



Analysis of Chemical Components from High, Med & Low Nicotine Cartridges

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1. Background

Nicotine solution cartridges were supplied for analysis by 'The Electronic Cigarette Co (UK) Ltd' as part of their due diligence to confirm the components currently found within the Nicotine Solution formulation. Samples cartridges labelled High, Medium and Low nicotine were supplied.

Solutions of this type can be used in an electronic cigarette which replicates the action of smoking, producing a tobacco aromatized smoke which when inhaled quickly delivers the nicotine to the lung.

The Electronic Cigarette does not emit a tarry smoke, or produce an ash deposit, and can be used to wean the smoker off 'cigarette smoking' in a controlled manner.

2. Sample

The samples were received on the 01/09/2008.

- 1 x Nicotine cartridge HIGH
- 1 x Nicotine cartridge MED
- 1 x Nicotine cartridge LOW

3. GC-MS Method

The samples were analyzed by an external flavour laboratory to determine the components present by GC-MS (gas chromatography mass-spectrometry).

Column: Alltech Flavour & Essences Capillary Column – 30 m x 250 µm x 0.5 µm
Temperature: 50°C 4 min, ramp 10°C/min to 210°C
Analysis Time: 81 min
Injection: Split
Carrier gas: Helium

The GC method employed may not detect some less volatile components that may be found in the samples, or where components are present in such low levels that they are below detection limits for the GC-MS method.

4. GC-MS Results

The Nicotine cartridge samples were diluted with Propylene Glycol to allow sufficient sample for injection.

Table 1 – Nicotine High/ Med / Low

Summary of GC-MS peak identification, CAS Number, and associated Risk Phrases

No	Component Name	Nicotine HIGH Cartridge Detected Yes/no?	Nicotine MED Cartridge Detected Yes/no?	Nicotine LOW Cartridge Detected Yes/no?	CAS No.	Effects to Humans of pure product in isolation via inhalation route R20 = harmful by inhalation R23 = Toxic by inhalation R26 = Irritating to respiratory system R39/23 = Danger of serious irreversible effects through inhalation
1	Nitrogen	yes	yes	yes	7727-37-9	Possibly present due to inert packaging
2	Ethanol	yes	no	no	64-17-5	R11 = Highly Flammable
3	Water	yes	yes	yes	7732-18-5	Non hazardous
4	Propylene Glycol	yes	yes	yes	57-55-6	Not currently recognized as giving any health hazards. So some MSDS's say no harmful effects from inhalation, while others may list some possible health hazards including by respiration route However, it is listed as a suspected respiratory toxicant, suspected skin or sense organ toxicant, suspected neurotoxicant, and a suspected immunotoxicant.
6	Nicotine	yes	yes	yes	54-11-5	R23 = Toxic by inhalation R24 = Toxic in contact with skin R25 = Toxic if swallowed Poison - maybe fatal if inhaled
7	Triacetin	no	yes	no	102-76-1	No Risks identified

5. Discussion

The composition of the three solutions in the nicotine cartridges has been investigated by LPD Laboratory Services, in order to try and re-affirm that the nicotine solutions are a much safer alternative when used in the electronic cigarette, when compared to smoking with traditional cigarettes.

All three solutions needed to be diluted with solvent (Propylene Glycol) to yield sufficient liquid to inject onto the GC-MS, and so nominal % compositions have been omitted.

All three nicotine solutions contain the addictive yet poisonous nicotine component, as do traditional cigarettes.

Only the cartridge labelled HIGH appeared to contain low levels of Ethanol solvent. Ethanol was not detected in the MED and LOW nicotine solutions.

All three nicotine solutions do appear to contain large amounts of propylene glycol aerosol forming solvent. Different suppliers of this chemical appear to offer differing hazard ratings on their respective MSDS's. Some indicate no ill effects from inhalation which is fine, while others indicate CNS and spleen health issues may exist from prolonged inhalation of the chemical.

Researching the chemical profile for propylene glycol¹ indicates that although there would appear to be 'no current recognized health hazards', the chemical is 'suspected to be a respiratory toxicant'. If Propylene Glycol subsequently becomes 'recognized as a respiratory toxicant' following the launch of the product in Europe, then 'Pillbox 38' should be looking for an even safer alternative such as Glycerol.

Only the MED nicotine solution contained traces of Triacetin, a noted cigarette additive with no identifiable risks.

6. Conclusion

On balance, the nicotine solution cartridges appears to offer a much safer alternative to the traditional cigarette. Apart from the required toxic Nicotine, the samples tested appear to be fairly clean and free from other potentially toxic chemicals.

Using this type of nicotine solution, the artificial smoke generated by an Electronic Cigarette would not appear to contain the toxic cocktail of toxic carcinogenic compounds found in traditional tobacco smoke. Some 600+ chemicals have been identified in traditional smoke tobacco, of which many are carcinogenic.

The primary aerosol forming solvent (Propylene Glycol) used in the preparation of the nicotine solution is listed as a 'suspected respiratory toxicant'.

'The Electronic Cigarette Co (UK) Ltd' should look at changing the aerosol forming solvent from the suspected respiratory toxicant 'Propylene Glycol', to an even safer solvent such as Glycerol.

7. Recommendations

- a) 'The Electronic Cigarette Co (UK) Ltd' should take a Proactive look at replacing the Propylene Glycol component completely with an alternative such as Glycerol, in the event that the solvent becomes added to the list of respiratory toxicants in the foreseeable future

8. References

- www.scorecard.org/chemical-profiles; The Pollution Information
- Reference to 100 fatal poisonings in Panama resulting from a Chinese factory falsifying records in order to export the cheaper but toxic Diethylene Glycol as the more expensive Glycerol.

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End of Report