

FTIR SPECTROMETER TESTING OF THE SUBSTANCE SOLD AS 'KUSH' IN RETAIL DRUG MARKETS, SIERRA LEONE AND GUINEA-BISSAU

Preliminary findings

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PURPOSE OF THE STUDY

On 4 April 2024, the president of Sierra Leone, Julius Maada Bio, declared a national emergency over drug use – principally due to the devastating impact on public health of the substance sold as 'kush' across the country. 'Kush', a substance used by people who use drugs (henceforth 'PWUD') was also reported to be entering retail drug markets in other countries in the subregion, including Liberia, Guinea, The Gambia, Guinea-Bissau and Senegal, indicating a fast-expanding regional phenomenon.¹ 'Kush' is only one of a number of synthetic drugs believed to be penetrating, and quickly becoming prominent in, retail drug markets across West Africa.²

In the absence of publicly available results from conclusive chemical testing, 'kush' has been thought to be a concoction of many things, including fentanyl, acetone, formaldehyde, tramadol and human bones. However, 'kush' was anecdotally most commonly believed to contain some type of synthetic cannabinoid. Without a scientific understanding of the precise composition of the substance, confirmatory testing was vital because people were believed to be dying from consuming it. Myths about the components of 'kush' have posed an obstacle to identifying effective responses to mitigate the risks and reduce the harms caused to PWUD in Sierra Leone and the wider subregion.

'Kush' is reported to have entered Freetown's retail drug markets in around 2016, and quickly spread across all regions of the country. 'Kush' is cheap and, according to all PWUD interviewed, the most widely consumed drug in Sierra Leone. While there are no official figures regarding the exact number of deaths linked to 'kush' in Sierra Leone, government (including departments that perform autopsies), civil society and PWUD in the capital, Freetown, are unanimous in reporting that the figure is significant.³ There has also been debate over whether the components of 'kush' were being locally manufactured or imported. The lack of clarity regarding the chemical composition and origins of this substance has been a key factor in missing, and urgently needed, data to inform an effective, tailored response to this public health crisis.

PWUD in Bissau reported that a substance, also known as 'kush' in Guinea-Bissau, had entered retail markets in that country sometime in 2023. Further, while the PWUD community and civil society in Guinea-Bissau reported that 'kush' was imported from Sierra Leone, in the absence of data regarding its chemical composition, these assertions were difficult to verify, and it was unclear whether this substance, marketed with the same name, shared the chemical composition of 'kush' found in Freetown.

The Global Initiative Against Transnational Organized Crime (GI-TOC), a non-profit research NGO specializing in research into organized crime,⁴ co-designed a research study into 'kush' in Sierra Leone with the Clingendael Institute, an independent think tank and academy on international relations. The research has been designed to support civil society and government stakeholders in Sierra Leone, West Africa more broadly, and internationally, to develop evidence-based responses by providing more data about 'kush'.

One component of the study, led by the GI-TOC, sought to test samples of 'kush' in Freetown with an FTIR spectrometer, equipment used to test the chemical composition of drugs, to identify the chemical composition of the substance. Authorization to conduct testing in Guinea-Bissau, to indicate whether the substance being sold as 'kush' in that country was the same as in Sierra Leone, was also requested.



The relevant government authorities, namely the National Drugs Law Enforcement Agency in Sierra Leone (in liaison with, and supported by, other government agencies in the country) and the Judicial Police in Guinea-Bissau, granted the GI-TOC and its partners authorization to conduct the study, including chemical testing of 'kush' and other illicit drugs available on the retail markets in Freetown, and Bissau.

In implementing the testing process, in Sierra Leone the GI-TOC worked with the Institute for Drug Control and Human Security (IDCHS), and Social Linkage for Youth Development and Child Links (SLYDC), Sierra Leonean civil society organizations working to mitigate harms to PWUD in Freetown. In Bissau, the GI-TOC worked with the Observatory of Drugs and Toxicology (Observatório das Drogas e da Toxicodependência), which works to enhance awareness around drug use in Guinea-Bissau.

