

Various Alcoholic Drinks Chemical Analysis

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ABSTRACT: The aim of the research is to evaluate 50 different brands of alcoholic beverages produced by local brewers in Kerala to discover whether adulterants were present and in what amounts. All 50 samples were submitted to chemical examination, and none of them returned positive results, suggesting that the alcohol samples are free of adulteration. The physical structure of the beverage samples was revealed by functional measures such as color and odor examination, while microscopic examination of samples revealed the presence of sediments when analyzed under a microscope, showing that the alcoholic beverage samples had not been sufficiently purified. An ultra-violet (UV) visible spectrometer was used in the instrumental process to verify the existence or absence of furfural and to estimate its amount in the necessary sample. To assess furfural concentrations, different chemical tests may be conducted, but in this study, a UV-Visible spectrometer was selected because it is highly sensitive and provides exact concentrations of the substance under examination. Although, various studies have been done in this field throughout previous decade but there is huge possibility of further research in this sector in future.

KEYWORDS: Alcoholic Beverages, Beer, Brandy, Furfural, Illegal Alcohol, Kerala, People, Rum, Vodka.

INTRODUCTION

In the broadest sense, forensic science is the application of scientific methods and ideas to the operation of the criminal justice system. To do their work effectively, forensic scientists must evaluate the values, definitions, and techniques. Forensic scientists look for substances that may be used to link criminals to crimes or reproduce them. This field of study is usually regarded as interesting, and its popularity is growing. Toxicology is a major component of forensic medicine [1].

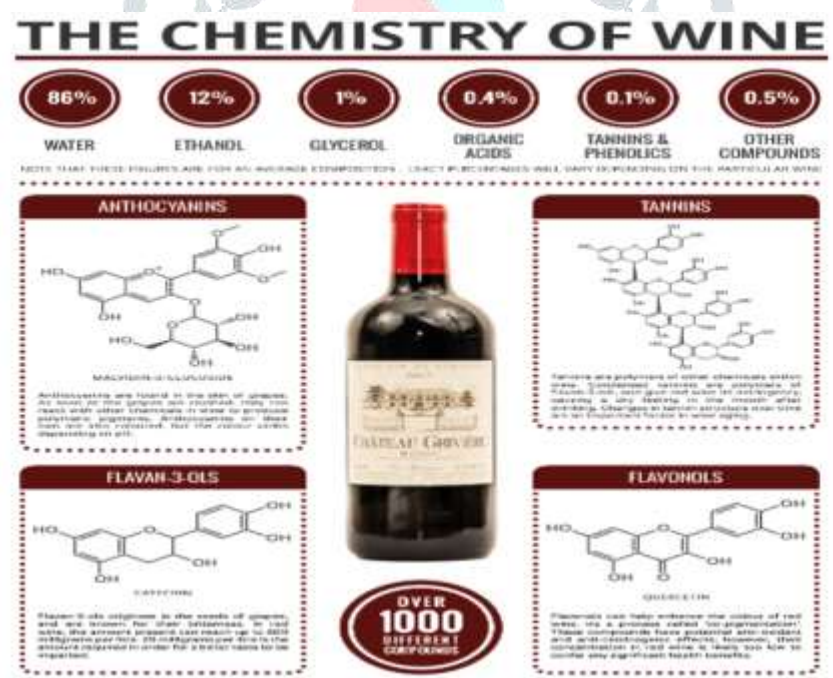


Fig. 1: The Identification Of Poisons, Medications, And Pharmaceuticals In Biological Samples Is Usually Done By An Initial Screening Followed By Clarification Of The Compound, Which May Need Quantitation.

Toxicology and related fields such as analytical chemistry, pharmacology, and medicinal chemistry are used in forensic toxicology to aid medical and legal investigations of suicide, overdose, and drug abuse. The main emphasis of forensic toxicology is the gathering and analysis of results, not the regulatory conclusion of the toxicological research or the equipment used. Toxicological testing may be performed on a variety of things. Any object found at a crime scene that may limit the search, such as pill bottles, powders, trace residue, and any accessible chemicals, must be assessed by a forensic toxicologist. With this information and samples to work with, the forensic toxicologist must assess which toxic compounds are present, at what doses, and what impact such chemicals are likely to have on the victim [2].

