	3.9	3.9	0.9
Samples with touching time (1 min)						
4	0.02	14.3	1.8	-	-	-
5	0.02	21.3	1.8	0.0	5.7	0.7
6	0.04	44	1.5	0.01	4.6	0.6
7	0.06	21	1.5	0.01	5.4	0.7

Table (2) shows the quantification of DNA recovered from touched cell phone (iPhone). The results showed that there is a difference between the quantification methods. The range of DNA amount recovered is (0.0-0.08ng). In addition there is no big difference between the times of touching the surfaces**.**

Table (2): Quantification of human DNA concentration from touch mobile (iPhone) samples

Samples with Touching time *(5 min)*	Organic method			Chelex method		
	Q-PCR	Nano drop	purity	Q-PCR	Nano drop	Purity
1	0.00	93.5	1.6	0.008	5.4	0.8
2	0.02	54	1.5	0.01	3.7	0.8
3	0.04	89.1	1.5	0.01	4.3	0.8
4	0.02	20	1.5	-	-	-
Samples with touching time (1 min)						
5	0.04	25.8	1.6	0.01	9.5	0.7
6	0.06	65	1.6	0.04	22.5	1
7	0.08	26	1.7	0.01	9	1

Table (3) shows the quantification of DNA recovered from touched cell phone (Samsung). The results showed that there is a difference between the quantification methods. The range of DNA amount recovered is (0.0-0.12ng). In addition there is no big difference between the times of touching the surfaces**.**

Table (3): Quantification of human DNA concentration from touch mobile (Samsung) samples

Samples with Touching time *(5 min)*	Organic method			Chelex method		
	Q-PCR	Nano drop	purity	Q-PCR	Nano drop	Purity
1	0.2	29	1.6	0.02	11.7	1
2	0.33	41.4	1.5	0.03	6.4	0.8
3	0.12	45	1.6	0.01	6.2	0.9
4	0.01	35.1	1.5	-	-	-
Samples with touching time (1 min)						
5	0.0	49.2	1.6	0.0	9.5	0.8
6	0.06	27	1.5	0.01	5.3	0.7
7	0.08	25	1.5	0.01	10.5	1

Table (4) shows the amount of DNA recovered from touched cell phones samples extracted by incubated overnight with Chelex. The results show no improvement in DNA recovery.

Table (4): Quantification of Chelex-extracted DNA amount recovered from different touch cell phones.

Samples with Touching time (5 min)	Type mobile	Q-PCR	Nano drop	Purity
1	**Samsung**	0.01	8.3	0.9
2	**Samsung**	0.0	2.6	0.6
3	**Samsung**	0.01	3.2	0.7
4	**iPhone**	0.0	2.2	0.7
5	**iPhone**	0.01	2.5	0.6
6	**iPhone**	0.0	4.2	0.6
7	**Sony**	0.01	3.5	0.7
8	**Sony**	0.02	6.1	0.9
9	**Sony**	0.01	2.7	0.6

STR analysis of touched DNA from all Cell phones brand showed partial profile. This is due to the lower touched DNA recovered from surfaces. An alternative method may be used is sequencing of DNA in spite of the low discrimination power of this method.

Cell phones surfaces differ according to manufacture companies. This work intended to estimate the difference in DNA recovery from different cell phones brands. The results showed that there is a difference between the two methods in quantification of touched DNA. Although spectrophotometer method is commonly used, it can be unreliable and inaccurate (8). UV absorbance measurements cannot distinguish DNA, RNA, or protein and not selective. Values are affected by other contaminants (free nucleotides, salts, and organic compounds) and variations in sample base composition. In addition, the sensitivity of spectrophotometry is often inadequate, prohibiting quantitation of DNA and RNA at low concentrations (9). The amount of DNA recovered from touched surfaces did not produce full STR profile Figure (1).

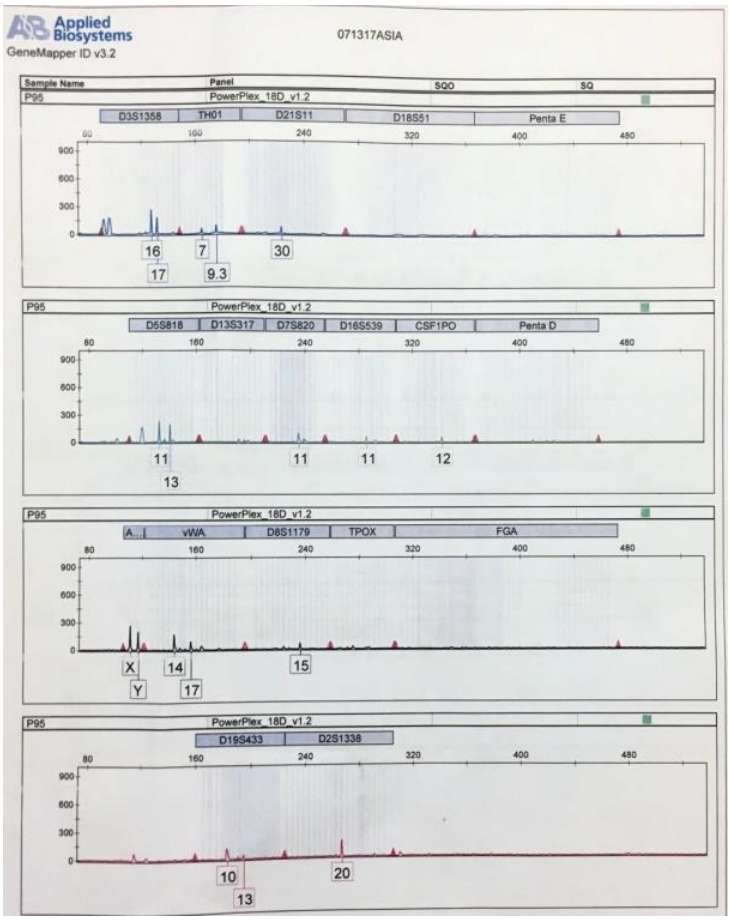

Figure (1): Chromatogram of STR alleles using Identifiler kit.

So maybe it needs improvement in DNA extraction or using more sensitive STR kit for low DNA amount. We can conclude the importance of cell phone touched DNA in crime scene investigation by recovery suitable amounts of DNA for analysis.

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