This paper sets out the results of the FTIR spectrometer tests and outlines the main preliminary findings. A more in-depth report on 'kush' in Sierra Leone will be co-published with Clingendael at a later date.

WHAT IS 'KUSH'?

'Kush' is a synthetic drug – identified by FTIR spectrometer testing to contain synthetic cannabinoids and/or nitazenes – sprayed onto a leaf. Marshmallow leaf, a legal commodity used for making teas, is most commonly used. However leaves growing naturally in Sierra Leone are also increasingly being used in its manufacture. 'Kush', which varies in colour (light green, dark green, brown and reddish), is smoked, typically mixed with tobacco.



Photo supplied

Use of 'kush' was first reported in Sierra Leone in around 2016, and has more recently also been reported in other countries in the subregion, including Guinea, Liberia, The Gambia, Guinea-Bissau and Senegal. Consumption is concentrated among the youth, broadly 20- to 35-year-olds. PWUD report that 'kush' enables them to forget the stresses of life and, depending on the potency, makes them feel relaxed, or simply removes all feeling. The effects of 'kush' are relatively short – typically lasting between 5 and 30 minutes.

'Kush' is very cheap in Sierra Leone. In Freetown, the price has steadily increased, from 5 SLL in 2020 (US\$0.25), to 10–15 SLL (US\$0.50–0.75) in January 2024, spiking to 15–20 SLL (US\$0.50–1.0) in April 2024. This recent spike is likely to be a result of the law enforcement crackdown on the drug in the wake of the declaration of a state of emergency related to drugs in Sierra Leone on 4 April 2024. In Bissau, one dose of 'kush' costs CFA 1 000 (US\$1.60) in June 2024, significantly more expensive than in Freetown.



STUDY METHODOLOGY

As noted above, the FTIR testing of retail drug samples is part of a broader research study into 'kush', focused on Sierra Leone, co-designed by the GI-TOC and the Clingendael Institute, which will be co-published at a later stage.

The GI-TOC, working with a drug testing expert and civil society partners, used an FTIR spectrometer to test retail drug samples in Freetown and Bissau. Sierra Leone is the country experiencing the most severe impacts from 'kush', and Guinea-Bissau was among the countries that had most recently reported the emergence of 'kush' in retail drug markets, and indicated Sierra Leone as the point of origin. 'Kush' remains relatively rare in Bissau, and consequently fewer samples were obtained and tested. PWUD in Bissau reported that use of 'kush' is more prevalent in the Bafata region, close to the border with Guinea. However, testing there was beyond the scope of this research study.



Photo supplied

Between 28 May and 3 June, the GI-TOC, working with a drug testing expert, and supported by the Observatory of Drugs and Toxicology, used an FTIR spectrometer to test 69 samples of a variety of illicit substances collected in Bissau. Prior to confirmatory testing, these samples were being sold as 'kush', cocaine powder, crack cocaine, Ecstasy, tramadol and 'snooth' (the chemical composition of 'snooth' remains unclear). The samples included a subset provided by the Judicial Police⁵ for testing (which did not include 'kush'), and samples collected from retail drug markets in the following areas of Bissau: Bairro de Reno; Bairro de Cuntum Madina; Bairro de Cupilum/Santa Luzia; Porto de canoa; Bairro de Mindará; Bairro de Belém; Bairro de Tchada; Bairro Militar; Bairro de Pefine; Missirá Condock; and Rua 10 Praça. Of the total group of samples tested, nine were of the substance believed to be 'kush'.

