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MODERN TECHNOLOGIES FOR DRUG IMPAIRMENT DETECTION

Summary. Using narcotic drugs and psychotropic substances in the modern world becomes increasingly popular. Unfortunately, despite the diffuse of drug use in non-medical purposes, knowledge about the dangers of using them is not widespread. The article presents the devices for initial testing on drugs as an innovation that help preventing especially impaired driving. The development of modern forensic technology in relation to the detection of psychoactive substances in the human body may be the innovation to help people realize how drugs are dangerous while weakening human psychomotor abilities.

Keywords: narkotester, narcotic drug, psychomotor activities, innovation.

NOWOCZESNE TECHNOLOGIE W WYKRYWANIU STANU ODURZENIA NARKOTYKOWEGO

Streszczenie. Zażywanie środków odurzających i substancji psychotropowych we współczesnym świecie staje się coraz bardziej popularne. Niestety, mimo popularności stosowania narkotyków w celach niemedycznych, wiedza o szkodliwości ich zażywania nie jest zbyt rozpowszechniona. Artykuł prezentuje urządzenia do wstępnego badania pod kątem obecności narkotyków w organizmie człowieka, które są pomocne w szczególności w zapobieganiu prowadzenia pojazdów mechanicznych pod wpływem narkotyków. Rozwój nowoczesnych technologii kryminalistycznych w odniesieniu do wykrywania substancji psychoaktywnych w organizmie człowieka może być innowacją, która pomoże ludziom zdać sobie sprawę ze szkodliwości narkotyków, zwłaszcza takich, które osłabiają zdolności psychomotoryczne człowieka.

Słowa kluczowe: narkotester, narkotyk, zdolności psychomotoryczne, innowacje.

1. Introduction

Using narcotic drugs and psychotropic substances in the modern world becomes increasingly popular. It is not insignificant however, that it is easier to get drugs today than it was 10 years ago. Every year more and more people reach for drugs, which in Poland – as in many other countries in Europe and the world – are not available in the official circuit, and their use is prohibited. Many of those who are taking drugs, are not aware of their actions, especially the side effects that they can cause. Perhaps this is also the reason why a large number of people choose to drive a car or other motor vehicle while being under the influence of these substances, and the drivers who use a different kind of drugs are a growing problem in road traffic.

Ways of using drugs and social approach to the people who take them, has changed a lot in over the last several years, because practically until the end of the nineteenth century in developed and developing countries the use of drugs in an illegal way did not appear. In European countries, Australia and the United States the fact that someone took drugs, was the subject of social disapproval, but it was not illegal. The most common substance of misuse in those days was, of course, alcohol¹.

Unfortunately, despite the diffuse of drug use in non-medical purposes, knowledge about the dangers of using them is not widespread. Some of them are even more dangerous than alcohol, and all of them combined with alcohol cause extreme increase of the risk of death even in the few minutes after taking². Probably everybody knows about harmfulness of drinking large amounts of alcohol or about drinking it too often. However the public awareness of the danger that arises after taking the drug is infinitesimal. Drug intoxication symptoms may vary depending on the ingested substance. For example, after taking amphetamines there is a strong stimulation, higher blood pressure, rapid breathing, increased heart rate, increased (but false) self-confidence. In extreme cases taking amphetamines may lead to paralysis, coma, heart attack or cerebral stroke³. Another popular narcotic substance - LSD - changes the perception of the environment, causes hallucinations and paranoia⁴. Another frequently used illegal drug is marijuana, which usually occurs in the form of so-called spliffs containing the dried leaves of cannabis. Intoxication effects are achieved by burning. Marijuana slows human reactions to the environment and reduces the ability to quickly respond to current events. After its adoption, the ability of perception of time and

¹ Bolt S.: *Drugs & the law*, [w:] *Hot topics: legal issues in plain language*, nr 59, red. Hammer C, Sydney 2010.

² *European Monitoring Centre for Drugs and Drug Addiction: Driving Under the Influence of Drugs, Alcohol and Medicines in Europe – findings from the DRUID project*, red. Hughes B., Vandam L., Luksemburg 2012, p. 25.

