

THE CURRENT STATE: VAPING, DEVICES, AND E-LIQUIDS



VCU

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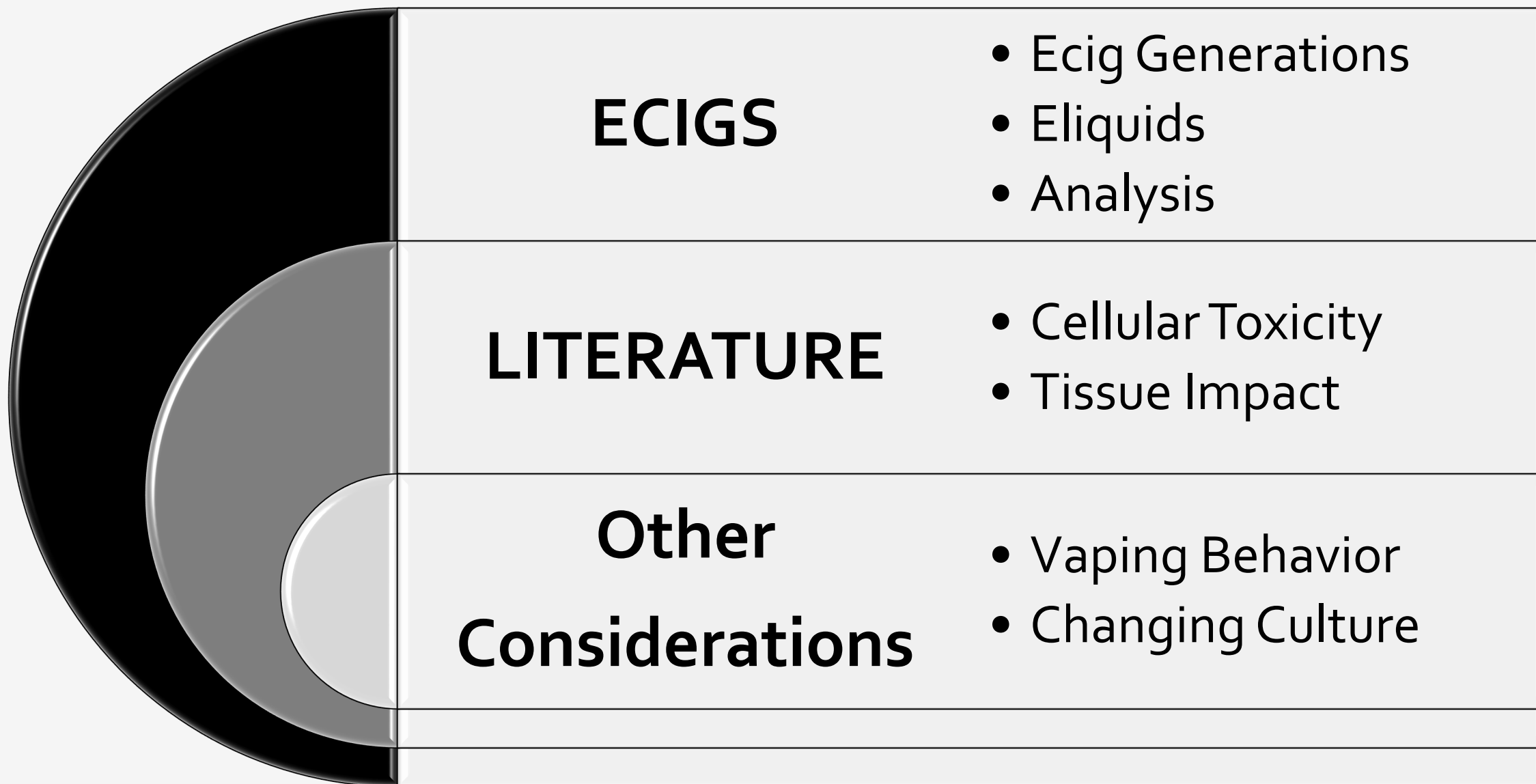
Virginia Commonwealth University

NIJ Statement and Financial Disclosure

- **Through the Looking Glass: Part 1 & 2 Abuse of the Evolving Electronic Cigarette and the Impact of Vaping Ethanol in the Evaluation of Impairment**
- **Characterization and Abuse of Electronic Cigarettes: The Efficacy of Personal Vaporizers as an Illicit Drug Delivery System**
- **Chasing the E-cigarette Dragon: Characterizing the Evolution and Impact of Design and Content**

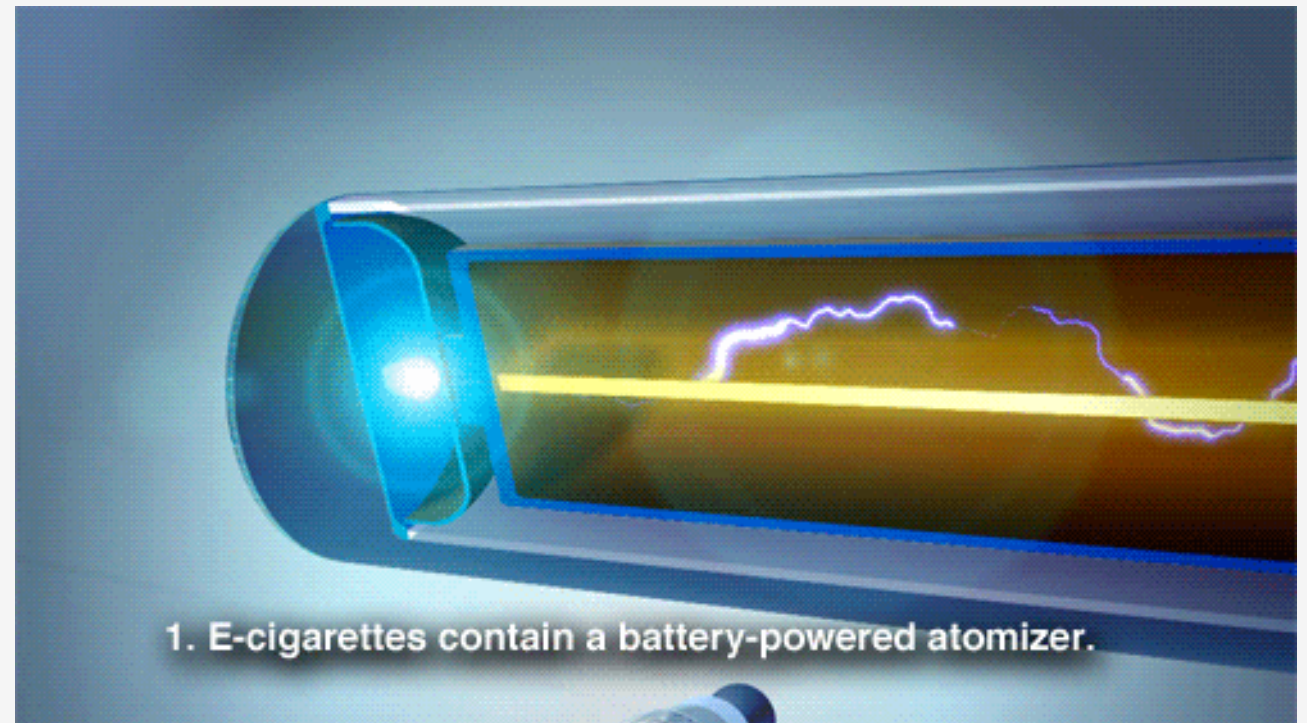
are supported by **Award Nos. 2014-R2-CX-K010 and 2016-DN-BX-0150 and 2018-75-CX-0036, 2019-MU-MU-0007** awarded by the National Institute of Justice, Office of Justice Programs, U.S. Department of Justice. The opinions, findings, and conclusions or recommendations expressed in this publication/program/exhibition are those of the author(s) and do not necessarily reflect those of the Department of Justice.