Between 28 May and 3 June, 96 samples of a variety of illicit substances were tested in Freetown.⁶ The GITOC was supported by the SLYDC and IDCHS. Prior to confirmatory testing, these samples were being sold as 'kush', tramadol, cocaine powder, crack cocaine, Ecstasy, 'Glady Glady' (identified to be methamphetamine) and 'Ghana dust' (used as a cold remedy, but believed to contain narcotics). The samples included a subset provided by the Transnational Organized Crime Unit (TOCU)⁷ for testing ('official samples'), and samples collected from retail drug markets in the Central, West and East districts of Freetown ('retail samples'). The research made an effort to collect and test a wide range of different samples to gain the most accurate picture possible of Freetown's drug markets. Official samples included substances seized from consignments that were being imported through Queen Elizabeth II Quay and Freetown Lungi International Airport. Of the total group of samples tested, 39 were of the substance believed to be 'kush'.

The study envisaged that confirmatory testing would be conducted on a selection of samples tested in both Bissau and Freetown using a different set of equipment, known as GCMS/LCMS testing. This confirmatory testing has been arranged for tested samples at a laboratory in Spain. However, the support of the governments of Sierra Leone and Guinea-Bissau are required to send the samples for laboratory testing. In the absence of this confirmatory testing, the FTIR spectrometer findings remain preliminary.



Key government agencies in Sierra Leone and Guinea-Bissau were briefed on the preliminary findings prior to these being made public. Consultations were also held with PWUD to share the preliminary findings and receive feedback.

Significant qualitative data was collected alongside quantitative data that emerged from the spectroscopy testing. This was taken from surveys conducted with the PWUD who engaged in the sample testing, together with additional complementary stakeholder interviews. Analysis of the qualitative data, together with the sample test results, is intended to continue following this preliminary dissemination of the findings from the FTIR spectrometer testing.

The analysis pertaining to 'kush' in Sierra Leone will be co-published with the Clingendael Institute in a later research study.

KEY FINDINGS OF SPECTROSCOPY TESTING OF 'KUSH'

The testing identified the presence of synthetic cannabinoids and nitazenes in the tested samples of 'kush' in both Freetown and Bissau. In Freetown, these findings were consistent in both the retail samples and official samples (in Bissau, no official samples of 'kush' were provided).⁸

In both countries, the FTIR spectrometer identified three main patterns within the 'kush' samples tested:

- Synthetic cannabinoids detected as the likely active ingredient (Type A).
- Synthetic cannabinoids detected as the likely primary active ingredient, with nitazene(s) detected as the likely secondary active ingredient (Type B).
- Nitazene(s) detected as the likely primary active ingredient (note, in such cases the FTIR picked up a very weak signal for synthetic cannabinoids, meaning that the testing is inconclusive as to the presence of synthetic cannabinoids) (Type C).

In Freetown the majority of samples tested (72%) were Type C, namely where nitazenes were detected as the likely primary active ingredient. This contrasted to findings in Bissau, where the majority of samples tested (44%) were Type A, with synthetic cannabinoids detected as the likely active ingredient. At this stage in the research, it is unclear what explains this discrepancy. Notably, the 'kush' market is far more entrenched in Freetown, and no deaths linked to 'kush' have yet been reported in Guinea-Bissau. The exact breakdown of the types of 'kush' identified in each country are shown in Figure 1.

Sample of 'kush' collected in Freetown, Sierra Leone. Many doses were packaged with stubs of tobacco. Photo supplied





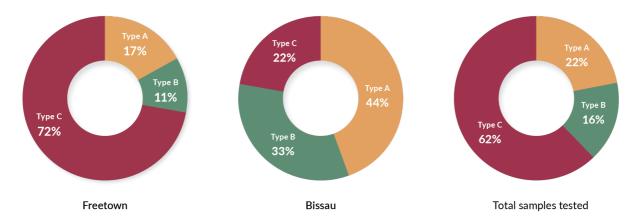


FIGURE 1 Three main types of 'kush' detected in the tests.

NOTE: In Freetown, three tested samples were excluded from all calculations because the samples were old and significantly degraded, and the signal was too weak to determine if they contained synthetic substances.

