Impact of the Consumption of Adulterated Oils and Alcoholic Beverages.

Section A: A review of analytical techniques to ensure the purity of edible oils.

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Abstract- Food adulteration is a topic of great concern in all parts of the world. Several kinds of literature are related to aspects of food adulteration including its detection. In this sense, methodological procedures of food adulteration detection have been reviewed extensively. Over the years, many cases of poisoning have been observed due to the ingestion of unsafe products. Numerous crises and scandals have shaken the European, Latin and Central America food sector over the past few years. food and beverages can be adulterated pursuing different purposes or advantages of the manufacturers or merchants; remembering that an adulterated food is one to which a substance has been deliberately and intentionally added or removed for fraudulent purposes. One of the foods with the highest risk of food fraud is olive oil. It is a product in great demand and not one of the cheapest. Sometimes, therefore, it can be mixed with other cheaper oils, such as peanut or hazelnut oil, which are not permitted from a legal point. Likewise, alcoholic beverages tend to be other of the most adulterated products, the Dominican Republic ranks 7th among the countries in the Americas with the highest consumption of alcoholic beverages, with an average of 6.9 liters per person. Currently in the Dominican Republic a total of 83 companies that produce and sell methanol clandestinely have been counted, given that in December 2017 where 41 people were poisoned (fatality = 29%) and December 2019, four intoxications (fatality = 50%). The use of Analytical Chemistry tools in the evaluation of food quality is aimed at ensuring the population against the consumption of products and beverages that guarantee their safety. In most cases, it is expensive and exhaustive to carry out adulteration tests to monitor the quality of beverages.

Index Terms- Adulterated alcoholic, Analytical Methods, Adulterated oils, Quality food and beverages

I. INTRODUCTION

Processed foods have become indispensable for the daily nutrition of consumers given the global demographic increase [23]. Feeding a growing world population is a major global challenge, which consists of increasing agricultural productivity, guaranteeing access to food for all individuals, and at the same time ensuring food security for consumers [7]. As we know the world has progressed through hunter-gatherer, agricultural, and industrial stages to a provider of goods and services , this progression has been catalyzed by the cultural and social evolution of mankind and the need to solve specific societal issues, such as the need for preservation to free people from foraging for food, and the need for adequate nutrition via consistent safe food supply [18]. These forces led to the development of the food industry, which has contributed immensely to the basis for a healthy human civilization that helped society prosper [20].

Acceptability of food is dependent on a knowledge of its ingredients for example, how pure is the drinking water or is there acrylamide in French fries or other fried food preparations, how much vitamin C, or ß-carotene, or proline is there in juices, what preservatives are there in bread, sausages or other food preparations, there are many more examples. This shows the importance of correct Analytical Chemistry results [29].

Measurement is proof of quality improvement cannot be verified if the quality is not measured. The very first step for a quality-oriented laboratory is to establish its present situation and quality level. Future comparisons will be referred to this base level. Then, the laboratory must define the parameters that the measurement is based on. Quality is monitored on a systematic basis and the quality results are recorded [10-16].

By using and transforming the agricultural and food raw materials, the food industry has the role of producing high-quality food products from the nutritive, sensorial, and hygienic point of view. The lack of noxiousness and toxicity represent the most important condition required from a food product, because, otherwise it could become a risk for the health and life of consumers, and for the food security in general, and it is here where Analytical Chemistry as Science plays an important role in the development of modern society, through its use for monitoring food and beverages quality [17-27].

II. FOODBORNE ILLNESSES

2.1 Analytical chemistry and diseases associated with the consumption of adulterated oils

The use of Analytical Foodborne illnesses are generally related to adulteration. Food adulteration is a topic of great concern in all parts of the world. Several kinds of literature are related to aspects of food adulteration including its detection. In this sense, methodological procedures of food adulteration detection have been reviewed extensively. Many of the methods for detection of food adulteration require high-end technologies and that makes the whole process difficult to perform and time-consuming [13].