The identification of poisons, medicines, and pharmaceuticals in biological samples is typically done by an initial screening followed by clarification of the compound(s), which may require quantitation(s) (Fig. 1). Different analytical techniques are used for sampling and validation, although this is not always the case. To ensure reliable and clear findings at all times, every analytical technique used in forensic toxicology should be thoroughly validated by conducting a validation of the process. To guarantee the best possible findings and the safety of every person, a forensic toxicology testing laboratory should follow a quality strategy. The method of testing chosen is largely dependent on the type of material expected to be discovered and the specimen on which the testing is conducted. The matrix effect, as well as the metabolism and conjugation of the target molecules, make biological samples more difficult to analyze.

The majority of toxicological data or samples are assessed using two types of testing: presumptive or tentative tests and confirmatory tests. In medical and forensic science, presumptive examinations examine a sample and determine one of the following [3]:

- The sample does not provide any evidence of the existence of a specific drug.
- The substance is most likely present in the sample.

The testing needed to verify the research are known as confirmatory tests. Since confirmatory tests are more expensive than simpler presumptive testing, presumptive tests are often used to determine whether confirmatory tests are needed. Color and screening tests are often used as presumptive tests, with instrumental examination performed as a confirming measure. Alcohol is a colorless, volatile, flammable liquid generated by spontaneous sugar fermentation. It is the intoxicating component in wine, beer, spirits, and other beverages, as well as an industrial solvent and gasoline [4].

Alcohol is a chemical which is a basic, small molecule ($\text{CH}_3\text{CH}_2\text{OH}$) that's water soluble and volatile. It also has basic pharmacokinetics (how the body reacts to the drug), particularly when compared to tetra-hydro-cannabinol (THC). At contrast to other substances, alcohol is generally non-toxic and may exist in high quantities in the blood. The concentration of alcohol in the blood is estimated in milligrams (1/1,000th of a gram), while the amount of THC in the blood is measured in Nano grams (1/1,000,000,000th of a gram). In contrast to many other medications, this makes alcohol identification much better [5].

An alcoholic beverage includes ethanol, a form of alcohol generated via the fermentation of grains, fruits, or other sugar sources. In many countries, drinking alcohol serves an essential social role. The manufacture, sale, and use of alcoholic drinks are all regulated in most countries. In general, alcoholic beverages are not hazardous, but they may be fatal and lethal in rare circumstances. Each hour, our systems can only digest one unit of alcohol. When people drink a lot of alcohol in a short period of time, their liver will fail due to the quantity of alcohol in their blood. It has the ability to [6]:

- Slow down brain functions, leading us to lose our feeling of balance.
- Irritate the throat, which causes vomiting and impairs the operation of our gag reflex.
- Affect the nerves that control respiration and heartbeat, resulting in both being halted.
- Dehydration, which may result in long-term brain damage.
- Lowering the body's temperature may induce hypothermia.
- Lower blood sugar levels, which may lead to seizures.

LITERATURE SURVEY

P. Panagiotopoulou et al. demonstrated that using 2-propanol as a solvent. Furfural hydrogenation resulting in furfural alcohol, which then undergoes hydro-hemolysis to generate methyl furan. Furfural decarboxylation and furfural alcohol ring hydrogenation also contain small quantities of furan and traces of tetra-hydro-furfural alcohol. With 2-propanol, furfural alcohol may dimerism or release ether. Increasing the reaction temperature or time improves the yield of methyl furan. Cross 95 percent and 61 percent, respectively, after 10 hours of reaction at 180 °C, maximum recorded process at temperatures less than 200 °C. Starting with furfural alcohol, methyl furan, and furan hydrogenation, the reaction network was studied by looking at the evolution of reaction intermediates and products. When beginning with furfural alcohol as the reactant instead of furfural, intermediates and methyl furan are produced faster, suggesting furfural. Experiments with indicate that, however, furfural improves at the cost of methyl furan. After catalyst recovery, the original catalytic action resumed. Author shows that Ru and RuOx are involved in the catalyst's active step [5].

