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A RESPONSE TO NEW CHALLENGES IN FORENSIC DRUG ANALYSES - EU PROJECT "RESPONSE" (2015-2017) - OBJECTIVES AND FIRST EXPERIENCES

EUROPEAN PROJECT RESPONSE to challenges in forensic drugs analyses

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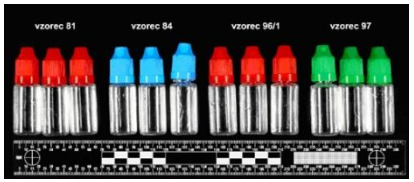
“RESPONSE” project in brief

The RESPONSE project (http://www.policija.si/eng/index.php/generalpolicedirectorate/1669-nfl-page-response**) addresses two specific topics of forensic drugs investigations:**

- **New psychoactive substances** (NPS) identification - challanges
  - unexpected growth in the number and type of NPSs [1]
  - easy availability of NPS, which are advertised and sold over the Internet
  - lack of the availability of reference materials (RM) and specific reliable spectra databases MS and FTIR are the main problem for accurate NPS identification
- **Drugs profiling** where the main problem is the recognized gap between customers (law enforcement, judicial system, EU policy makers) needs and ForL capacities, methodologies and staff competencies.

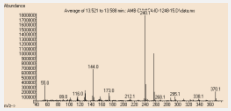
[1] New Psychoactive substances in Europe, EMCDDA, March 2015, (http://www.emcdda.europa.eu/publications/2015/new-psychoactive-substances)

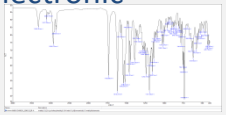
NPS facts & project objectives



FACTS:

- NPS are mainly detected in forensic and customs labs.
- Identifying of NPS means to elucidate compoud structure, to give the substance a name and formula
- To identify new substance reference material (RM) or special techniques are needed
- RM are not available (in real time)
- Most of laboratories have to realy:
  - on comparison of their results to available MS and/or FTIR spectra in searchable electronic libraries (not updated in real time)
  - or existing information exchange channels and/or open source data





PROJECT OBJECTIVES:

- to provide numerous spectral data MS, FTIR-ATR and FTIR-condensed phase on newly appearing NPS
- to implement spectra into electronic data repositories of European Network of Forensic Institutes - Drugs Working Group (ENFSI - DWG).
- to share analytical data, knowledge and information efficiently through different communication platforms (SI EWS, EMCDDA, EUROPOL, cooperation /communication with other complementary projects) and open source repositories
- By internet purchasing of NPSs the project will aim at implementing a pro-active forensics respond to the NPS phenomena and form " NPS material bank".

Sources of materials & Chemical characterizations

Type of material	Analytical methods
Reference materials (Different vendors; around 200)	GC-MS, FTIR-ATR, GC-MS-FTIR-(condensed phase) - optional
Test purchases (Internet based vendors; 200 to 300 samples)	GC-MS, FTIR-ATR, GC-(MS)-FTIR-(condensed phase), HPLC-TOF, NMR, for "unknowns" combined with ion chromatography for anions (IC)…
Seized samples (Police/ Customs)	
Collected samples (NGO – anonymous users, project partners, other)	

The compounds are identified in the Slovenian forensic laboratory (NFL) and NMR conifirmed in FKKT (SI) and spectra provided to EI-MS and IR libraries of ENFSI DWG

Test purchases over the internet

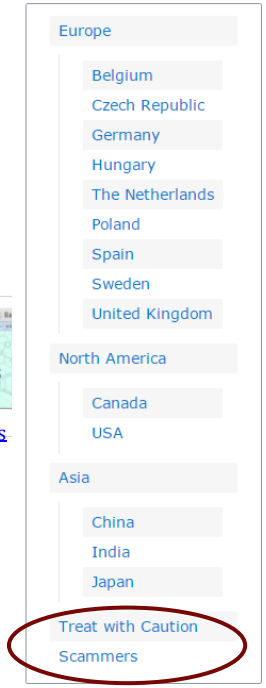
Detect what is new [L. Ask Reitzel et all, Systematical methodology for finding novel NPS (New Psychoactive Substances) over the Internet, EAFS-2015, Prague, 2015]