- No funding was obtained from any manufacturer of any product used in this study.
-



Electronic cigarettes are a safer alternative to traditional cigarettes

- They use FDA approved ingredients
- They are non-combusting
- They do not contain tobacco
 - No tar
- They will not lead to cancer



E-CIG GENERATIONS

First Generation – “Ciga-like”



- looks like real cigarettes
- simplest make-up (battery, coil, and filling)
- low single voltage
- can contain a cartomizer
- appeal to visual users trying to quit traditional cigarettes

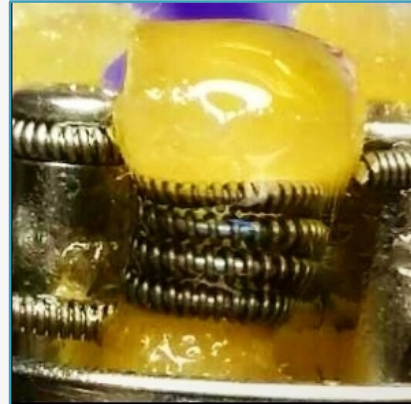
Second Generation – “Mid-size”



- looks like a pen
- larger than cigalikes and are more customizable
- commonly called a clearomizer
- rechargeable battery and refillable tank decreases cost

E-CIG GENERATIONS

Third Generation – “Advanced Personal Vaporizers”



- stronger batteries and various settings
- rebuildable atomizer
- smoked by advanced vapers because of the endless modification possibilities

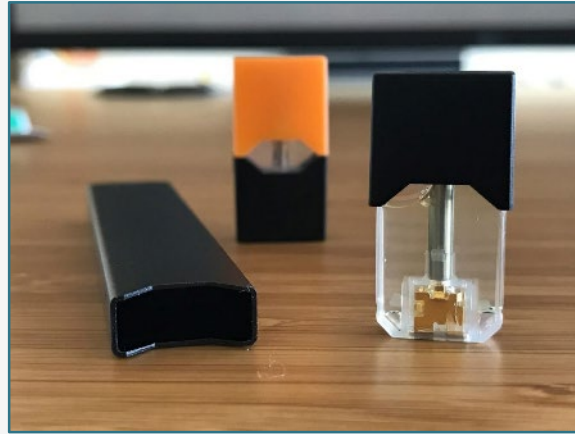
Fourth Generation – “Alternative Vaping Products”



- Liquid with particulates
- Non-liquid vaping material

E-CIG GENERATIONS

Fifth Generation



- POD MODS
 - “Ultra-portable” = Easy to Conceal
 - Nic-Salts
 - EtOH Content?

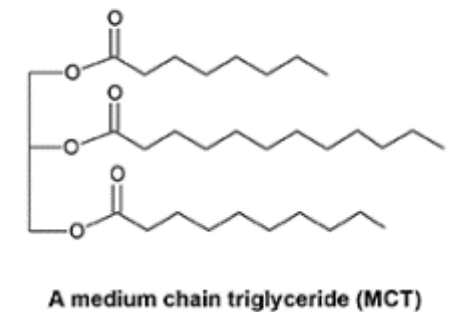
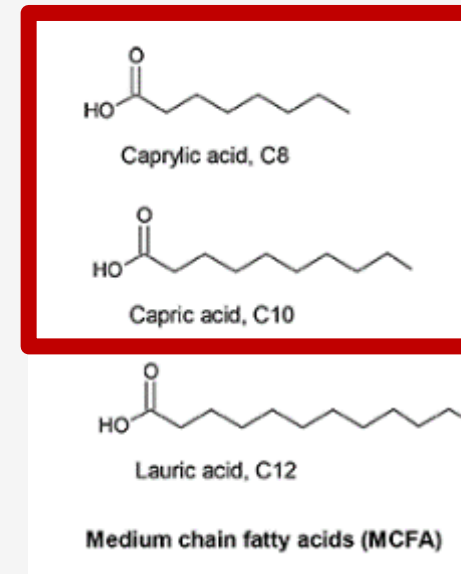
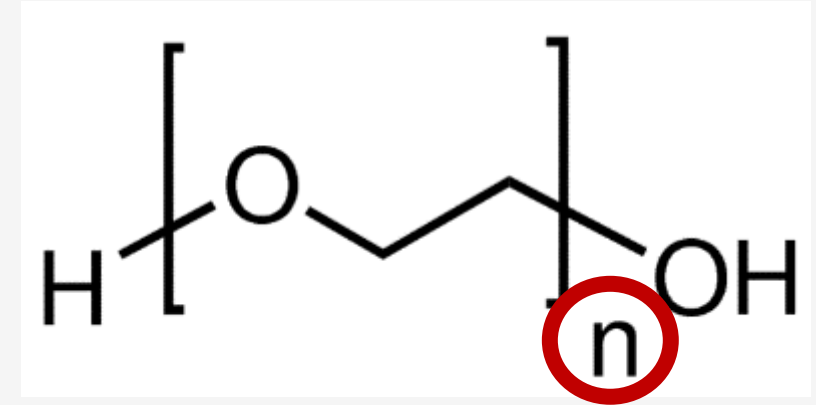
E-liquid Composition

- Propylene Glycol (PG)
- Vegetable Glycerin (VG)
- Flavorants
- Active ingredients
 - Nicotine
 - Drugs Other Than Nicotine (DOTNs)
 - Ethanol
 - Natural products/plant materials
 - Non-Traditional Pharmaceuticals
 - Scheduled Drugs
 - Designer Drugs

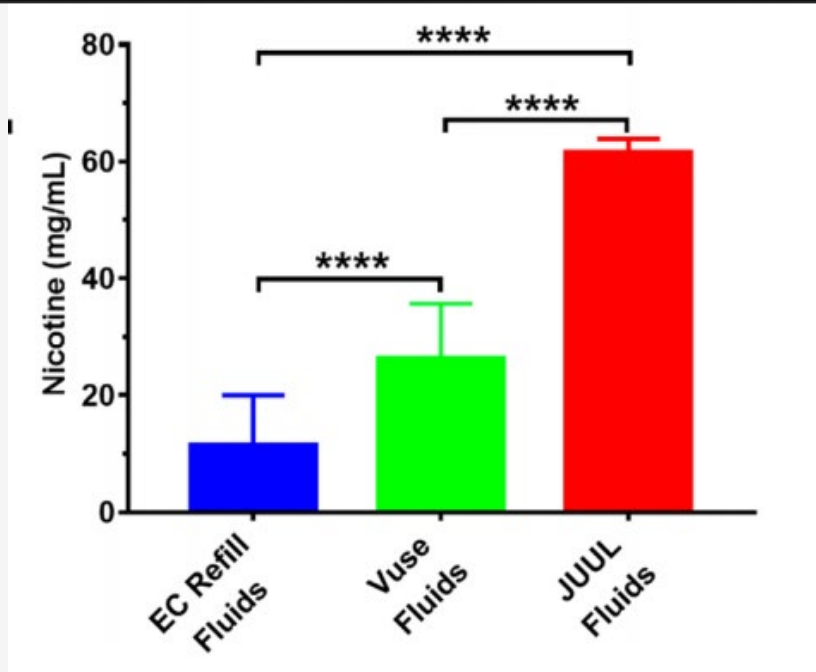


E-liquid Composition??