Chemistry tools in the evaluation of food quality is aimed at ensuring the population against the consumption of products and beverages that guarantee their safety. Over the years, many cases of poisoning have been observed due to the ingestion of unsafe products. Numerous crises and scandals have shaken the European food sector over the past few years. Despite far-reaching regulations and governmental control, most of the causes were not detected until after the crises had occurred, leading to a decline in consumer confidence in the safety and quality of many food products [19]. This is the case of poisoning with adulterated rapeseed oil in Spain 40 years ago, the famous Toxic oil syndrome, which is a multisystemic epidemic disease that appeared in 1981 in Spain, the only country affected. The toxic oil syndrome was a national catastrophe and a challenge for the country's health authorities, as more than 20,000 people were affected. Investigations have pointed to the consumption of imported rapeseed oil, denatured with 2% aniline for industrial use, and later fraudulently refined for sale as food, as the cause of the syndrome [8-12].

In 1968 in western Japan, approximately 1,800 people ingested food cooked with rice oil contaminated with dioxin-like compounds. The contaminants were at least 74 polychlorinated biphenyls (PCBs) and 47 polychlorinated dibenzofurans (PCDF), which appear to have entered the oil In 1968 in western Japan, approximately 1,800 people ingested food cooked with rice oil contaminated with dioxin-like compounds. The contaminants were at least 74 polychlorinated biphenyls (PCBs) and 47 polychlorinated dibenzofurans (PCDF), which appear to have entered the oil accidentally during its manufacture. The syndrome resulting from this massive poisoning was called "Yusho" which in Japanese means "oil disease". In 1979 in Taiwan, something similar happened with the same type of oil, affecting about 2,000 people [27]. PCBs are absorbed through the gastrointestinal, inhalation and skin routes. Man is exposed to them through food (fish, especially) and polluted waters. In the body, PCBs are distributed in tissues, skin, and adipose tissue. They can cross the placenta distributing in fetal tissues and reach the same blood levels as in the mother. They also accumulate in breast milk [14].

For its part, in 1993 Mexico began the registry of cases of acute poisoning due to the use of pesticides in the aquaculture sector (IAP), with a total of 1,576 cases. This figure increased to 67,711 cases throughout the country during the 1995-2012 period. The states that consistently presented the highest incidence rates of API throughout that period were Nayarit, Colima, Morelos, and Jalisco [6].

As it is observed, there are many critical health conditions due to adulteration in the food production and commercialization process, and alcoholic beverages have not been the exception. According to the information provided by the Government, the World Health Organization estimates that, globally, 27.7% of alcohol consumption is illicit, which hits African and Eastern European countries, as well as much of Latin America. Already in 2017, it was alerted that in Latin America 15% of the alcoholic beverages consumed were illegal, with countries such as Mexico, Ecuador and Bolivia in the lead; and where our country also appeared in the ranking. Similarly, countries such as Peru (21 deaths), Costa Rica (43 deaths) and Mexico (+100 deaths) also had similar problems with adulterated alcohol in 2020 [11].

2.2 Analytical chemistry and diseases associated with the consumption of adulterated alcoholic beverage

In the Dominican Republic there have been outbreaks of methanol poisoning, such as those that occurred in December 2017 where 41 people were poisoned (fatality = 29%) and December 2019, four intoxications (fatality = 50%). In April 2020, local rapid response teams from the Ministry of Public Health are investigating an outbreak of methanol poisoning that involved almost 50% of the provinces. 369 cases were identified, including 227 (62%) deaths, of which 323 (88%) were men; median age 45 years (range: 7-82). In November 2020, an outbreak occurred in the Santo Domingo Este municipality, 9 intoxicated men (56% fatality) after consuming adulterated drinks purchased at retail in a community business. On April 4, 2012, the Ministry of Health notified an outbreak of methanol poisoning with 25 affected people, including 11 deaths [11-21].