- use a Google engine and simple word search
- follow social networks related to recreational drugs (blogs/discussion forums/chats)

Find a internet vendor(s) and evaluate its reliability (NFL-SI)

https://www.reddit.com/r/RCSources/wiki/vendors

- use information (and updates) from the internet
- check the payment options
- check minimum required order (some only sell bulk quantities)
- test vendors by small orders (few samples) first

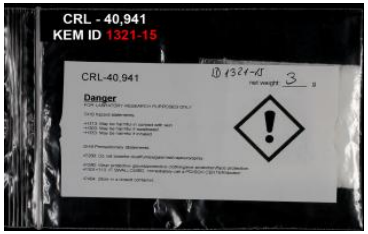


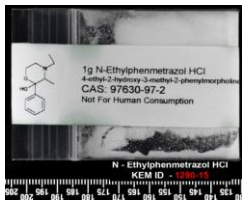
Purchasing procedure:

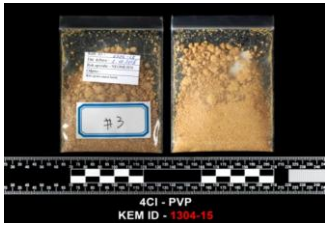
- shall follow institutional and national rules (quite complicated)
- information exchange system between national authorities concerning internet orders has been established. (Police (NFL), Ministry of Health (general approval was issued before the project started, Customs (NFL informs about every purchase in advance and afterwards when samples are received).

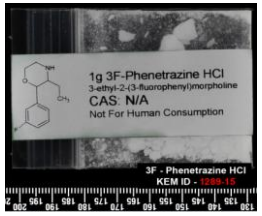
Test purchases - experiences

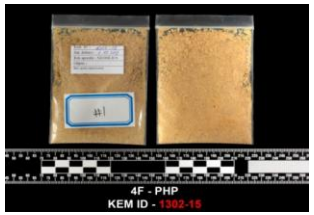
- Around 90 samples were ordered and are available in NFL "NPS materials bank"/ so far, only 2 samples were not delivered
- Delivery time vary (from few days to two months)
- The rate of false advertised/ delivered compounds is around 20%
- Labeling and packaging very different /depends on vendor







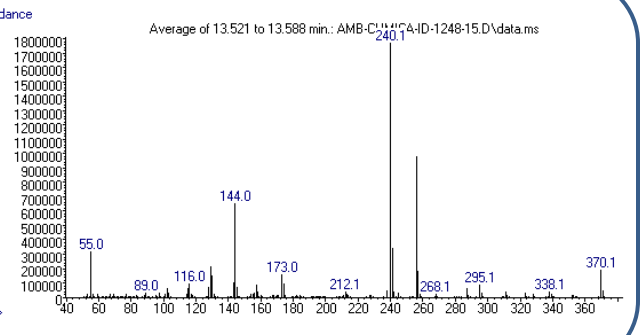




Chemical characterizations in practice

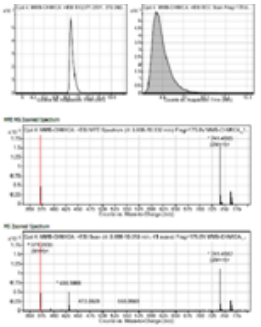
GC-MS

Single chromatographic peak was observed (No hits)

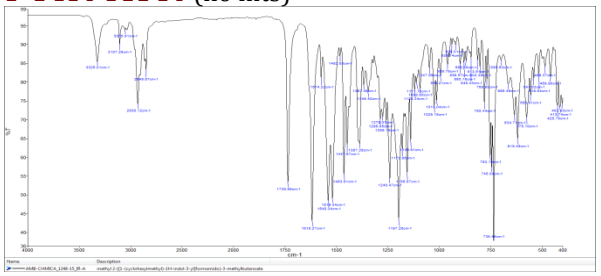


HPLC-TOF

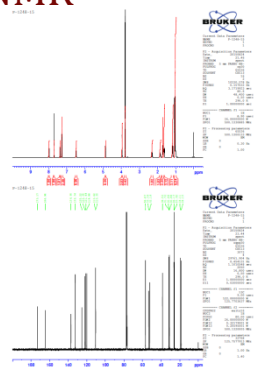
Mass: 370.493
Exact mass: 370.2256
Formula: C22H30N2O3