- Polyethylene Glycol (PEG)
 - “polyethylene oxide” or “polyoxyethylene”
 - Medical use:
 - Laxatives
 - Pharmaceutical binder or bulk
 - Food additive
 - Creams/lotions
 - Toothpaste
- Medium Chain Triglycerides (MCT)
 - Coconut Oil
 - Easy to digest
- Glycerin/Glycerol

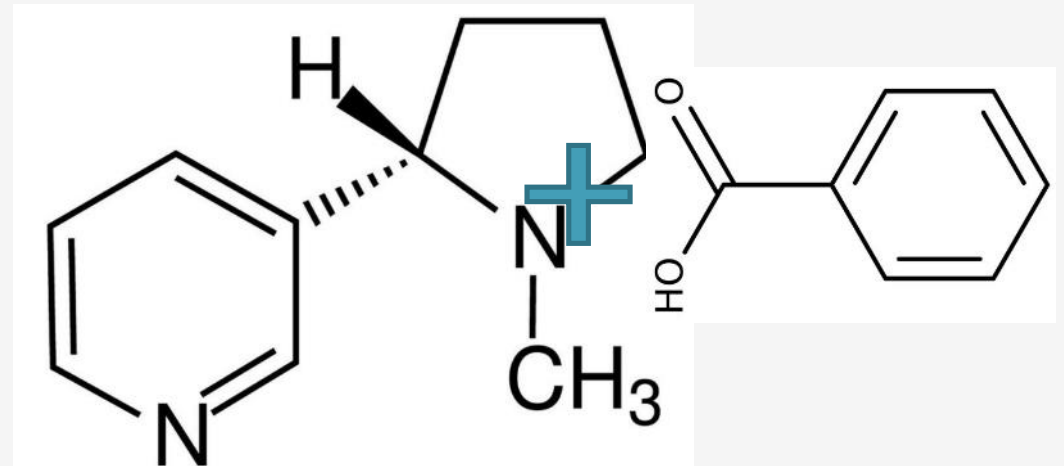


NICOTINE SALTS



What Are Nic Salts?

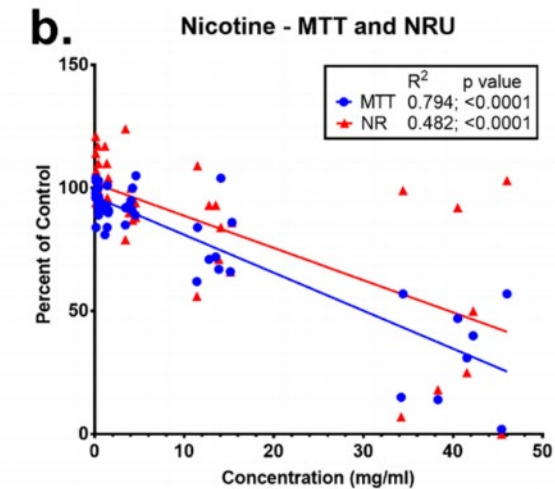
Nicotine vs Nicotine Salt



2 mg nicotine/cig =
40 mg in pack



Single pod =
55-65 mg



Nicotine Label vs Actual

American Producers

Nicotine 6-22 mg/mL

>10% Diff:

18 of 27

>20% Diff:

