

How to increase the chances of solving more crimes, by knowing the location of cells on sampling material.

More crime scene samples can be used for identification if the concentration of DNA would be higher. The DNA concentration was increased by locating cells and decreasing the material used during the extraction.

Tens of thousands of samples are collected from crime scenes and sent to the Swedish National Forensic Centre for analysis every year. Unfortunately, many samples do not provide sufficient DNA concentrations to be used for further DNA profiling or as evidence. This is, for example, often the case for the commonly used cotton swab.

Today, it is common that personnel at the forensic center cut almost all cotton from the stick, to be sure that as many cells as possible are kept for DNA extraction. However, more cotton in the test tubes means that more liquid is needed during extraction, thus resulting in a lower concentration of DNA. Without knowing where the cells are located, it is hard to justify changing the way cotton is cut today. Especially, since the person cutting the swab often has not seen what part of the cotton head was in contact with the trace at the crime scene. Moreover, the technique of cutting the swab is not simple and often results in bulky pieces. These take up a large space in test tubes and this impairs the extraction efficiency.

However, if a smaller piece of cotton with a higher density of cells would be used for DNA extraction, the DNA concentration and the extraction efficiency could increase. Therefore, the location of the cells on swabs was studied with the extraction of DNA. The results showed that the vast majority of cells are located on the top outer part of the cotton swab. Hence, only the top part of the cotton is needed for DNA extraction. By using less cotton, a lower amount of extraction volume is required. This results in a higher concentration of DNA in the extraction solution, which could be enough for further analysis and to generate a DNA profile. Furthermore, the top part of the cotton turned out to be more compact and kept its shape, which seemed to improve the efficiency of cell release.

The results from the thesis prove that there are more effective and easier ways of handling samples of cotton swabs. Operating scissors are often tough on the hand. It would be much easier to perform fewer cuts to remove the top part of the cotton swab, than having to make many cuts around the cotton piece to remove it. Most importantly, obtaining higher DNA concentrations could be vital for the sample to be useful. Higher concentrations of DNA lead to more confident profiles and results. This is important since it could be used as evidence later.

Having a better understanding of the location of the cells will be useful when creating instructions for how to handle the swab samples and performing the extraction. As a result of these findings, a project has started at the Swedish National Forensic Centre, evaluating the method of cutting only the top part of the cotton head. The DNA concentration in the top part of the cotton swab has been compared to that in the bottom part of the cotton. Our results so far, have indicated that most of the cells are located on the top part of the cotton. However, the results must be further analyzed to give a final conclusion.

During this project, access to an advanced fluorescent microscope was possible. With this, dyed cells could be visualized on a cotton swab. Both pictures of the outside and inside of the cotton swab were taken and it properly demonstrates what otherwise would have only been shown by graphs and numbers.