World Health Organization (WHO) said that drug addiction is one of the major causes of early death and disease, and it has a significant effect on public health. The quantity of alcohol consumed over time; the pattern of consumption, which involves intermittent or frequent drinking to intoxication; the drinking environment, which

raises public health risks; and the nature or toxicity of alcoholic drinks are all factors that contribute to the unhealthy use of alcohol. About every organ and structure in the body may be harmed by alcohol. Its use has been linked to about 60 diseases and disorders. In 2002, it was projected that 2.3 million people died prematurely as a result of excessive alcohol consumption throughout the globe (3.7 percent of worldwide fatalities). It is the world's fifth-largest contributor to disease burden [7].

M. S. Sankhla said in the article that the word alcohol is used as a valid name for both the pure material, which scientists refer to as ethyl alcohol, and its mixtures of lesser quantities of water and tiny amounts of other compounds. The term alcohol is used as a wide or general name in chemistry to represent a number of different compounds. India has had a long history of alcohol addiction. Over the last two decades, the quantity trend being used and the related issues have altered considerably. This revenue-generating sector includes western-style alcoholic spirits like bourbon, rum, and gin. The maximum alcohol level permitted is 42.8 percent. Aside from authorized distilleries, there are a multitude of small processing facilities that operate beneath the surface. They use similar fundamental components to make liquor, dodge regulatory quality standards, the alcohol content in their goods fluctuates, and adulteration is common. It's not uncommon to acquire samples of rum, bourbon, or gin that contain up to 56 percent alcohol. Industrial methylated spirit is a dangerous adulterant that causes mass poisoning in humans, resulting in death or serious eye impairment. Due to the lack of government revenue, illegal alcohol is much less costly than licensed nation liquor, and therefore has a ready market among the weak [2].

H. Zhang, Q. Ping, J. Zhang, and N. Li reported that based on UV spectroscopy, a rapid method for detecting different furfural concentrations in ethanol-water hydrolysate of reed was described in this paper. As a trace, substances were removed first by distillation. By detecting the maximum that wavelength, the distillate was used to determine the presence of furfural. The overall absorption wavelength of the signature peak in an ethanol water solution corresponded well with the composition of furfural mixture. These links may be used to evaluate the relative amounts of furfural in a mixed solution [4].

ALCOHOL POISONING SYMPTOMS

There are numerous different kinds of alcoholic drinks, and the amount of ethanol in each one varies. Since yeast stops growing when the concentration of ethanol reaches about 15 percent, alcoholic drinks made utilizing yeast to ferment different sugar-containing plant sources typically have a low concentration. Distillation, on the other hand, is used to produce stronger liquors [8].

Brandy is an alcoholic drink usually consumed as an after-dinner digestive. Some are decorated with caramel coloring to simulate age. Brandy is often characterized as burnt champagne, or to put it another way, it is a golden brown spirit made from wine. Certain fruits' wines, like as pears and apples, may also be used to make brandy. There are numerous different kinds of brandy, but the one people are most definitely familiar with is Cognac, also known as Hennessy. Cognac is a brandy made exclusively from grapes grown in a restricted area of France. Brandy has its own language that allows people to determine how old it is. When a brandy is designated Very Special (VS) or has three stars on the bottle, it has been aged for at least two years. This is the most frequent brandy used in cocktails. Brandy that has been aged for at least four years is designated as Very Special Old Pale (VSOP). The term Xo brandy refers to a brandy that has been aged for at least six and a half years. Vintage brandy, commonly known as hors drag, is a super-special brandy that has been aged for over a decade and may bear the year of manufacture [9].

Vodka is a fermented alcoholic beverage consisting mainly of water and ethanol, but with residues of impurities and flavorings. It is produced in Poland. In the vodka belt countries of Belarus, Estonia, Finland, Iceland, Lithuania, Latvia, Norway, Poland, Russia, Sweden, and Ukraine, vodka is generally drunk neat or straight, although it is often served freezer chilled. Vodka martinis, Cosmopolitans, Vodka Tonics, Screwdrivers, Greyhounds, Russians, Moscow Mules, Bloody Marys, and Bloody Caesars are only a few of the cocktails and blended drinks that use it. Vodka may be produced material, although the majority of vodka today is created from grains like sorghum, maize, rye, or wheat. Rye and wheat vodkas are usually regarded as superior grain vodkas. Oranges, oats, extraction and are utilized to make some vodkas. Some vodka is made in, by simply fermenting a crystal sugar and yeast solution. Many preferences developed in traditional regions, may enhance the taste of vodka. Mango is among the flavorings. Pertsovka, a vodka popular in Russia. Ubrówka (Polish) and zubrovka (Belarusian) vodkas are made with and have somewhat sweet flavors and light amber colors. Krupnik is a popular honey-infused vodka in Lithuania and Poland. Vodka may also be used in the kitchen, and many recipes benefit from the utilization main component. In the 1970s, vodka sauce became popular as with milk, as well as vodka. Vodka may be used to produce flakier pie crusts by substituting it for water in baking [10].