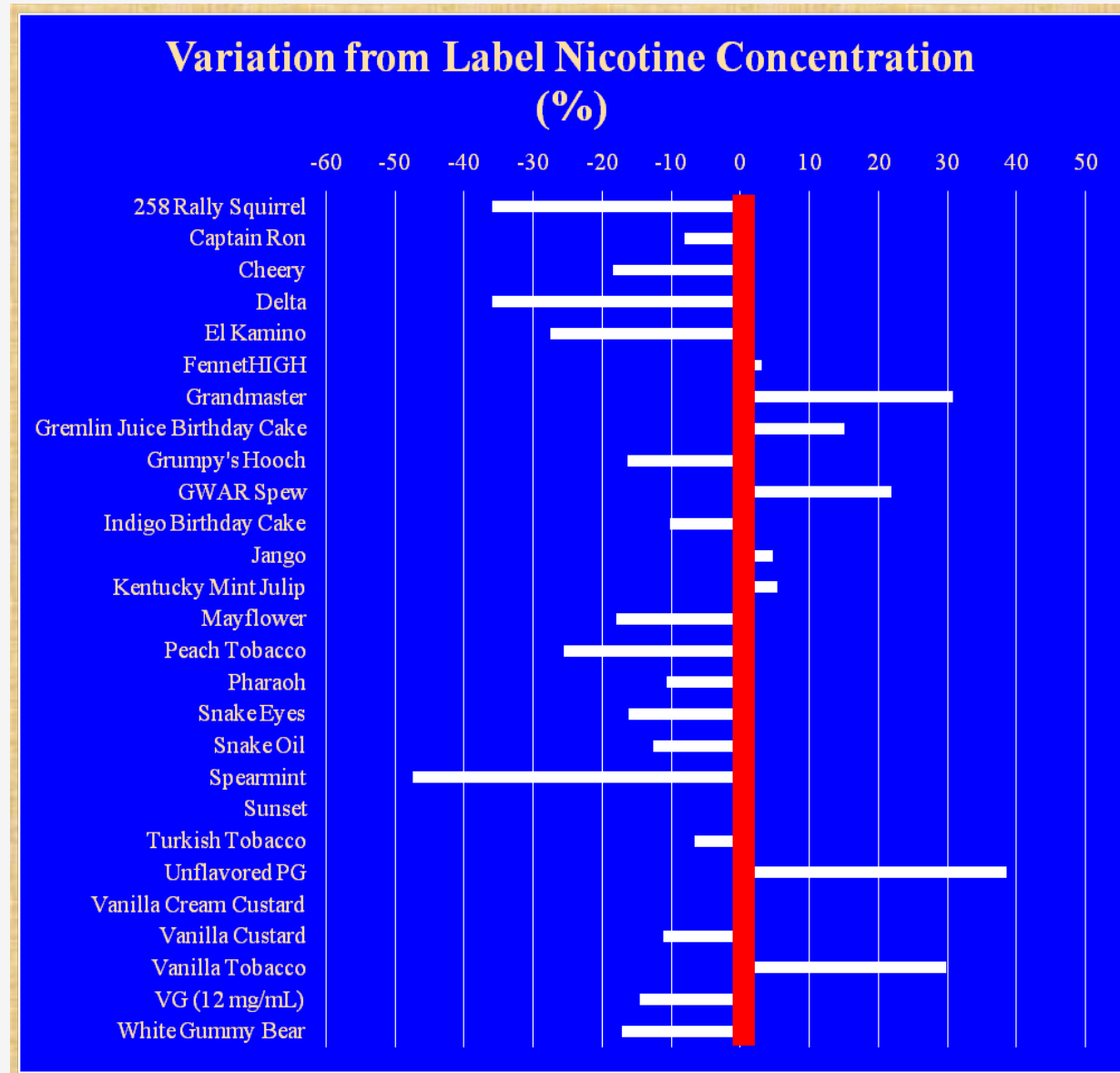
9 of 27

>30 % Diff

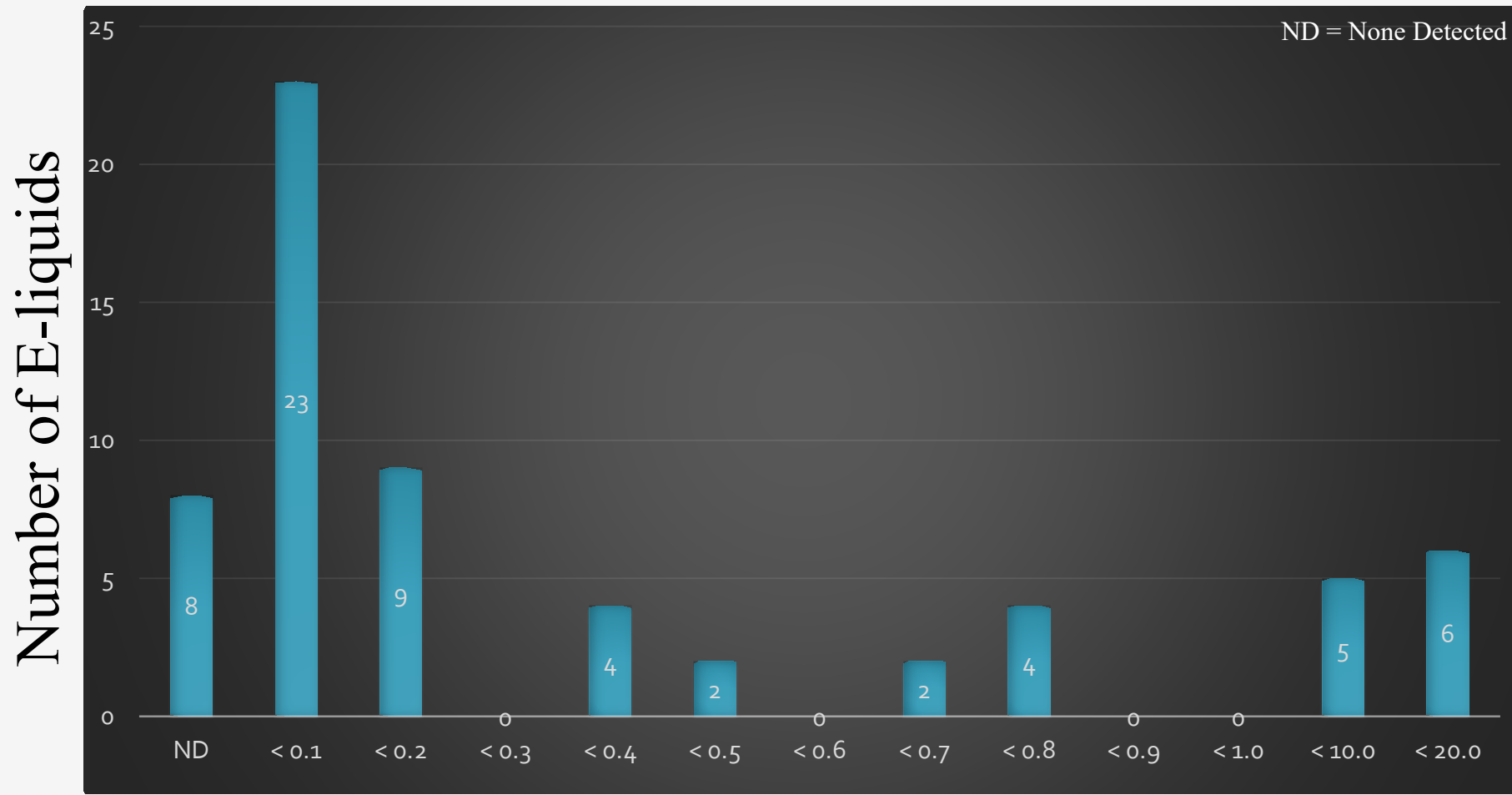
5 of 27

Range:

-47% to +39%



Headspace FID Analysis of 63 E-Liquids



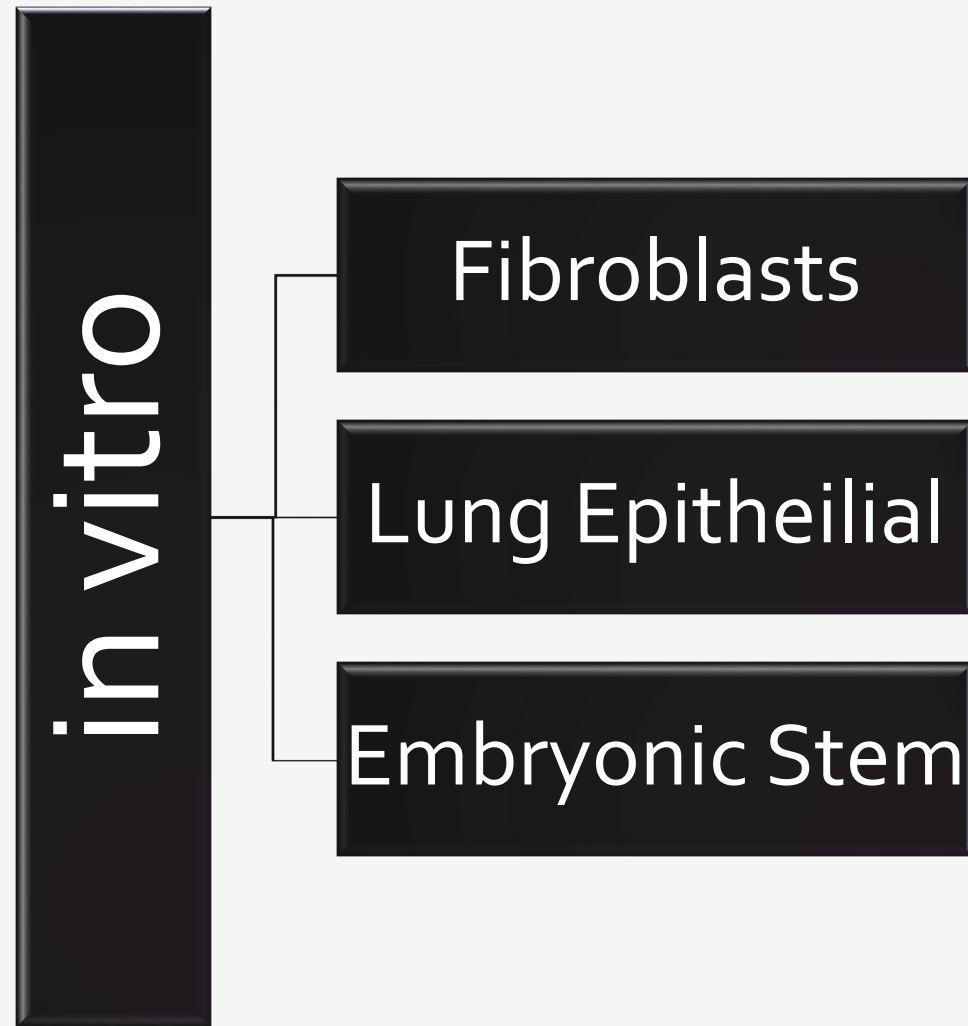
Other VOC:
Acetone
Isopropanol
Methanol

Concentration of Ethanol in % by Weight per Volume

Cytotoxicity

Eliquids vs Aerosols

Flavorants vs Solvents



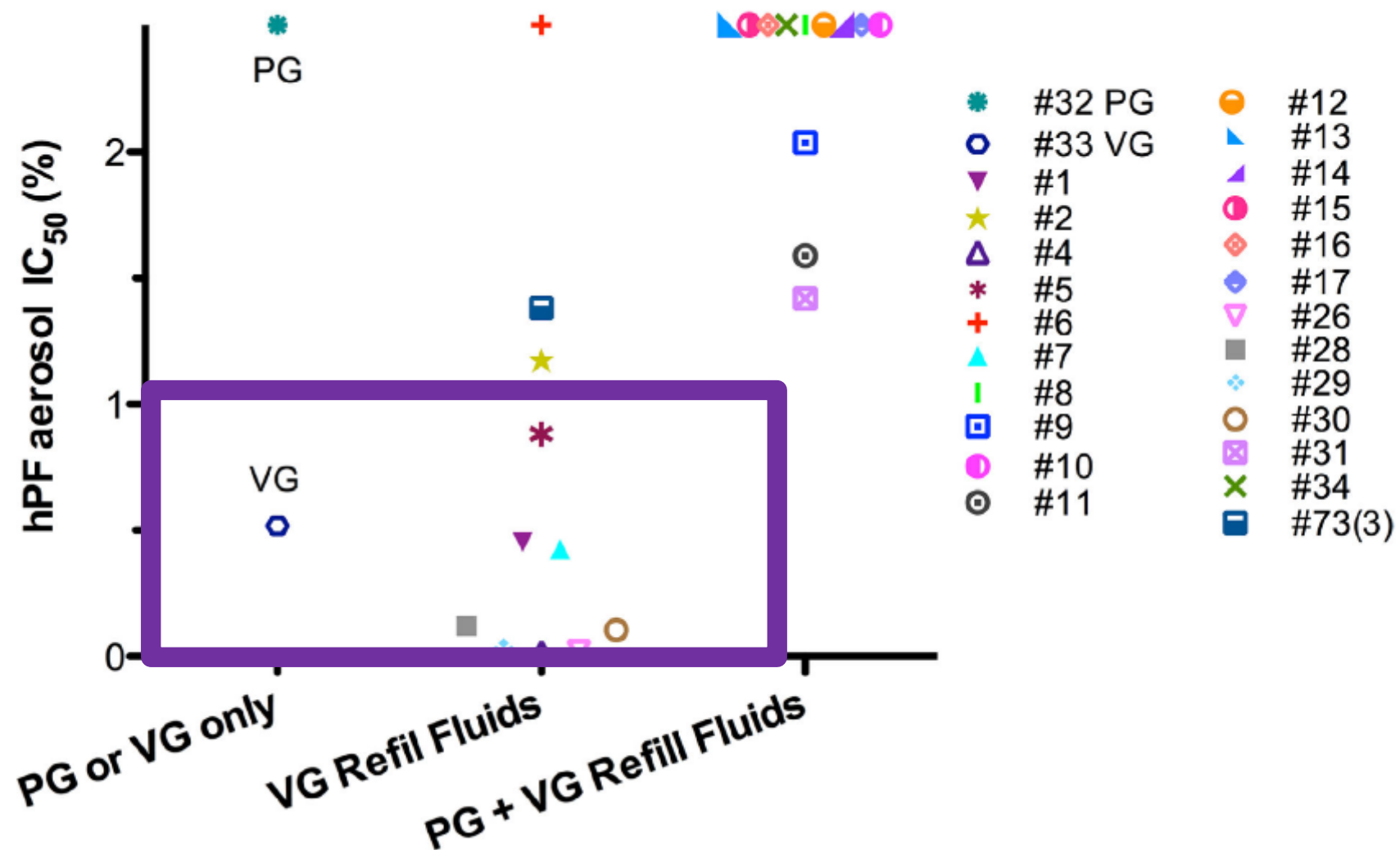
Cytotoxicity

Toxic flavors:

- Tobacco
- Mint
- Creamy/buttery

Behar et al.

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E-liquid Composition

E-LIQUID VS E-LIQUID AEROSOL^{1,2}

- Must evaluate the aerosol
- Chemical by-products
 - Formaldehyde
 - Acrolein
 - Acetaldehyde
 - Benzene, Pyridine
 - Nitrosonornicotine (NNN) + ketone (NNK)
 - Heavy Metals
 - Dozens of other potential chemical irritants

FLAVORANTS³

- Almost all flavoring chemicals are Generally Recognized as Safe (GRAS)
 - FOR ORAL CONSUMPTION ONLY
 - Food approved flavorants are the only source for e-liquids
 - Evaluated previous studies for reported concentrations
 - Only 1 flavoring chemical present at toxic level
 - All other flavorants “far below” levels needed for toxic classification
 - At some concentration, all flavoring chemicals have a toxic impact

¹Varlet, Internat J Environ Res Public Health, 12, p4796

²Lim, Anal Bioanal Chem, 409, p1247

³Farsalinos, Harm Reduction, 16:48 (2019)

E-Cigarette Deterioration?

- Potential sources of toxic metals:

Atomizer



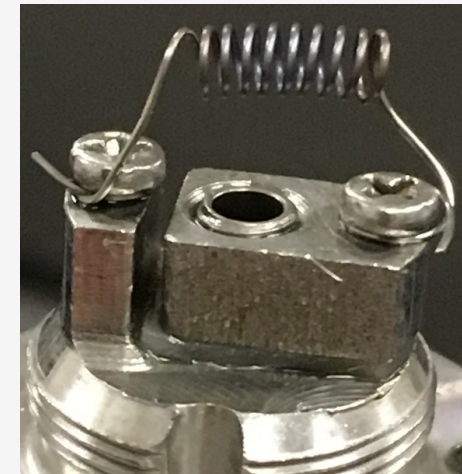
<http://www.dhgate.com/store/product/vivi-nova-atomizer-clearatomizer-ego-atomizer/165977769.html>

E-liquid



<http://vaping360.com/best-e-juice-e-liquid-and-vape-juices/>

Coil

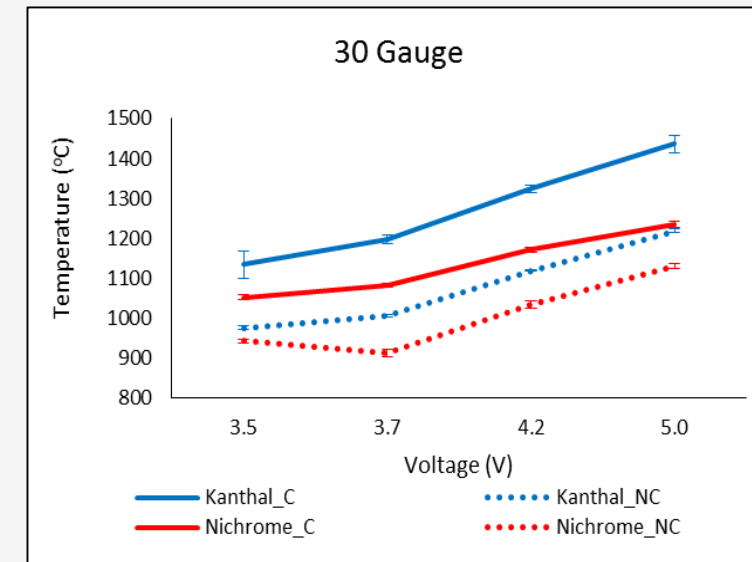
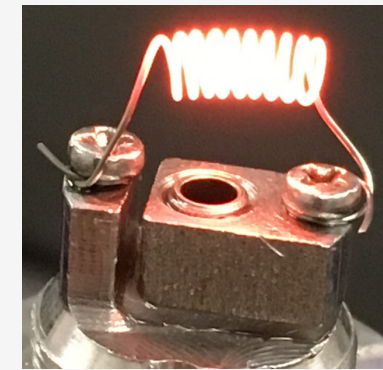
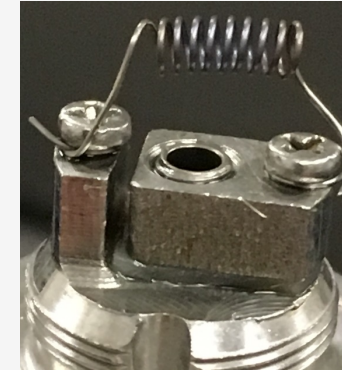


Kamilari, et.al. Food Chem Toxicol 2018 June;116(Pt B)
Palazzolo, et. Al. Front Physiol. 2017 Jan 10;7:663

E-Cigarette Deterioration?

Kanthal A-1 Wire Composition					
C	Si	Mn	Cr	Al	Fe
0.08%	0.70%	0.40%	23.5%	5.80%	68.32%

Nichrome Wire Composition		
Fe	Ni	Cr
24%	60%	16%

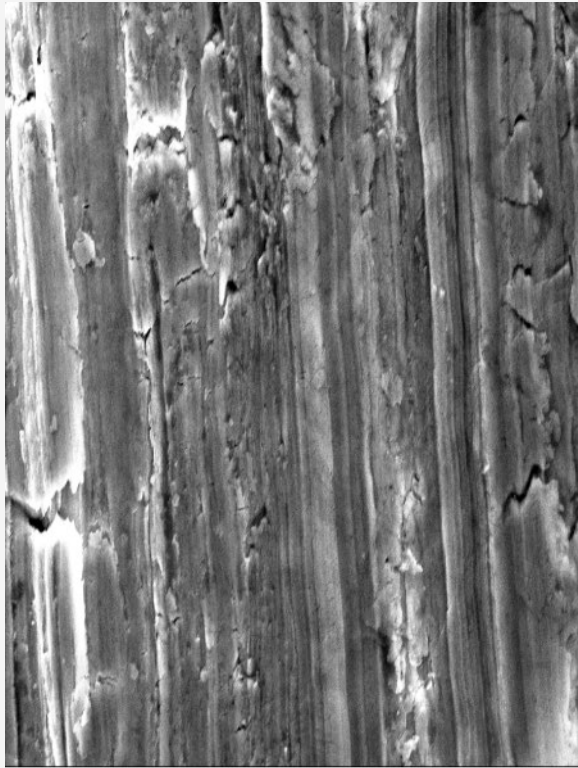


Peace, et.al. Preparing for publication

E-Cigarette Deterioration?