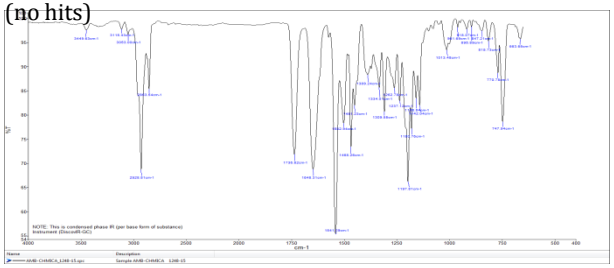
FTIR-ATR (no hits)



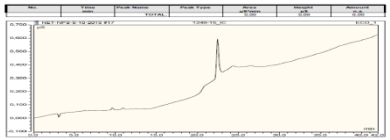
NMR



GC-(MS)-IR-condensed phase (no hits)



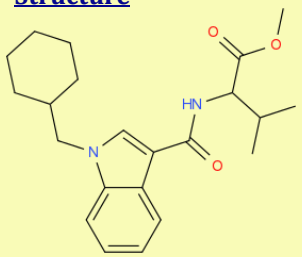
IC -anions



COMPOUND IS IDENTIFIED ☺

Formula: C22H30N2O3; M_W: 370.493 g/mol

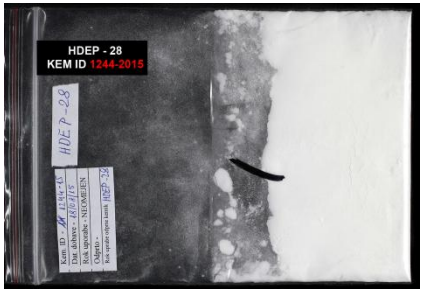
Structure

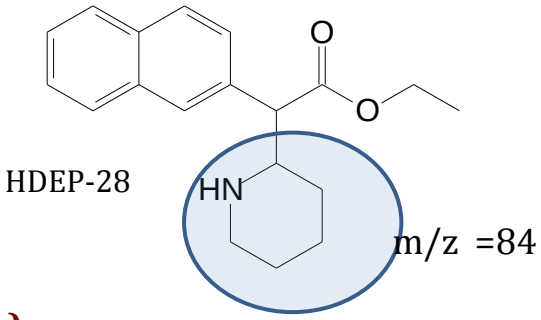


Chemical name:
methyl 2-(1-(cyclohexylmethyl)-1H-indole-3-carbonylamino)-3-methylbutanoate

Nick name: AMB-CHMICA
StdInChIKey: ROWZIXRLVUOMCJ-UHFFFAOYSA-N

Case ID: m/z = 84 or HDEP-28 story ☺





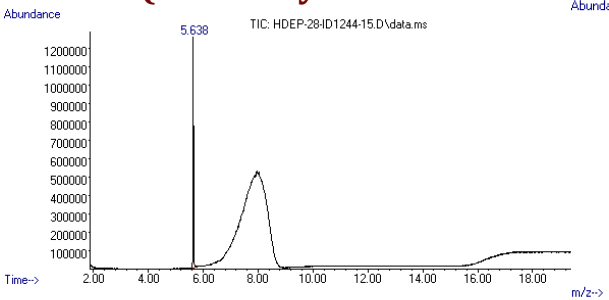
HPLC-TOF

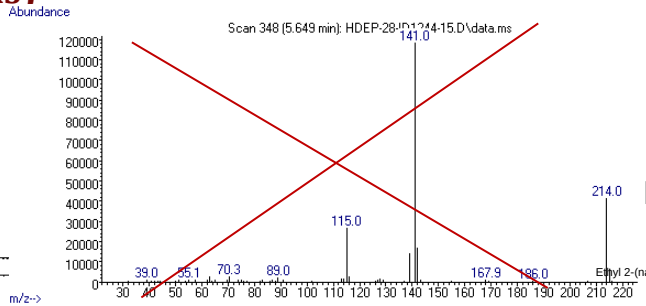
Impurities not detected
Formula: C22H30N2O3
Exact mass: 370.2256
Mass: 370.493