Presence of nitazenes, but no PCP or fentanyl



Sample of 'kush' collected in Freetown being tested for the presence of fentanyl and nitazenes using immunoassay test strips. The results show positive for the presence of nitazenes, and negative for the presence of fentanyl. All samples were also tested with an FTIR spectrometer.

Photo supplied

The FTIR spectrometer identified nitazenes to be present in 83% of samples of 'kush' tested in Sierra Leone, and 55% of samples tested in Guinea-Bissau. Nitazenes are powerful synthetic opioids, some of which can be up to 100 times more potent than heroin and up to ten times more potent than fentanyl. Nitazenes were first developed by the medical industry in the 1950s, but were never approved for use as medicines. The potency of different nitazene types varies significantly – this is why confirmatory testing with a GCMS is required to provide further evidence as to which nitazenes are present. Protonitazene – considered to be two times stronger than fentanyl – is among the nitazenes most commonly detected in 2024, and has been found in substances sold as synthetic cannabinoids. 11



In a number of the samples where the FTIR spectrometer identified nitazenes, a secondary immunoassay nitazene test strip was also used. In all cases where the FTIR indicated nitazene presence, the test strip also showed positive for the presence of nitazenes. Although multiple types of nitazene were prominently matched in the FTIR spectrometer findings, it is not possible to confirm which nitazene, or if multiple nitazenes are present in 'kush' without further confirmatory testing using a different techniques, known as GC-MS and LC-MS testing. Confirmatory testing has been arranged for these tested samples; the support of the governments of Sierra Leone and Guinea-Bissau is required to send the samples from each country for laboratory testing.

Since 2019, nitazenes have been linked to a significant number of overdose deaths in the United States, ¹⁴ and since 2022 in a number of other countries, including the United Kingdom ¹⁵ and several countries in Europe. ¹⁶ Nitazenes have been identified repeatedly in substances sold as other drugs, most prominently opioids, and cannabis products. This means that PWUD – including in Sierra Leone and Guinea-Bissau – are most likely taking nitazenes without knowing the risks they face.

The GI-TOC believes that these results are the first indication that nitazenes have penetrated retail drug markets in Africa.

Nitazenes alone are known to be the cause of overdose deaths; however, their use in combination with other drugs, including alcohol, cocaine and methamphetamine, is believed to increase the risk of overdose, although nitazenes remain a relatively unresearched class of substance.¹⁷ PWUD in Freetown are typically poly-drug users, and often reported using 'kush' alongside other drugs, such as cannabis and tramadol, meaning the risks of use are heightened.

'Kush' is sold on Freetown's retail illicit drugs market in three varieties, referred to locally as 'mild', ¹⁸ 'hard' ¹⁹ and 'K2'. While 'mild' and 'hard' are the two most common varieties, 'K2' is perceived by PWUD to be a distinct variety and was reportedly the original type 'kush', which first appeared in the retail illicit drug markets in around 2016. According to the findings from the FTIR spectrometer and nitazene test strips, samples types A, B and C (see above) did not match up with the products being sold as 'mild', 'hard' or 'K2'. Only 15% of samples sold as 'mild' or 'K2' contained no nitazenes. In Bissau, PWUD reported no difference in how 'kush' samples are sold.

The FTIR spectrometer tests identified no fentanyl or phencyclidine (PCP) present in the 'kush' samples – a finding that runs counter to information circulating regarding the chemical composition of 'kush'. Fentanyl immunoassay test strips were applied to a number of kush samples, and returned negative tests in every case.

The 'kush' supply chain

There has been ongoing debate as to whether the majority of the components of 'kush' present in Freetown are locally manufactured or imported. Similarly, while reports from Guinea-Bissau and other countries in the subregion identified Sierra Leone as the point of origin for 'kush' reaching their retail drug markets, it was unclear whether the substances called 'kush' had the same chemical composition or shared a supply chain.