On April 7, the Police reported the dismantling of two clandestine laboratories to produce clerén in the Monte Plata and Barahona provinces, where they had used 23,028 liters of this artisanal drink. At the site, the institution also seized a total of 67 tanks with a capacity of 55 gallons each, to fill a total of 23,028 400-milliliter bottles with the also known "triculí". Among other measures, the Government has announced the strengthening of methanol import and marketing controls, as well as the implementation of an intelligence and traceability program in the methanol import and marketing chain [3-15].

The Dominican Republic ranks 7th among the countries in the Americas with the highest consumption of alcoholic beverages, with an average of 6.9 liters per person. Currently in the Dominican Republic a total of 83 companies that produce and sell methanol clandestinely have been counted [21], the largest amount is in Santo Domingo (Figure 1).

Figure 1. *Shows the location points of companies registered in Santo Domingo that are dedicated to the production of methanol.*

Consumption as well as imports, both of oils and beverages in the Dominican Republic, is very notorious. In 2005, the Dominican Republic imported 52.3 million gallons of oils and fats 5, spending more than 70 million dollars, and domestic production was 54.3 million gallons (Figure 2).

Productos	Volumen		Valores CIF		Precios
	Galones EE UU	%	Millones RD$	%	RD/ galón EE UU
Aceite de soya crudo	34,924,424	64.3	1,832	64.3	52.47
Grasa amarilla	19, 483, 647	19.3	329.2	11.6	31.41
Aceite de girasol c.	3, 098, 477	5.7	196.0	6.9	63.25
Aceite palma crudo	2, 692, 170	5.0	134.4	4.7	49.94
Otros	3, 086, 881	5.7	357.1	12.5	115.69
TOTAL	54, 285, 599	100.0	2, 849.1	100.0	

Figure 2. *Imports of edible oils and fats, 2005.*

Considering that the local production of crude palm oil (4.7 to 6.3 million gallons annually) is entirely dedicated to human consumption and that exports of vegetable oils and derivatives can be estimated at between 1.0 and 1.3 million gallons, it can be estimated that consumption Apparent human volume ranges from 38.7 to 40.0 million US gallons. Thus, The Dominican Republic is a net importer of vegetable oils and fats for human and animal consumption and, at the same time, manages to add significant value to the edible oilseeds that it produces commercially [30].

One of the foods with the highest risk of food fraud is olive oil. It is a product in great demand and not one of the cheapest. Sometimes, therefore, it can be mixed with other cheaper oils, such as peanut or hazelnut oil, which are not permitted from a legal point of view and which, in addition, can pose health risks [4].

As seen, food and beverages can be adulterated pursuing different purposes or advantages of the manufacturers or merchants; remembering that an adulterated food is one to which a substance has been deliberately and intentionally added or removed for fraudulent purposes and has been modified to vary its composition, weight, or volume or to cover up a defect. Food fraud is an intentional act to obtain profit, violates food laws and misleads the consumer. In many cases the deception has to do with the substitution of ingredients, incorrect labeling, the sale of conventional products as organic or the use of logos with a specific origin or quality that are not. Therefore, an adulterated food is one that contains substances other than those declared on its label or in advertising; They do not have to be toxic or illegal, but they can be harmful to the health of the consumer, so this study is of the utmost importance for the food and health sector as main points for the sustainability of society.

In the European Union, several initiatives are being carried out to improve the ability to identify food fraud as soon as possible, that is, an action whose intention is to obtain an undue benefit. This category is included in Regulation (EC) 178/2002 within the section "fraudulent and deceptive practices".

Errors or fraudulent practices are controlled with innovative methods of food analysis. The detection of adulterated food is possible through the identification of markers. The techniques used range from infrared spectroscopy to proton transfer reaction mass spectrometry. The latter serves to quickly authenticate monovarietal olive oil and is useful for checking that the variety of oil that appears on the label corresponds to the content of the container. Analytical techniques based on molecular detection (PCR or Polymerase Chain Reaction) are currently used to control food, capable of detecting infinitesimal parts, that is, protein molecules or DNA [1-28].