Kanthal Wire.

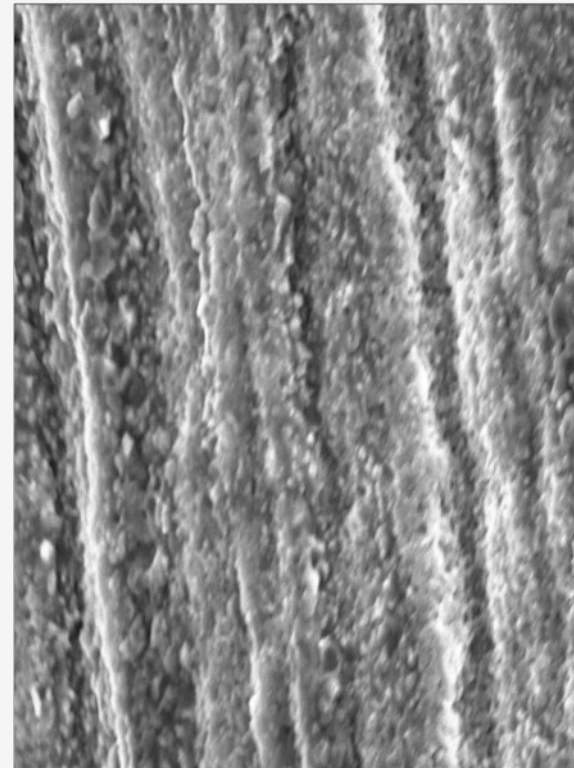
All pictures taken at 2000x magnification