In Freetown, the official samples of 'kush' tested included those that the TOCU identified to have been from consignments seized at Elizabeth II Quay between 2019 and 2024 (the 'import samples'). The FTIR spectrometer identified the presence of synthetic cannabinoids and/or nitazenes in the import samples seized from 2021 onwards. The findings of tests done before 2021 on samples believed by the TOCU to be 'kush' or its components (most prominently marshmallow leaf, a product sold for making tea, which is commonly used in making 'kush') were inconclusive. These samples appeared to be degraded to a degree that may have affected the identification of any synthetic drugs in the results. The FTIR spectrometer identified the 2021 sample to be type A; the 2022 sample to be type B; and the 2024 sample to be type A. This indicates that, according to the information and



samples provided by the TOCU, between 2021 and 31 March 2024, marshmallow leaf contaminated with synthetic cannabinoids and/or nitazenes has been imported by sea into Sierra Leone through Elizabeth II Quay. This suggests that synthetic cannabinoids and nitazenes are being imported into Sierra Leone from other countries.

As noted above, the FTIR spectrometer tests identified the same three types of 'kush' in samples tested in Bissau, Guinea-Bissau. Firstly, this confirmed that the substance being sold as 'kush' in Bissau was of a similar chemical composition to that found in Freetown, although the prevalence of the different types differed between the two countries. Secondly, this could support qualitative findings to indicate that the 'kush' being sold in Bissau's retail markets is part of the same supply chain.

THE PUBLIC HEALTH RESPONSE

Naloxone, a pharmaceutical opioid antagonist typically used to treat the effects of opioid overdoses, is reportedly effective in reversing overdoses of nitazene. Larger or multiple doses might be required for naloxone to be effective.²⁰ Consequently, as part of the public health response to 'kush', there is urgent need to increase the availability of nalaxone through a free distribution programme to stakeholders in Freetown, including first responder organizations (including civil society) and hospitals, and to train stakeholders in its use.

As manufacture of synthetic drugs accelerates, ²¹ it is likely that a growing range of synthetic drugs will penetrate West Africa's retail drug markets, as is being tracked globally. Chemical testing equipment – including FTIR spectrometers, and GCMS testing capabilities – are urgently needed in Sierra Leone and Guinea-Bissau, alongside capacity building to ensure correct usage. Without this, it is impossible for the government of Sierra Leone, Guinea-Bissau and the wider subregion to accurately monitor the countries' illicit drug markets and develop evidence-based responses.



Notes

⁴ See https://globalinitiative.net/.

analysis capabilities of mass spectrometry.

⁷ A government unit that falls under the Ministry of Internal Affairs of Sierra Leone.

- ¹⁰ The following is an indication of the range of potencies: etonitazene considered to be 10 times stronger than fentanyl; etonitazepyne considered to be 10 times stronger than fentanyl; isotonitazene and protonitazene considered to be two times stronger than fentanyl; metonitazene considered to be as potent as fentanyl.
- ¹¹ For example, there was an identification of protonitazene February 2024 from the MK11 postcode region of England, where the purchase intent was a cannabinoid. See sample W048826, https://wedinos.org/sample-results.
- 12 Immunoassay nitazene test strips (like all immunoassay test strips) have been designed for use in urine testing. It is advisable to use these strips in conjunction with other testing procedures, like an FTIR spectrometer. Immunoassay nitazene test strips have been known to give false positives where caffeine or heroin is present. To date, no other substances are known to result in a false positive. There were no indications that caffeine or heroin was present in 'kush' (either from the FTIR testing, or qualitative interviews with 'kush' manufacturers). However, immunoassay nitazene test strips are relatively new on the market. They are therefore continuing to undergo performance testing. Performance testing allows experts to identify whether there are other substances that can cause false positives.