³ Connolly S.: *Warto wiedzieć... Amfetamina*, Warszawa 2003, p. 4-7; See also: Podleś D.: *Ujawnianie i kontrola osób prowadzących pojazdy pod wpływem narkotyków*, Szczytno 2007, s. 96.

⁴ Davenport-Hines R.: *Odurzeni. Historia narkotyków 1500-2000*, Warszawa 2006, s. 10.

distance are reduced, the concentration is weakened and there arises a feeling of sleepiness⁵. While at first glance, drug intoxication symptoms in the majority do not seem to be particularly dangerous, they reduce human psychomotor performance, which could have dire consequences if he decides to take any action to which this psychomotor performance is fully needed. The best example here would be driving. The driver, who decides to travel (drive) under the influence of drugs, will be a threat not only for himself but also for other road traffic users.

Testing for the presence of drugs in the body virtually did not exist before 1980⁶. Only since then more attention was paid to the phenomenon of using the illegal substances. Until recently, the driver who was driving the car after taking the drug, but did not cause any accidents, in the vast majority of cases remained unpunished. There was in fact no way that the police could investigate the driver for the presence of drugs in the body during a routine traffic control. The only way to find out if a person is under the influence of drugs, was a blood test that must have been performed in a designated for this purpose medical unit. The situation was the same when the drugs were eg. in the form of powder. Beyond the specialized, expensive and lengthy laboratory tests there was no way to verify that the found substance is legal or it is a drug. Even if the behavior of the driver pointed to the fact that he probably did take some drugs, he could explain it with e.g. tiredness or cold and so on.

Fortunately, in recent years more and more police patrols have devices called “narcotests” or “narcotesters”. These are test kits or single test, which can detect the presence of drugs in the body by testing saliva⁷. If a police officer during a road control observes that the driver has “mydriasis despite the entry of light (flashlight), conjunctival redness, glass eyes, unsteady gait (after an intense intake), (...), apathy, tiredness, thinking in a way of race thinking, impaired ability to concentrate, impaired ability of critical thinking, impaired sense of time and a short-term memory”⁸, he decides to test him with a narcotester. If the test is positive, the driver of the vehicle is stopped by the police and brought to the laboratory, where he has blood to the detailed studies for the presence of drugs collected. Unfortunately, random drivers’ testing is not possible in such a way, as it is done in case of the presence of alcohol in the body. This may be due to the price of the test - depending on the manufacturer and type of the detected substances one test price ranges from \$20- \$50⁹. However, in the international arena we may observe that that not only the police carry out drug testing. “Alcohol and illicit substance abuse in the workplace is increasingly becoming a major human resource and

⁵ Podleś D.: *Ibidem*, s. 97.

⁶ Fortner N.A., Martin D.M., Esen S.E., Shelton L.: Employee Drug Testing: Study Shows Improved Productivity and Attendance and Decreased Workers’ Compensation and Turnover [in:] *The Journal of Global Drug Policy and Practice* (2011), Vol. 5 Iss. 4, p. 11.

⁷ Fortner N.A., Martin D.M., Esen S.E., Shelton L.: *Op. cit.*, p. 16.

⁸ Podleś D.: *Op. cit.*, s. 97.

⁹ Fortner N.A., Martin D.M., Esen S.E., Shelton L.: *Op. cit.*, p. 16.

employee relations issue”¹⁰. So also private companies check their employees, whether they do not do their job after taking illegal substances. In a study conducted by the American Management Association in 2000 it was found, that most of the controls (78.5% in the case of New Hires and 42.4% for All Employees) was found in Manufacturing branch¹¹.

Today, many companies in the market offers narcotesters and but for the purposes of this article there will be presented only some of them.