In most cases, it is expensive and exhaustive to carry out adulteration tests to monitor the quality of beverages and oils, so this study aims to point out the most important analysis methods for quality control in oils and beverages.

III. ANALYTICAL METHODS TO MONITOR THE QUALITY OF EDIBLE OILS

3.1 Analytical Methods in the Oil Industry

Oils are made up of fatty acids and an alcohol or polyol; that constitute cellular structures such as phospholipids, glycolipids, lining elements; like waxes and cutins, reserve substances and sources of cellular energy; necessary for processes metabolism of a plant. In general, these are compounds that are insoluble in water and soluble in organic solvents, counting as its main characteristic that its composition is not visible altered by being exposed to heat and distillation. Fixed oils are found in greater quantities in the seeds of the fruits; from which they can be extracted by two methods: Cold or hot expression in hydraulic presses [13].

Lipids are classified into three major subclasses, based on the products of their hydrolysis: simple lipids, compound lipids, and steroids. Edible fats and oils are simple lipids, which by hydrolysis produce fatty acids and glycerol (Figure 3).

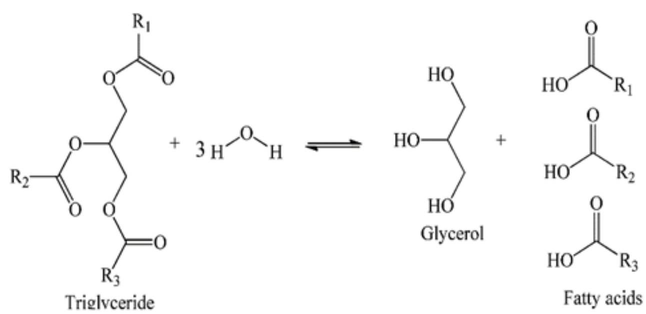

Figure 3. *Shows the result of hydrolysis of a simple oil.*

The biological importance of oils lies in their irreplaceable energy supply, constituting the body's most important energy reserve. Providing a high caloric intake, they prevent heat loss, protect viscera, and transport fat-soluble vitamins (A, D, E and K). Among other uses is giving culinary preparations special organoleptic characteristics that increase their flavor [22-25].

Most fats and oils are obtained by pressing, solvent extraction or melting, and are not suitable raw materials for direct consumption. They usually contain, depending on the raw material and the production method used, different types of substances: polar lipids, especially phospholipids, free fatty acids, sapid and odorous substances, waxes, pigments (chlorophylls, carotenoids and their degradation products), compounds sulfur compounds, phenolic compounds, trace metals, pollutants (pesticides, polycyclic hydrocarbons) and autoxidation products [2].

To eliminate all these substances and make it suitable for consumption, the oil almost always must be subjected to the refining process, Oil refining does not usually affect the fatty acid composition but removes most of the unsaponifiable fraction. Hence, refined oils lose the nutritional advantages due to the presence of fat-soluble vitamins and are also less stable due to the lack of natural antioxidants (tocopherols).

Edible oils are one of the main constituents of the diet used for cooking purposes. Oils with lower values of viscosity and density are highly appreciable to consumers as they signify good quality fresh products. Temperature affects the quality of edible oils. The effect of temperature on the physicochemical characteristics and rancidity of two edible oils.

3.2 Quality Oil: Parameters Related to Characterization

Current legislation establishes, through different provisions, quality criteria that must be met by edible fats and oils, including heated ones. There are also official methods of analysis of oils and fats. The main parameters aimed at establishing the characterization of the different edible oils, as well as their stability [5]:

3.2.1 Sensory characteristics

The appearance (turbidity) is studied, in the case of oils, the smell, the taste and the color.

