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Solving Forensic Mysteries with the Power of Fluid Mechanics

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Abstract

In an effort to enhance the monitoring of persistent drug use in individuals, a group of experts hailing from the National University of Singapore (NUS) has introduced an innovative approach. Led by a professor from the NUS Department of Pharmacy, the team has uncovered three new urine biomarkers. These biomarkers could be employed to detect the consumption of the emerging synthetic cannabinoid ADB-BUTINACA, classified as a novel psychoactive substance (NPS). The same cutting-edge technology also enables the differentiation between natural and synthetic cannabinoids.

Keywords: Drugs • Forensic medicine • Fluid mechanics

Introduction

In 2009, one of the victims was convicted of a face-to-face shooting that took place in 2003. Curiously, despite substantial evidence of backward blood spatter, he was discovered wearing white clothing entirely devoid of any bloodstains. This apparent contradiction, suggesting he may have been the shooter, led scientists from Iowa State University and the University of Illinois at Chicago to delve into the intricate realm of fluid dynamics associated with this perplexing forensic case.

Description

In recent years, users of New Psychoactive Substances (NPS) have accounted for the third-largest proportion of drug overdose fatalities in Singapore, with synthetic cannabinoids dominating the NPS market in the country for the past four years. The nature of most synthetic cannabinoids allows them to be quickly metabolized by the body, rendering them nearly undetectable in urine tests.

Following a gunshot, there is a dispersion of droplets propelled from the victim towards the shooter. The researchers then focused their attention on the interplay between these blood droplets and the powerful vortex ring of muzzle gases emanating from the shooter towards the victim. They hypothesized that this incoming turbulent vortex ring, despite its inherent complexity, might have the capacity to entwine, merge, and transport the back-spattered blood droplets within its flow [1-5].

Conclusion

In order to explore individuals' attitudes and distinguish novel biomarker metabolites in urine, the team conducted the synthesis of crucial ADB-BUTINACA compounds within the research facility, utilizing human liver catalysts. Through this method, they successfully identified a total of 15 ADB-BUTINACA metabolites, along with elucidating their distinct biotransformation pathways within the body. Due to their consistent metabolic patterns, the researchers have proposed four out of the 15 newly discovered metabolites, including one for which a reference standard currently exists, as potential urine metabolite biomarkers. It is suggested that one or a combination of these four recently established urine biomarkers could be employed for detecting ADB-BUTINACA usage, as endorsed by a panel of experts. Moving forward, the team aims to expand their current methodology, with the goal of gaining deeper insights into how the kidneys process novel metabolites originating from synthetic cannabinoids and understanding their fate when excreted in urine.

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