New



1 Burn



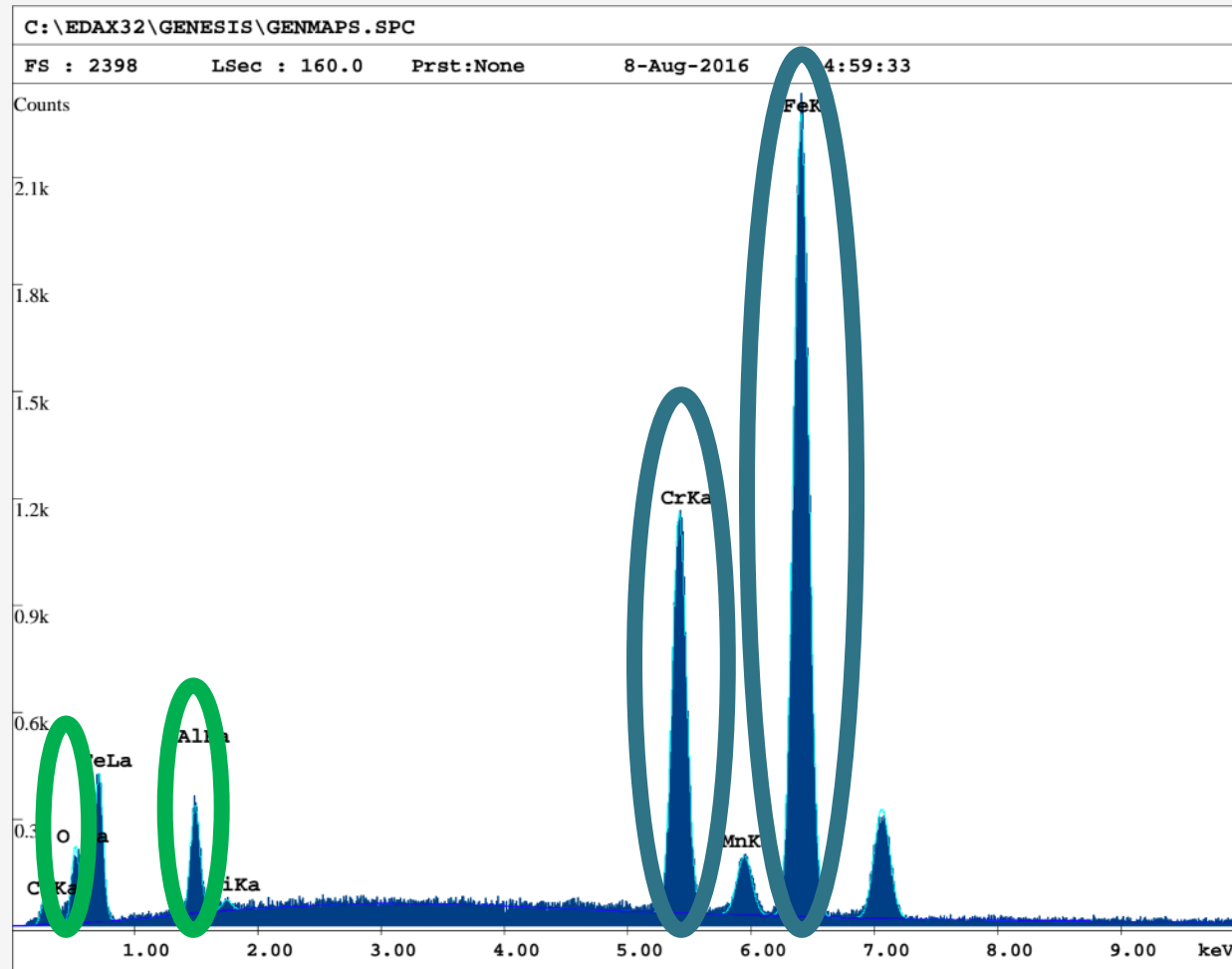
50 Burns



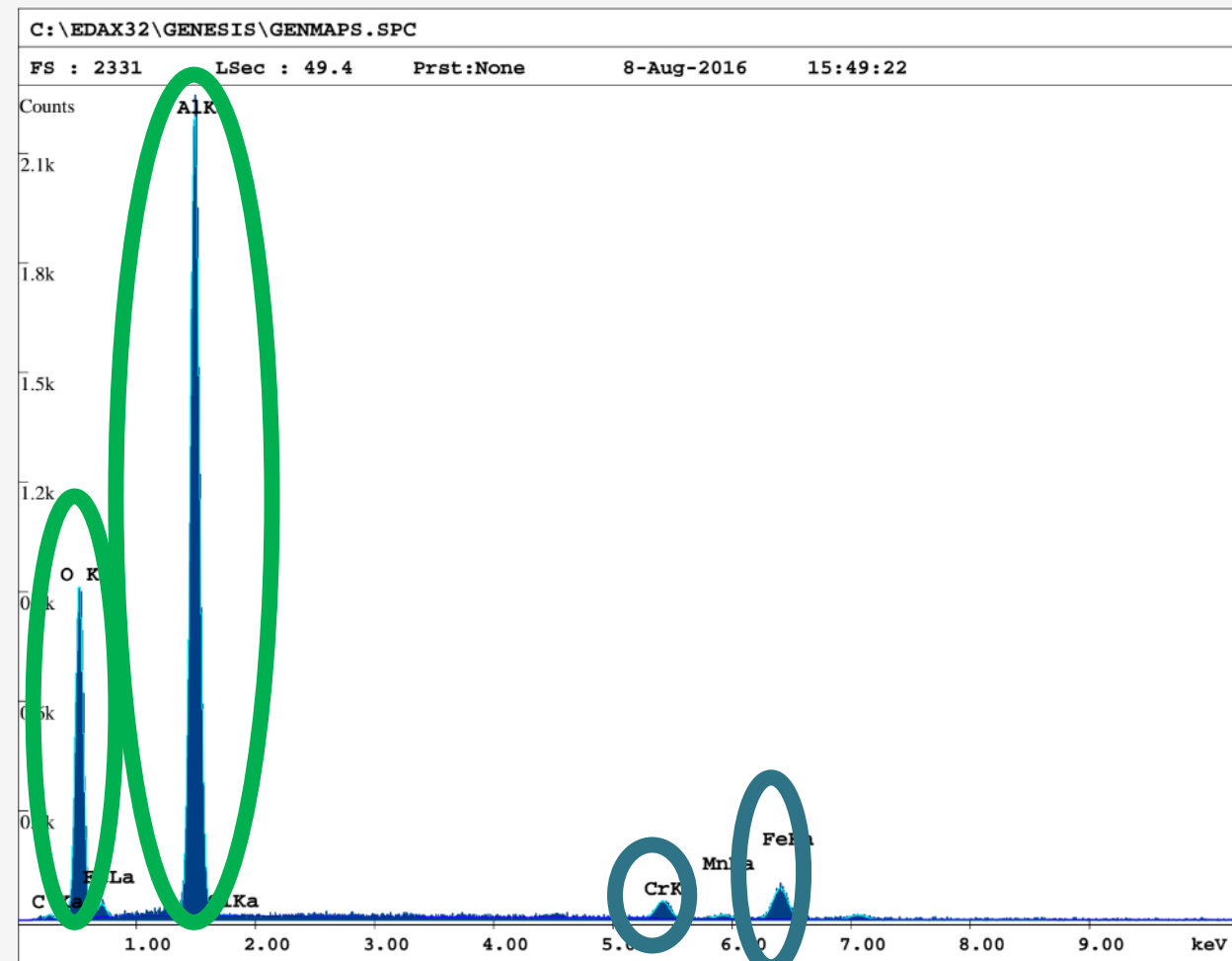
150 Burns

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E-Cigarette Deterioration?



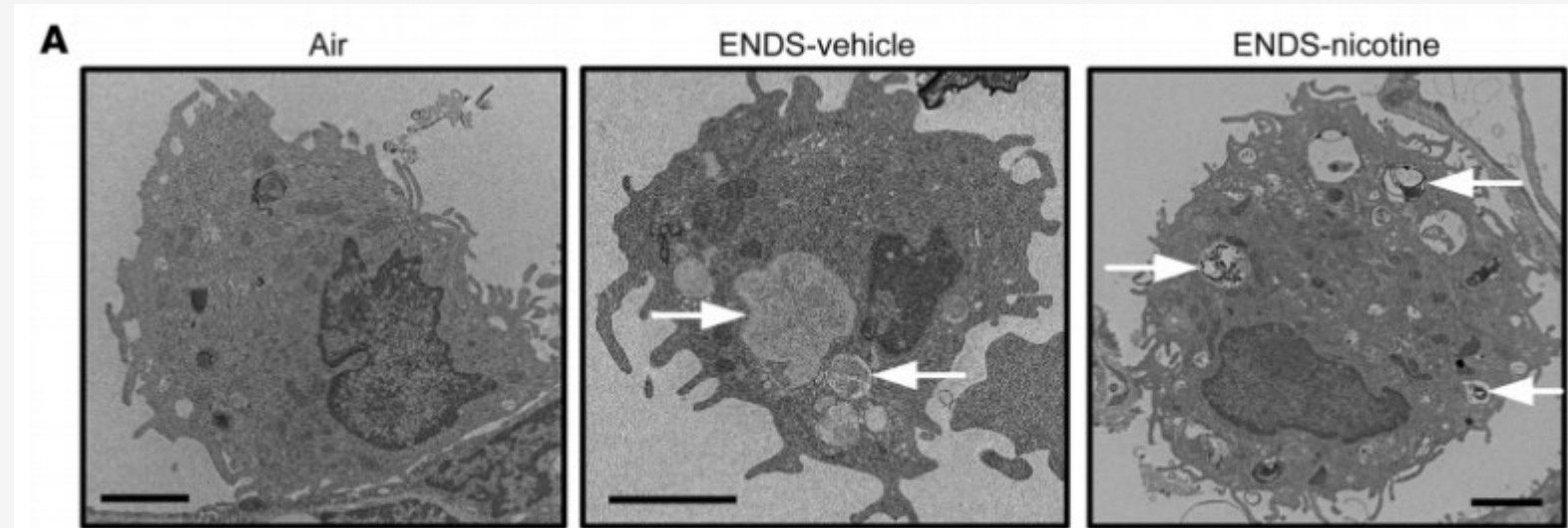
30 AWG Kanthal New



30 AWG Kanthal 150 Burns

Complaints

- Nose irritation, Sneezing
- Watery eye, red eyes, sore eyes
- Sore throat, dry throat, cough, asphyxia
- Airway irritation ↑
- Mucus hypersecretion
- Inflammatory response ↑
- Exacerbates asthma, COPD, Cystic fibrosis
- Acute Lipid Pneumonia in mice



Lestari, J Environ Public Health, v2018, 9014340
Thirion-Romero, Rev Invest Clin, 2019, 71:17-27
Madison, J Clin Invest, 2019, JCI128531

CASES

As of October 01, 2019:

- 1,080 lung injury cases
- 18 deaths
- 48 states + 1 US Territory

UTAH:

- 6 cases: Lipid-laden macrophages

NORTH CAROLINA:

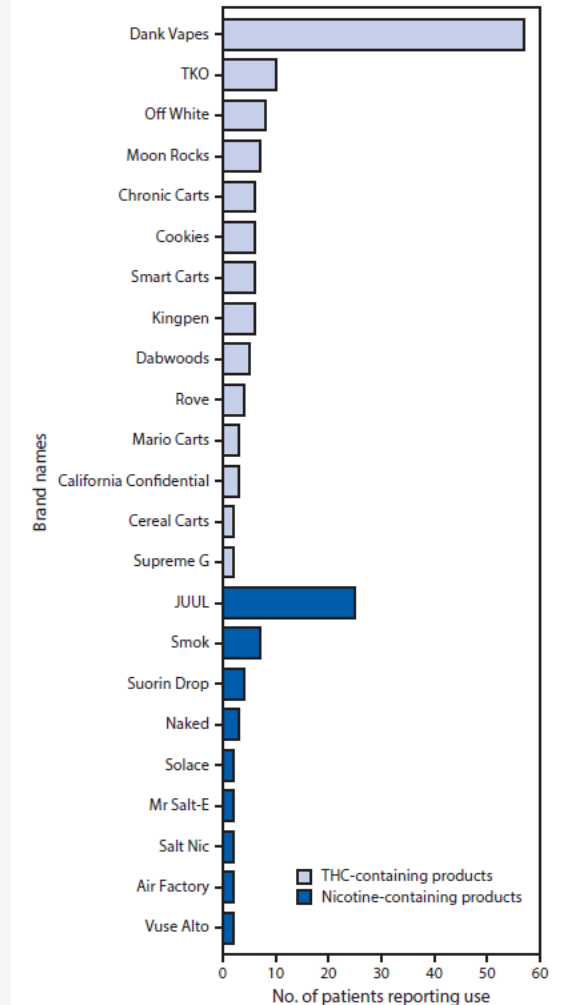
- 5 cases (100% THC, 3/5 nicotine)
 - Lipoid pneumonia – lipid-laden macrophages

CDC>Basic Information>E-cigarettes> Severe Lung Disease
Ghinai, et.al MMWR Octo4, 2019. V68 #39

ILLINOIS and WISCONSIN

- 127 cases total
 - Interview with 86 of 127 patients
 - 87% used THC products
 - 71% used Nicotine products
 - 58% used THC+Nicotine products
- As of early September, 24 cases had samples taken
 - 14 had cell counts measured
 - Only 7 of 14 measured macrophages
 - ALL 7 were lipid-laden

