



## DETECTION OF ADULTERATION IN LIQUOR BY CONGENER ANALYSIS

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### ABSTRACT

*In alcoholic beverages, there are impurities called congeners produced during fermentation, which are responsible for some of the taste, aroma, and colour of what you drink. These impurities are not the sole cause of a hangover, yet they do seem to contribute in some manner to the severity. Not everything you drink is created equal when it comes to the concentration of these impurities. "Top Shelf" bottles generally contain fewer impurities than the type of booze you find in plastic bottles. This is because expensive liquor usually undergoes a more rigorous distillation process. In this paper, an attempt is made to find the duplication in liquor samples by congener analysis. This approach is useful to find out the suspected duplicate samples.*

### KEY WORDS

*alcoholic beverages, Fermentation, Congener Analysis*

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### INTRODUCTION:

Cheaper alcohols are rarely made as well (filtered as well) as top-shelf brands and that can add to your hangover. Even more important is the amount of congeners in a type of alcohol. Congeners are found in greater concentration in darker liquors and seem to play a huge part in how severe your hangover is going to be. A study done in Britain discussing what drinks cause hangovers has brandy & red wine at the top of their list for causing the worst hangovers. Last on their list is vodka, causing the fewest symptoms. So it is not just the heavy stuff different types of wine make for varying types of hangovers. Believe it or not, in some cases wine from countries with a bad frequent urination also expels salts and potassium that are necessary for proper nerve and muscle function; when sodium and potassium levels get too low, headaches, fatigue and nausea can result. [1]

Liquor is the alcoholic distillate obtained by the fermented mash of grain molasses and contains a varying percentage of ethyl alcohol with specific

ingredients. Duplicate foreign liquors are analyzed and detected as per the specifications [2-4]. Duplicate foreign liquors are sold by the same brand names for monetary gain. The alcohol percentage can also be detected by using GC, DMA, refractive index, and specific gravity [5].

Postmortem forensic toxicology frequently finds alcohol both alone and in combination with drugs. Although benzodiazepines are generally considered safe, they are considered dangerous with alcohol [6]. A colorimetric method for the determination of chloral hydrate in alcoholic beverages is reported [7]. Richard A Frazier, et al [8] described the capillary electrophoresis method for the determination of food colors and sweeteners in soft drinks. Tripathi M et al [9] described a novel method for the determination of synthetic colors in ice cream by paper chromatography and UV Visible spectroscopy. Pratima Rao [10] described 'A comparative study on the synthetic food colors.

**Selected congeners to detect adulteration.**

Methanol	Ethyl Acetate	N-propanol	2-butanol	Isobutanol
1-butanol	Acetaldehyde	Iso amyl alcohol	Furfural	Acetic Acid

**Gas Chromatography Operative Protocol**
**Instrument details:**

Make	: Agilent
Model	: 7890 A
Sampling Type	: Auto sampler (ALS) system ALS is being used with a total sample size of 16
Detector	: FID
Column	: DB WAX (30 m X 0.53 mm X 1µm)
Carrier Gas	: Nitrogen
Column Material	: Nonpolar bonded and cross-linked, inertness low bleeding and Good thermal stability
Split flow	: 1:50

**Method:**

- Internal standard method (2-pentanol)
- Method Calibration: 8 levels (5,10,20,40,60,80,100,120 ppm)

**Optimization of Method**

- Stabilize the baseline output.
- After creating the sequence click file for save option.
- Save the sequence and click Actions.
- In Run segment click "Start run when ready" and "suppress Reports"
- If the instrument is ready (FID signals are constant) click OK.
- Run will get started.