DISCUSSION

Adulteration refers to the act of decreasing the content of something by adding another component. An adulterant is a drug that is present in other substances such as fruit, beverages, oils, or chemicals despite the fact that it is not permitted for legal or other reasons. It is unlikely to be in the specification or declared content of the product, and it may be illegal. Adulterated alcoholic drinks are legal alcoholic beverages that have been charged with illegally, placing them in new cans to hide their true origin, or adding harmful chemicals to modify the properties of the drink. Alcoholic beverages that are properly formulated and approved are comprised of ethanol, a kind of alcohol that is safe to consume in moderation. Fake alcoholic beverages, on the other hand, may be made using cheaper kinds of alcohol, which could have serious health consequences. Methanol, chloral hydrate, acetone, furfural, copper, and iron are frequent adulterants detected in alcoholic drinks. National alcohol laws do not cover the manufacture and use of alcohol that occurs outside of the jurisdiction of law enforcement. The use of such alcohol is known as unrecorded alcohol usage, while the alcohol that is trafficked is known as illicit alcohol or criminal alcohol. The licit or legal market, as well as publicly documented consumption, are the focus of laws to expose alcohol issues. They relegate the subject of illegal drinking to a footnote or a brief comment. When illegal alcohol consumption is limited, as it is in most developed nations, the effectiveness of alcohol laws is not impacted. However, in many poor nations, illegal alcohol accounts for the majority of alcohol use. When these countries recognize the need for alcohol restrictions and search the globe for recommended or evidence-based policies, they find those that are still in place in the wealthier world. Alcohol laws in wealthy countries are much more inclusive. Policies that help in the reduction of alcohol-related issues in rich nations are also beneficial in impoverished countries, albeit maybe not to the same degree. In many of the developing nations, there is a thriving illegal alcohol industry. When it comes to creating alcohol laws, this aspect is usually ignored as a nuisance. Researchers must consider unrecorded alcohol use as more than just an impediment to policy implementation in poor countries. This region must be given particular attention when it accounts for a significant proportion of overall consumption. The issue is that unlawful or illicit production is impossible to quantify by its simple existence. Having alcohol laws that are sufficiently broad to encompass both licit and illegal alcohol is a difficult problem. There are no real-life scenarios to model for. Scientists don't really have a theoretical basis to operate with. But, since they are already late, the initiative must begin now.

CONCLUSION

The study looked at 50 different kinds of alcoholic drinks (Brandy, Whiskey, Rum, Beer, Vodka, and Toddy) made by local brewers in Kerala to identify whether adulterants (Methanol, Copper, and Furfural) were present and at what amounts. The chemical tests were performed on all 50 samples, and no positive findings were found on any of them, indicating that the alcohol samples are free of adulteration. So that they're safe to eat. Functional measurements such as color and odor analysis revealed the physical composition of the beverage samples, while microscopic inspection of samples 21, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, and 50 revealed the presence of sediments when examined under a microscope, indicating that the alcoholic beverage samples had not been properly purified.

In the instrumentation procedure, a UV-Visible spectrometer was used to confirm the presence or absence of furfural and to quantify its quantity in the given sample. The absorbance of each solution was measured at absorption limit using 10mm quartz cuvettes using a working regular solution. The samples 2,5,13, and 19 were found to have the maximum absorbance at 280nm, and the normal furfural solution likewise had the largest absorbance at 280nm, according to the UV-Visible spectrometer results. At 281nm, the greatest level of furfural concentration was identified in sample 6, i.e. 0.88910^{-3} mg/ml, while the lowest level of furfural concentration was found in sample-8, i.e. 0.11310^{-3} mg/ml. Many chemical tests may be conducted to assess furfural quantities, but in this research, a UV-Visible spectrometer was used because it is extremely sensitive and provides precise concentrations of the substance under inquiry.

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