FIGURE. Frequently reported brand names of tetrahydrocannabinol (THC)- and nicotine-containing electronic cigarette (e-cigarette), or vaping, products^{a,b} reported by patients with lung injury^a — Illinois and Wisconsin, 2019



CDC>Basic Information>E-cigarettes> Severe Lung Disease
Ghinai, et.al MMWR Octo4, 2019. V68 #39

OTHER CONSIDERATIONS

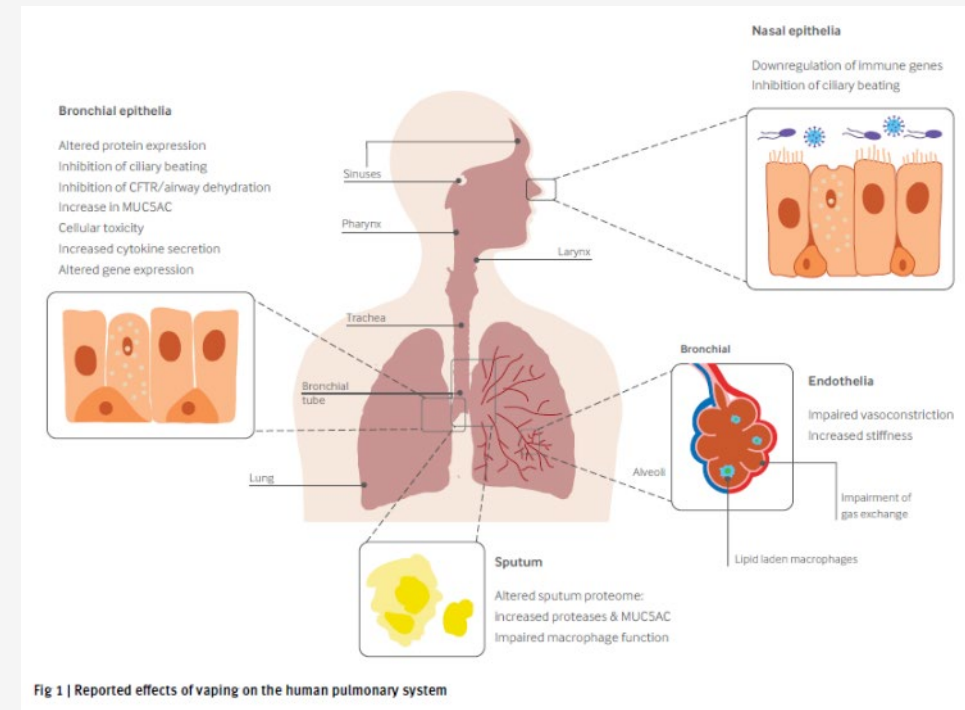
- No data on how many patients voluntarily stop vaping
- Practice of vaping has evolved
 - Deep inhale and hold (THC advice?)
 - Concealment
- E-liquid composition
 - Easier to inhale and hold longer
 - Flavors
 - NicSalts (+ benzoic acid)
 - Ethanol

MECHANISM?

- Still needs to be hypothesized and tested
 - PG and VG are hygroscopic = drying
 - Deep lung tissue lined with water and surfactant
 - Chemicals and metals are irritants
- 11th finger mentality for vaping
 - Combine with long holds

- **MECHANISM IS STILL UNKNOWN**

Gotts, et al. BMJ September 2019;366:L5275



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https://www.charlotteobserver.com/news/local/article203727924.html



CBD oil in electronic cigarettes or vaporizing pens might be driving users to emergency rooms, North Carolina health authorities say. Nam Y. Huh - AP

LOCAL

CBD oil in your e-cig or vape pen might send you to the ER, NC says





BY BRUCE HENDERSON

bhenderson@charlotteobserver.com

March 06, 2018 01:33 PM

Updated March 06, 2018 03:38 PM



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Tobacco-Free Living

Health Effects of Vape Oils Containing Unknown Substances

Last Updated: April 25, 2018

APHC Home / Topics / Healthy Living / Tobacco-Free Living / Health Effects of Vape Oils Containing Unknown Substances



PUBLIC HEALTH ALERT



PUBLIC HEALTH ALERT: Users of e-cigarettes and/or vaporizer pens must ensure that the products they purchase do not contain Cannabidiol (CBD) oil, CBD, tetrahydrocannabinol (THC) or synthetic cannabinoids.

[CLICK HERE TO VIEW THE ALARACT ON AKO \(CAC REQUIRED\)](#) @

Other Articles:

Annual Tobacco Ce Events

Information about the nationally supported is cessation events to aid need to quit tobacco u

Related Sites

Related Sites for tobacco Living.

TPL Education for I

Information and Info on Tobacco-Free Living

10,075 views | May 26, 2018, 03:18pm

Fake CBD Poisoned At Least 52 People In Utah Last Winter, Officials Say

Janet Burns Senior Contributor @ Consumer Tech
I cover AI, cybersecurity, culture, drugs, and more.

Shutterstock

Virginia Commonwealth University

MRPeace. September 2019

Case	Location	Product Purchase	Victim Quotes
High School Senior	Georgia	Store	One of the times I confronted [my son] in his room pale and glassy eyed...
Doctoral Student	Georgia	Store	It was a hard high – was it a reaction to CBD?
Unknown	Unknown	Online	Have you tested other CBD products because this is some bad [stuff]
Unknown	Unknown	Online	I know what pot makes me feel like and this...wasn't it
Immigrant	California	Online	I've not left my apartment for 4 days
72 yo female	Florida	Store	...bought a product for knee pain...her pharmacist recommended it the most...
79 yo female	Missouri	Store	...she has rheumatoid arthritis...she just wanted to be painfree...
Nurse	New Jersey	Store	...I can only describe as a situation rapidly devolving into the scariest night of my life. I felt I like I was dissociating from reality

Case	Location	CBD Present	Unexpected Ingredient
High School Senior	Georgia	No	MEP-Fubinaca
Doctoral Student	Georgia	Yes	5F-ADB & Dextromethorphan
Unknown	Unknown	Yes	5F-EDMP-Pinaca?
Unknown	Unknown	No	4F-MDMB-Butinaca
Immigrant	California	No	MMB-Fubica
72 yo female	Florida	Yes	SynCannabinoid
79 yo female	Missouri	Yes	SynCannabinoid
Nurse	New Jersey	Yes	SynCannabinoid





r/CBD

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Posts



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11



Posted by u/Fuckgamblingfuckfuck 4 months ago

Yet another Diamond CBD warning.

I saw t

<https://>

Note h

hell is

17 C



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18



Posted by u/ethansmith2000 7 months ago

worried about diamond cbd

back in december of 2017 i think, my mom had first acquired diamond cbd chill gummies. I was immediately sketched out by the fact that it didn't say how much cbd was in them and that the oil had leaked out of the gummies. However, my

mom

helped

and s

found

How

but sh

every

As

Posts



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BECOME A REDDITOR



32



Posted by u/TWOATTICS 4 months ago

Diamond CBD - Failed Drug Test

I have not smoked weed in over 6 weeks. I bought a Diamond CBD Full Spectrum cartridge recently and failed a drug test for THC. I also had a false positive for opioids. I haven't taken tramadol in 3 weeks, when I got my cortisone shots, so it's strange that would be an issue.

I cannot say without a doubt Diamond CBD caused my false positives, but I don't know what else would've caused it. I've read some buyer beware posts (after I bought it of course) so I wanted to add to the list of beware posts.

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COMMUNITY DETAILS



r/CBD

63.4k

Subscribers

306

Online

community site for vetted
t [http://theCBD.place]
CBD.place). It's time that this
s given more internet exposure.
e to discuss topics related to
arijuana and our experiences
Please do not assume that



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