2. Dräger DrugTest® 5000

This product was manufactured by the German company Dräger, where one of the main goals is to answer the technological innovation to respond to the needs of people¹². The product consists of two parts: Dräger DrugTest 5000 Test Kit, which is used to take samples from the person being tested and analyzer Dräger DrugTest 5000. In order to check whether there are some drugs in a driver’s body, he is given a probe and asked to place in it his mouth. Then he has to move the test for approx. 1-4 minutes the upper part of the probe between the gums and cheek to collect the test material. When enough saliva is collected, the indicator on the tester will turn blue. The tester shall then be returned to the police officer, who places it in a second set - the analyzer. Then the analysis starts automatically, and the results appear in a few minutes. It should be noted that the person who performs the test has no contact with the sample, so there is no risk of falsification of the result¹³. Depending on the type Dräger DrugTest 5000 can detect the following combinations of drugs:

- cocaine and opiates,
- cocaine, opiates, cannabis, amphetamines, methamphetamines and synthetic amphetamine,
- cocaine, opiates, benzodiazepines, cannabis, amphetamines, methamphetamines and synthetic amphetamine,
- cocaine, opiates, benzodiazepines, cannabis, amphetamines, methamphetamines, synthetic amphetamine and methadone,
- cocaine, opiates, benzodiazepines, cannabis, amphetamines, methamphetamines, synthetic amphetamine, methadone and ketamine¹⁴.

¹⁰ Holland P.: Case-Study. Drug Testing in the Australian Mining Industry [in:] *Surveillance & Society* 1(2), 2003, p. 204.

¹¹ American Management Association, *A 2000 AMA Survey: Workplace Testing: Medical Testing: Summary of Key Findings* (New York, NY: American Management Association, 2000), p. 1.

¹² http://www.draeger.com/sites/enus_us/Pages/Company/Innovation.aspx.

¹³ http://www.draeger.com/sites/assets/PublishingImages/Products/cdi_drugtest_5000/PL/9094586-DrugTest-5000-Testkit-PI-PL-20140711-L2.pdf.

¹⁴ *Ibidem*.

If saliva testing with using the Dräger DrugTest 5000 is positive, it must be confirmed by laboratory blood or urine expertise.

3. Branan Medical Corporation (BMC) products

Branan Medical Corporation is a manufacturer of several products for the analysis of drugs. In their offer they have both saliva tests for the presence of drugs and tests to reveal adulterated urine samples. The company's activity is compatible with the norm ISO 13485:2003. Products for initial saliva testing released into the market by come from the ORATECT series: Oratect®, Oratect®III, OratectPlus®¹⁵.

Oratect® Oral Fluid Drug Screen Device can detect a single or combination of substances out of the six basic groups: methamphetamine, marijuana, cocaine, amphetamines, opiates, phencyclidine. To have the sample tested properly, the tested person must not have consumed tobacco in any form (chewing, drinking, smoking) in 10 minutes before the test. Then he has to rub with the probe the inner sides of the cheeks and then the upper and lower part of the tongue (each approx. 15-20 times). After completing these steps, the probe must be placed under the tongue for about 30 seconds to collect the saliva. All operations performed by the test should not last longer than three minutes. Subsequently, the tester must be placed on a flat surface, and the result can be read after about 5 minutes¹⁶.

The testing looks the same while testing with the Oratect®III¹⁷. They are only slightly more sensitive than basic Oratect®. It also look very similar using OratectPlus® tests, but they are also able to detect the presence of alcohol in the body, which is undoubtedly an advantage if the tested person is being suspected to have taken drugs combined with alcohol¹⁸. Just as when using the Dräger tester - if the test is positive, it must be confirmed by laboratory blood or urine expertise.

4. Drugdetect Saliva6

Like the previous models, Drugdetect Saliva6 is a test to detect the presence of drugs in the body by testing saliva. Using them, it is able to detect the presence of the most popular drugs, such as amphetamines, cocaine, marijuana, opiates, and phencyclidine. Testing on illegal substances can be taken from 10 minutes to 72 hours after ingestion. These tests are

¹⁵ <http://www.brananmedical.com/drugtests.php>.

¹⁶ http://www.brananmedical.com/salivadrugtest_oratect.php.

¹⁷ http://alkolab.pl/dane_teczniczne/oratect.pdf.

¹⁸ http://www.brananmedical.com/salivadrugtest_oratectplus.php.

used only for initial verification, and a positive result must be confirmed by laboratory expertise - the manufacturer suggests gas chromatography or mass spectrometry¹⁹.