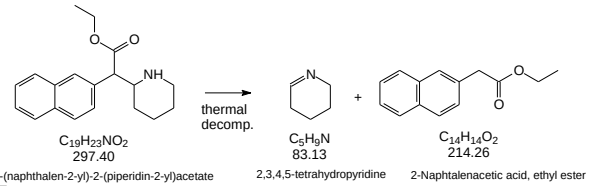
NMR

Proposed structure confirmed.
Compound is pure by NMR.

GC-MS (std. analytical conditions)

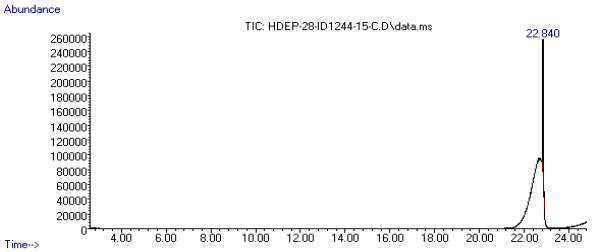


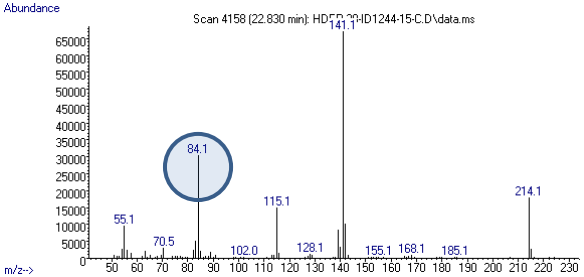


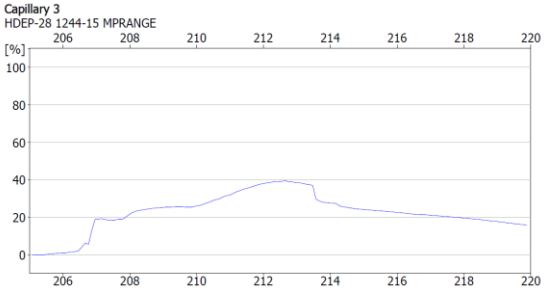


Chromatogram and MS obtained at our standard analytical conditions (inj. Port 280 st. C)

GC-MS (low T conditions)



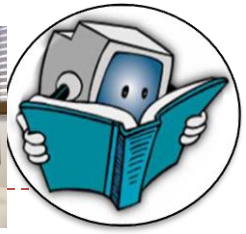




Chromatogram and MS obtained modified T(inj. Port 180 st. C, oven program changed as well)

Meting curve observed (by Mettler Toledo MP90 Melting Point System)

Validity of collected data



- Competent personal in all steps of analyses and data interpretation
- Instrumental techniques and instruments validated
- Analytical procesess under control (calibrators, quality check samples – control samples..)
- Use of supporting computerized tools for data interpretation and validation (some implemented in the instrumental software, some available as separate packages or for free over the internet) and already existing information (literature and other scientificaly valid resources)
- Quality checks of library entrys are done independantly by library managers (MS and FTIR)
- Adequate supporting information on sample is given

Organize information sistematically

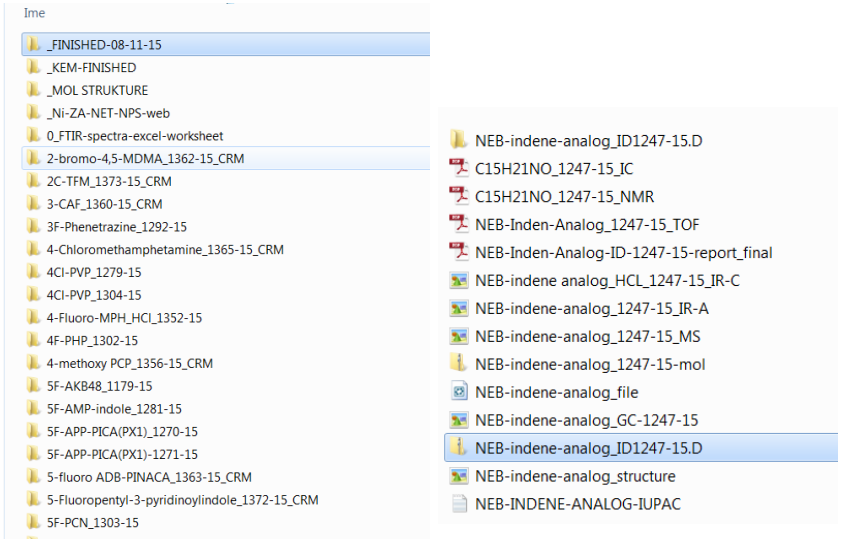
We try to keep the system simple and efficient !