 13 Gas chromatography-mass spectrometry (GC-MS) is an analytical technique that combines gas chromatography (GC) and mass spectrometry (MS) to identify and measure the concentration of chemicals. GC-MS is considered the 'gold standard' for forensic substance identification because it can perform a 100% specific test. Liquid chromatography-mass spectrometry (LC-MS) is an analytical chemistry technique that combines the physical separation capabilities of liquid chromatography that uses a solvent with the mass
- ¹⁴ US Department of Health and Human Services/Centers for Disease Control and Prevention, Nitazene-related deaths Tennessee, 2019–2021, September 16, 2022, Vol. 71, No. 37, https://www.cdc.gov/mmwr/volumes/71/wr/pdfs/mm7137a5-h.pdf.

¹⁵ Adam Holland et al, Nitazenes—heralding a second wave for the UK drug-related

death crisis? 2024, The Lancet, https://www.thelancet.com/pdfs/journals/lanpub/PIIS2468-2667(24)00001-X.pdf.

- ¹⁶ European Monitoring Centre for Drugs and Drug Addiction, Drug-induced deaths the current situation in Europe, European Drug Report 2023, https://www.emcdda.europa.eu/sites/default/files/pdf/31087_en.pdf?82341.
- ¹⁷ See Canadian Centre on Substance Use and Addiction, March 2022, https://www.ccsa.ca/sites/default/files/2022-03/CCSA-CCENDU-Drug-Alert-Nitazenes-2022-en_0.pdf; Joseph Pergolizzi Jr et al, Old drugs and new challenges: A narrative review of nitazenes, 2023, *Cureus*, https://assets.cureus.com/uploads/review_article/pdf/140595/20230721-19876-tfqx6z.pdf.
- ¹⁸ 'Mild' is also known as 'tramadol kush', 'trammer juice' and 'pauda', among others.
- ¹⁹ 'Hard' is also known as 'jagaban' (allegedly after a politician running in the 2018 elections), 'blow blow', 'big man kush' and others. 'Buga', a term predominantly used in the East District of Freetown, is also believed to be a 'hard' form of 'kush'. However, dealers reportedly choose to use the word 'buga' rather than 'jagaban' because PWUD tend to avoid purchasing 'jagaban', as it has gained a reputation for being dangerous.
- ²⁰ US Department of Health and Human Services/Centers for Disease Control and Prevention, Nitazene-related deaths Tennessee, 2019–2021, September 16, 2022, Vol. 71, No. 37, https://www.cdc.gov/mmwr/volumes/71/wr/pdfs/mm7137a5-h.pdf
- ²¹ Jason Eligh, Global synthetic drug markets: The present and future, March 2024, GI-TOC, https://globalinitiative.net/analysis/global-synthetic-drug-market-the-present-and-future/.



 $^{^1}$ PWUD reported the presence of 'kush' in retail drug markets in Guinea-Bissau and Senegal; PWUD and government authorities and local media have all reported the presence of 'kush' in The Gambia, Liberia and Guinea.

² Jason Eligh, Global synthetic drug markets: The present and future, March 2024, GI-TOC, https://globalinitiative.net/analysis/global-synthetic-drug-market-the-present-and-future/.

³ PWUD interviewed as part of this research study consistently reported personally knowing individuals consuming 'kush' who had passed away within the last 12 months. Participants believed these deaths to be connected to 'kush' use.

⁵ A government agency with the mandate to investigate organized crime in Guinea-Bissau.

⁶ Fourier transform infrared spectroscopy is an analytical technique used to identify organic, polymeric and inorganic materials. The FTIR analysis method uses infrared light to scan test samples and observe chemical properties. This technology has been adopted worldwide for drug checking and to analyze illicit and unregulated substances. The technology helps PWUD, health agencies and researchers identify potentially more harmful additives and impurities, ultimately promoting safer drug consumption by providing information about components.

⁸ Retail drugs are often sold as substances that do not match up with their chemical composition. The use of the term 'kush' in quotation marks refers to the substance that is believed to be – either by PWUD or national authorities – the drug known as kush.

⁹ I Ujváry et al, DARK classics in chemical neuroscience: etonitazene and related benzimidazoles, ACS Chem Neurosci., 12 (2021), 1072–1092.



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