5. Drugdetect S10

This test is used to detect various kinds of drugs in various types of fluids and other suspected substances (e.g. powders), and also in urine. The manufacturer ensures, that there is no risk of interactions with conventional drugs, so we can be sure that if the test is positive, the sample includes drugs. The test can detect the following substances: amphetamine, cocaine, metamphetamine, opiates, phencyclidine, THC, benzodiazepines, barbiturates, tricyclic antidepressants, methadone. In some countries, eg. in the USA, the test results may be intrinsic evidence in court proceedings²⁰.

6. Products of SIRCHIE Company

The company produces its products based on Law Enforcement Standards developed by the Laboratory of the National Bureau of Standards. They meet the requirements of norm No. 0605.00, issued by the National Institute of Justice. SIRCHIE has products for pre-check whether the given sample may be intoxicating substance. Tests made by this company are sold in sets: NARK® oraz NARK ® II and they are in the form of:

- sachet tests - where the chemical reaction of the sample with a reagent takes place inside a sealed bag, and the detection of the tested substance is indicated by change of a reagent color inside the bag;
- ampule tests - where the chemical reaction of the sample with a reagent takes place inside an ampule and the detection of the tested substance is indicated by change of a reagent color inside ampule;
- so-called rubbing test - the test is carried out using a tissue or swab soaked with the appropriate reagent; the tested surface shall be rubbed by that tissue (e.g. package having contained a cocaine), and in the case of detection of illegal substances the tissue/swab changes color;
- a reagent for thin-layer chromatography²¹.

¹⁹ <http://www.kryminalistyka.net/testy-na-sline>.

²⁰ <http://www.kryminalistyka.net/testy-na-podejrzane-substancje>.

²¹ <http://www.transfarm.pl/technika-kryminalistyczna/produkty-sirchie/narkotesty.html>.

Nark ® tests are designed mainly for use in the field – in difficult conditions or conditions impossible to conduct professional, laboratory analysis. The reagents are placed in small, sealed ampoules, protected with a plastic cover. Exemplary reagents and substances detected with them are shown in the table below:

Table 1

Exemplary reagents and substances detected with Nark ® test

Nitric Acid Reagent	• Differentiate Heroin/Morphine
Cobalt-Thiocyanate Reagent	• Cocaine, Crack
Dille-Koppanyl Reagent	• Barbiturates
Mandelin Reagent	• Amphetamines
Ehrlich's Reagent	• LSD
Duquenois Reagent	• Marijuana, Hashish, THC
KN Reagent/ Fast Blue B Salt	• Marijuana (green plant & seeds)
Valium, Rohypnol & Ketamine	• Valium, Rohypnol, Ketamine
Sodium Nitro Prusside Reagent	• Metamphetamine & MDMA
Ephedrine	• Ephedrine, Pseudoephedrine
Special Oplates	• Codeine, Heroin & Oxycodone
GHB Reagent	• GHB (so-called roofie)

Source: Own elaboration on the basis of information from the producer²².

NARK® II sets are slightly extended version of the NARK® test. In addition to the above-mentioned substances they are capable to detect even boosters (mephedrone, alpha-Pyrrolidinopentiophenone) and hallucinogens including psilocybin²³. To read the result of test carried out with this device, we have to find the characteristics of the reagent used in the "color chart" supplied by the manufacturer. For example, using a reagent Mandelina will obtain in the following results color:

- olive or green-navy – if the sample contained methadone;
- yellow-green – if the sample contained methamphetamine;
- green-yellow – if the sample contained amphetamines²⁴.

²² Ibidem.

²³ Ibidem.

²⁴ http://www.transfarm.pl/assets/kryminalistyka/pdf/Karta_identyfikacji_kolorow_NARKII.pdf.

Bringing oneself in the a state of intoxication may be achieved not only by taking drugs, but also by taking quite legitimate medications, both the ones prescribed by the doctors as well as those widely available. However, people often forget that taking medicines in a wrong way may result in the occurrence of side effects, and any medicinal product may affect our psychomotor skills. Therefore, before taking any medication, we should carefully read the accompanying leaflet to check whether e.g. it does not affect the ability to drive or perform other activities that require full psychomotor skills.