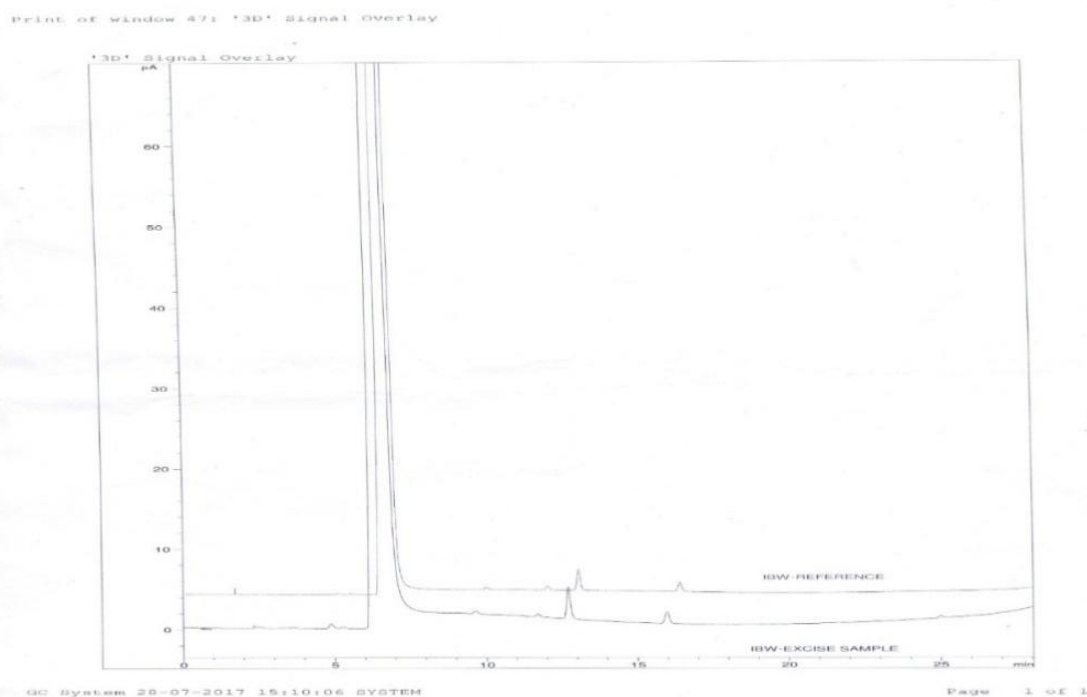
**Initial temperature setting:**

- Injector: 180°C, Oven: 50°C, Detector: 210°C

**Sample Preparation:**

- Take 1 ml of internal standard solution (200 ppm) in a 5 ml Vol. flask.
- Make up to 5 ml with sample to be analyzed and mix well.
- Take sample in to a 2-ml vial and crimped.
- Sample is prepared placed in the auto sampler develop the Sequence in the software.
- Click sequence tab and choose "create new sequence."
- After logging on in Global parameters select the instrument
- and in build click "from Template". After choosing to do ok.
- Fill Sequence information as Sample Name, Vial Number/ position, Report method, Data file name

**Imperial Blue (IBW):** GC Chromatogram



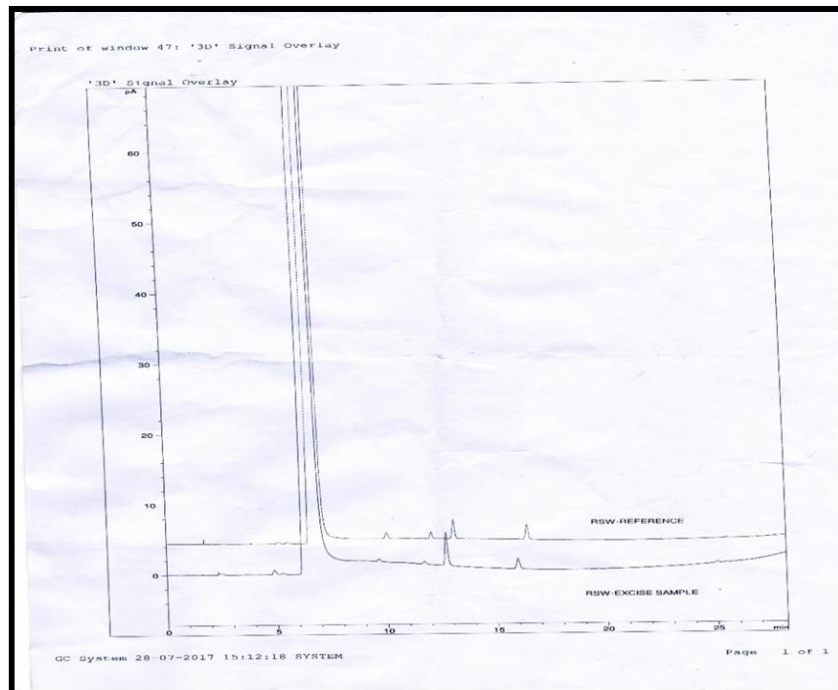
## RESULTS AND DISCUSSIONS:

### Elution Order of Congeners

The elution order of the congeners is Methanol, Ethyl Acetate, N-propanol, 2-butanol, Isobutanol, 1-butanol, Acetaldehyde, Iso amyl alcohol, Furfural and Acetic Acid.

Internal standard solutions injected on the gas chromatogram under identical chromatographic conditions chromatograms recorded. It was very critical to elute and separate congeners in alcoholic beverages on gas chromatography. An alcoholic beverage contains higher amounts of congeners, sugars and esters. Here we have done it on an AGILENT gas chromatography. The modular design of components allows easily changing any GC configurations. Up to three injection units and three detector units can be mounted simultaneously. AGILENT selective detectors specifically eliminate matrix interferences while providing maximum sensitivity. The detector's data

acquisition rate is up to 300 Hz for better repeatability and accuracy of chromatographic data. Gas sampling valves, auxiliary ovens, switching valves and other optional devices make AGILENT GC the most suitable gas chromatograph for the development of complex analytical systems in a wide range of applications. AGILENT GC can be connected to AGILENT software workstation through a local area network (LAN). Dedicated turnkey systems are the added value of all AGILENT instruments. covers a wide range of applications for environmental, chemical, petrochemical, pharmaceutical, food and beverages. Figure 1 shows the gas chromatogram of Imperial Blue (IBW). Figure 2 shows the gas chromatogram of Royal Stage (RSW). This chromatogram shows the elution order of congeners. By overlapping the chromatogram one can easily find out the genuine sample and adulterated samples.

**Royal Stag (RSW): GC Chromatogram**

**CONCLUSIONS**

Our study aimed to identify and quantitatively analyze alcohol volatile congeners to detect adulteration in different types of spirits. For that purpose, beverages were analyzed on the content of Methanol, Ethyl Acetate, N-propanol, 2-butanol, Iso-butanol, 1-butanol, Acetaldehyde, Iso amyl alcohol, Furfural, Acetic Acid.

**Forensic Significance of Congener Analysis:**

**The reason to start congener analyses in the late 1970s was to contribute to an everyday problem which seemed to be a specific German problem because of legal peculiarities.** It deals with the so-called hit-and-run delinquency. In Germany, many drunken drivers prefer to leave the scene of an accident even when the other party needs help. The fear of disqualification from driving is greater than that of punishment for hit-and-run driving. When caught one or two hours later with alcohol in their blood many of these drivers claim to have been sober at the time of the accident and only started to drink after the accident, because of excitement.

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