- Instrumental raw data (and internal libraries) we keep on instruments and backups are done regularlly
- For every new NPS in our databases (RM, test purchase, seized or collected) we produce "Analytical report" which containes:
  - Information on sample & identified compound (1st page)
  - Information on analytical methods applied
  - Suporting analytical data

Analytical reports are generated "semi autmatically", from an excel worksheet. where some imprtant data are summarized.

Adobe Acrobat Document

Analytical reports are available here:
http://www.policija.si/apps/nfl_response_web/seznam.php



Project comunication platforms (I)

- ENFSI –DWG (implementation of relevant spectra electronic data repositories; (MS and FTIR library managers are project partners)
- Project deliverables and tools:
  - MS spectra (MS – Agilent Format) + supporting information and compound structure (mol format)
  - IR-ATR and IR-condensed phase (in dx format) + supporting information

- EMCDDA (their continously updated EDND database and other tools are of outstanding importance for forensic labs to keep the track of nevely appearing NPSs – THAK YOU!);
- Project deliverables:
  - Standard EMCDDA-EUROPOL reports on nevely detected compounds in SI, supported by Analytical reports and electronic raw data, where applicable
  - Other information included in national reports and/or "public restricted" reports on special cases

- EUROPOL receives relevant information from SI ENU (strongly correlated with NFL, both belongs to SI Police and SI EWS) and/or from EMCDDA
- Slovenian National stkeholders including SI EWS and NGOs
- Non- formal contacts with other projects : SPICE2, CLEN, I-SEE..
- Presentations at conferences and written reports: (ENFSI-DWG, May 2015 (3), EMCDDA June 2015 (1), EAFS September 2015 (3), writen reports (3), CLEN, Brussels (1))

Project comunication platforms (II)

- RESPONSE PROJECT WEB PAGE: public opened has been launched recently.
  - General information about the project one can see here:
    - http://www.policija.si/eng/index.php/generalpolicedirectorate/1669-nfl-page-response
  - Chemical information on NPSs and related compounds is joined in the "Drugs Monographs" tool – an interactive table (searchable along different criteria)
    - http://www.policija.si/apps/nfl_response_web/seznam.php
- ANNOUNCED EVENT (May 2016): **22nd ENFSI Drugs Working Group** (ENFSI DWG) **Meeting** taking place from **May 10th-12th, 2016** in Bled in the beautiful Alpine part of Slovenia, not far from our capital city Ljubljana.
  - http://www.enfsidwg2016.com/invitation.html

Drugs monographs table

RESPONSE

NPS AND RELATED COMPOUNDS - ANALYTICAL REPORTS

Co-funded by the Prevention of and Fight against Crime Programme of the European Union

Show 15 entries

Search:

Substance class	substance (NPS) common name	structure (created by OPSIN free tool)	NPS1 systematic name	other names	Formula per base form	Mw (g/mol) per base form NPS1	MS (BP1)	MS (BP2)	MS (BP3)	GC-MS-RT NFL/min	MS spectrum (picture)	StdIn ChIKey	Type of detection	comments	date of ent
Piperidines & pyrrolidines	TH-PVP		2-(pyrrolidin-1-yl)-1-(5,6,7,8-tetrahydronaphthalen-2-yl)pentan-1-one		C19H27NO	285.43	126	127	91	8.79	show	search	test purchase	NMR-pending	2015-10-04
Cathinones	MDPHP		1-(1,3-benzodioxol-5-yl)-2-pyrrolidin-1-yl-hexan-1-one		C17H23NO3	289.37	140	141	149	8.40	show	search	test purchase	25% of an unknown organic impurity by NMR	2015-08-19
Arylalkylamines	5-APB NBOMe-HCl		1-(benzofuran-5-yl)-N-(2-methoxybenzyl)propan-2-amine		C19H21NO2	295.38	121	164	91	8.92	show	search	test purchase		2015-04-17
Others	2-MeO-diphenidine		1-(1-(2-methoxyphenyl)-2-phenylethyl)piperidine	Methoxphenidine, MXP	C20H25NO	295.42	204	188	91	8.25	show	search	test purchase		2015-10-14
Others	2MeO-Diphenidine		1-(1-(2-methoxyphenyl)-2-phenylethyl)piperidine	Methoxphenidine, MXP	C20H25NO	295.42	204	205	91	8.23	show	search	seized		2015-07-17
Piperazine derivates	Methoxphenidine		1-[1-(2-methoxyphenyl)-2-phenylethyl]piperidine	MXP, 2-MXD, 2-MeO-Diphenidine	C20H25NO	295.42	204	205	91	8.22	show	search	RM-reference material		2015-08-31
Benzodiazepines	Bentazepam		5-phenyl-3,5a,6,7,8,9-hexahydro-2H-[1]benzothieno[2,3-e][1,4]diazepin-2-one	Thiadipone	C17H16N2OS	296.39	267	296	268	11.49	show	search	RM-reference material		2015-08-31
Piperidines & pyrrolidines	HDEP-28		ethyl 2-(naphthalen-2-yl)-2-(piperidin-2-yl)acetate	ethylnaphtidate, HDEP-28, 2-(2-ethoxy-1-(naphthalen-2-yl)-2-oxoethyl)piperidin	C19H23NO2	297.17	180	214	181	9.58	show	search	test purchase	GC-RT and MS spectrum refers to HDEP-28-TFA derivative; for more information read the Analytical report	2015-08-19
Piperidines & pyrrolidines	HDEP-28-thermal-decomposition		ethyl 2-(naphthalen-2-yl)-2-(piperidin-2-	ethylnaphtidate, HDEP-28, 2-(2-ethoxy-1-(naphthalen-2-yl)-2-	C19H23NO2	297.17	141	214	115	5.65	show	search	test purchase	GC-RT and MS spectrum refers to HDEP-28 decomposition product; for more information	2015-08-19

Acknowledgements

To partners and associate partners
University of Ljubljana, Faculty of Chemistry and Chemical Technology (FKKT), Slovenia
Ministry of the Interior, National Forensic Institute (INPS), France
Hungarian Institute for Forensic Sciences (HIFS), Hungary
National Institute of Criminalistics and Criminology (INCC), Belgium
Institut for Foresic Medicine, Aarhus (UNI Aarhus), Denmark
University of Copenhagen, Faculty of Health (UNI CPHG), Department of Forensic Medicine, Denmark
Ministry of the Interior of the Republic of Croatia, Forensic Science Centre (MUP RH), Croatia

European Monitoring Centre for Drugs and Drug Addiction (EMCDDA), Portugal
Forensic Science Lab, Dublin (FSL), R Ireland
Forensic Science and Toxicology Lab, State General Laboratory, Ministry of Health (FSTL), Cyprus
Judiciary Police, Scientific Police Laboratory (SPL), Portugal
National Investigation Service Norway (KRIPOS), Norway
National Institute for Public Health (NIJZ), Slovenija
University of Ljubljana, Faculty of Medicine, Department of Toxicology (UNI LJ FM DT), Slovenia
Association DrogArt (DrogArt), Slovenia

To EU COMMISSION: ***The RESPONSE project is financially supported by the Prevention of and fight against crime Programme of the European Union (grant agreement number JUST/2013/ISEC/DRUGS/AG/6413).*** ***We kindly acknowledge this!*** *The content of this presentation is the sole responsibility of the author and can in no way be taken to reflect the views of the European Commission.*

Many thanks also to my small but excellent team!

Thank you for your attention!