

Detection of Tampering by Chemical Means

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There are currently many products on the market that detect tampering through chemical means. This overview analyzes the effectiveness of these chemical detection methods in various applications and discusses the advantages and limitations of chemical detection in general.

Introduction

Detecting if something has been tampered with is important for many different applications; all security devices use some sort of mechanism to determine if tampering occurred. Many of these systems, such as house and car security systems, work through electrical sensors or are mechanically triggered. However, chemical detection is often preferred for applications such as drug detection where a substance is added or removed. In these cases, chemical detection may be used to test for the occurrence of a chemical reaction or the presence of specific substances in chemical solutions.

Applications

One popular application of chemical detection is using forensic testing, such as ink dating, to authenticate records in law cases. Ink dating provides a valuable method of determining when a document was written. For example, ink dating was highly beneficial in a trial involving a doctor; the doctor kept his records along with the pens he used to write them over the course of five years. In a later trial of a case where the authenticity of those medical records was under question, ink dating allowed the records to be authenticated, leading to a case dismissal (Speckin, 1995). Another law case involved a plaintiff arguing that a critical entry was artificially added later to disputed records, but ink dating proved that the entry was added at the same time as the other entries on that document (Speckin, 1995).

Another area where chemical detection is heavily used is in testing for the tampering of urine samples. Athletes, hospital workers, and pre-hire workers are often drug tested by testing for drugs in their urine. People attempt to avoid being caught for using drugs by changing something in the urine or substituting something else for it. Therefore, adulteration, or “cheating,” drug tests by changing the concentrations is a form of tampering that labs must test for in order to accurately detect if a person has been using drugs. This includes tests such as specific gravity, pH, creatinine levels, and temperature (OHS, n.d.). These are becoming more and more accurate as the tests are becoming more thorough. pH and temperature can be tested for by testing the properties of the solution. However, tests for creatinine, which can be used to dilute urine samples, test specifically for the presence of that particular drug in the urine. This is also true for other “doping” samples, or other common tests used to check for dilution of urine, such as soap, salt, bleach, and eye drops (OHS, n.d.). In all of these cases, tests check for each specific substance individually.

Another application, testing for drugs in alcoholic beverages, uses a similar method. There are numerous strips, coasters, straws, and cards on the market that test for the most common drugs used in Drug Facilitated Sexual Assaults (DFSAs). These chemical tests will check for the presence of these drugs within the beverage and change color to alert the user of tampering. Unlike the urine tests, these strips must account for being used with a variety of alcoholic beverages. Thus, it is impossible for them to be as accurate in all cases.

Advantages of Chemical Testing

Chemically testing for tampering has one major advantage as compared to other detection techniques when the method of tampering involves an addition or

removal of a substance: if designed for the task, a chemical test can provide a definite response. This means that if a test for a specific substance comes back positive, there is a strong chance that the substance is present. False positives may occur, but in controlled settings (such as a laboratory testing urine samples) this rarely happens. This is vital for uses where people need to know the exact composition of a substance.

Another advantage to chemical detection is that many chemical tests are small and portable. For example, the cards used to detect drink tampering at bars or clubs are only 0.16 ounces in weight (DateRape, n.d.). This is beneficial due to the fact that they can be easily transported by individuals and do not take a lot of room to store.

Disadvantages of Chemical Testing

Although chemical testing is appropriate in some cases, for a real time response it is difficult to be effective. For most of the chemical detection that occurs, the substance in question is tested after tampering is suspected. Since most testing equipment is either expensive or not reusable, it becomes highly inefficient – if not impossible at times – to provide constant monitoring.

Additionally, a chemical reaction does not always occur with the addition of a substance. Therefore, looking for signs of one (easiest detection) such as change in color or temperature may not be fruitful. In these cases, it is most effective to look into testing for specific substances which is what most of the chemical detection techniques do. This, however, is limiting since you have to know for what to test. This is sometimes a problem, such as in the example of drink tampering at bars and clubs.

Chemical solutions are a logical conclusion since the issue (drugs in drinks) is one involving chemicals. However, this method cannot reach a maximum level of security since many drugs are used for DFSAs, and many more will be used in the future (Schwartz, 2000). This is also true for the urine drug tests; many athletes have gotten away with using performance enhancing drugs because existing chemical tests simply have not

caught up to checking for the specific drugs used by those athletes. For example, Lance Armstrong famously was found to be doping through the use of a drug called Erythropoietin (EPO). In the early 2000s when Armstrong was accused of using EPO, tests for EPO were just emerging. However, it wasn't until later that the tests became reliable and Armstrong tested positive for the use of the drug (Park, 2012).

For a singular substance, such as urine, very sophisticated and accurate tests may be performed, but when the tested material differs there is a higher chance of failing to detect tampering. In various alcoholic drinks such as margaritas, coffee-based liqueurs (ex: Baileys), and even tap water, the pH of the drink will render most of the current testing products useless.

Conclusion

Chemically testing for tampering is very useful in limited cases, but restricting in most. It required very specific circumstances and a knowledge for what to test for in order to provide results. However, it has high accuracy when those conditions are met. Thus chemical detection is an excellent tool in some cases (such as laboratory testing), but is difficult to broaden to testing generally for tampering of any kind.

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