On the market there are also pharmaceutical agents that contain drugs, so if the person who has taken them before, was tested with a narcotester, the result would be positive. A good example here is a medicine of British company GW Pharmaceuticals - Sativex. It is “a cannabinoid medicine for the treatment of spasticity due to multiple sclerosis which is also in development in cancer pain”²⁵. In its composition we can find mainly cannabidiol (CBD) and delta-9-tetrahydrocannabinol (THC), the two main psychoactive substance in cannabis²⁶.

Physicians and pharmacists distinguish three groups of drugs that affect human psychomotor performance:

- 1st group - absolute contraindications to drive, substances which belong here: narcotic analgesics, psychotropic drugs, neuroleptics and antidepressants, local anesthetics;
- 2nd group - relative contraindications to drive, substances which belong here: soothing drugs and antihistamines;
- 3rd group - without contraindications to drive with providing special precautions, substances which belong here: weak painkillers, antibiotics and chemotherapy drugs²⁷.

We shall keep in mind that any pharmaceutical product can affect the central nervous system of a human. Some of them have a weaker effect, other stronger, but all are equally dangerous if used carelessly. If we decide to take drugs or medicines that may weaken our concentration, we can obtain the "narkotest" by ourselves and do the test by ourselves to be absolutely sure about not being a danger to ourselves and to the environment.

The development of modern forensic technology in relation to the detection of psychoactive substances in the human body is an example of innovative activities helping to diagnose the psychomotor state and to prevent threats (mainly in communication). However, the method of collecting the material to be tested is a bit cumbersome for the tested person,

²⁵ Notcutt W., Langford R., Davies P., Ratcliffe S., Potts R.: A placebo-controlled, parallel-group, randomized withdrawal study of subjects with symptoms of spasticity due to multiple sclerosis who are receiving long-term Sativex® (nabiximols) [in:] Multiple Sclerosis Journal, February 2012, Vol. 18, No. 2, p. 219.

²⁶ Notcutt W., Langford R., Davies P., Ratcliffe S., Potts R.: A placebo-controlled, parallel-group, randomized withdrawal study of subjects with symptoms of spasticity due to multiple sclerosis who are receiving long-term Sativex® (nabiximols) [in:] Multiple Sclerosis Journal, February 2012, Vol. 18, No. 2, p. 219.

²⁷ Seńczuk W. (red.): *Toksykologia. Podręcznik dla studentów, lekarzy i farmaceutów*, red. Seńczuk W., Warszawa 1999.

who not necessarily wants to cooperate in such situation. Further technological innovation should therefore go towards improvements on how to collect the material and shorten the time of its preliminary analysis.

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Omówienie

Przyjmowanie substancji psychotropowych i środków odurzających staje się coraz popularniejsze. Cele, dla których się je przyjmuje oraz stosunek społeczny do osób, które się na to decydują, drastycznie zmienił się na przestrzeni ostatnich lat. Niestety, wiedza o zagrożeniach płynących ze stosowania narkotyków nie idzie w parze z powszechnością ich używania. Wiele osób nieświadomych wpływu takich substancji na organizm człowieka decyduje się prowadzić samochód bądź inny pojazd mechaniczny pod ich wpływem. Przez wiele lat kierowca, który decydował się na podróż będąc w stanie odurzenia narkotykowego, pozostawał bezkarny, ponieważ obecność nielegalnych substancji w organizmie mogła zostać potwierdzona jedynie poprzez laboratoryjne badanie krwi, a te z kolei były przeprowadzane wyłącznie, jeżeli dany kierowca uczestniczył w wypadku drogowym. Nie istniał żaden sposób, aby Policja mogła przebadać osobę podejrzaną o przyjęcie substancji odurzającej podczas rutynowej kontroli drogowej. Artykuł przedstawia innowację w tym zakresie – tzw. narkotestery, które pozwalają przeprowadzić badanie wstępne na obecność narkotyków w organizmie człowieka. Jednak mimo tak dużego postępu technologicznego w tym obszarze, badania za pomocą wspomnianych urządzeń bywają uciążliwe dla osób badanych. Dalsze innowacje technologiczne powinny iść więc w kierunku ulepszenia sposobu pobierania materiału do badań oraz skrócenia czasu ich trwania.