3.2.2 Physical indices

Viscosity: allows to measure the thermal stability of the oil. And in it referring to the absorbed oil allows to detect alterations in the presence of free fatty acids and in general chemical changes. (Polymerization Reactions). For viscosity measurement it is important to consider the temperature of the samples (25ºC), because if the temperature is higher or lower, the results obtained would be altered and there would be no precise or certain knowledge.

Refractive index: The samples are measured with a refractometer with scales from 1.3 to 1.7 at 20ºC or 25ºC for oils and 40ºC for fats, since the most fats are liquid at that temperature. In general, the refractive indices of substances fat range from 1.4600 to 1.5000 plus or minus 15 or 20 degrees centigrade. It is affected by temperature and free fatty acids (by increasing Both lower the refractive index).

Melting point: The melting point is the temperature at which matter changes from a solid state to a liquid state. To determine the melting point of a substance fat, a closed capillary tube is used in one of its ends and a thermometer graduated in units of 0.2°C Natural fats and oils, such as mixtures of glycerides and other substances have no melting point net and defined. They do not present a critical point from solid to liquid; This step is done gradually through pasty to completely liquid states.

Moisture Content: Moisture and other volatile matter are undoubtedly the most common minor impurities. There are several methods for determining moisture and most of them are made by evaporation of the same, for this reason they include the other volatile materials, although there are also methods like Karl Fisher in which chemically measures the amount of water in the sample. Refined oils usually have moisture levels less than 0.1%; crude oils have levels between 0.1-0.3%, while acid oils, for being more polar in nature, may have greater humidity levels.

3.2.3 Chemical indices Saponification index:

Saponification value: The saponification value is defined as the weight in milligrams of Potassium Hydroxide needed to saponify 1 gram of fat. If the fat is acceptably pure, the method constitutes a system of calcification of oils and fats since the saponification value is inversely related to the length of the acids fatty constituents of fat glycerides. The method is applicable for oils and fats with a wax content not exceeding 5% [9].

Iodine number: amount of fixed iodine per 100 g of fat; measures the degree of fat unsaturation. It is determined by adding to the sample an excess of halogenated reagent and titrating reagent surplus [13]; that is, it adds an excess of halogen to the sample, the reduction of the remaining ICL with KI and finally a titration of released iodine with thiosulfate solution of sodium of known concentration using starch as an indicator.

Oils with an iodine value of approx. 105 contains glycerides of melting points high enough to deposit as solid crystals when kept at moderately low temperatures. This harms the properties of the oil. Table oil should remain clear and bright without clouding or solidifying at refrigeration temperatures [26].

Hydroxyl number: amount of KOH needed to neutralize the acetic acid that combines by acetylation with 1 g of fat; reflects hydroxy fatty acids, mono- and diacylglycerols, as well as free glycerol.

3.2.4 Fatty acid analysis

Through various analytical techniques, especially gas chromatography, the fatty acids that make up a fat can be determined. This information allows knowing the qualitative and quantitative composition of fatty acids, which allows the characterization or identification of a fat.

3.2.5 Analysis of the unsaponifiable fraction

The determination by chromatographic techniques of non-saponifiable compounds characteristics of the different fats can be used for their identification. There are other determinations that are used as quality criteria: tests of purity, soap residues, heavy metal residues, etc. Organic materials can be impurities such as mineral oil or natural origin as: Sterols, account for most of the unsaponifiable material, are chemically inert and they do not confer properties to the oil. Its content in oil is reduced by steam treatment at high temperatures. are also found tocopherols or pigments [17-26].

3.2.6 Parameters related to degree measurement of alteration of fats

Acidity

The magnitude of the acidification caused by liposis is measured through the degree of acidity or acid number, which is expressed as the amount of KOH needed to neutralize 1 g of fat. It is generally determined by means of potentiometric acid-base titration. If the oil is very dark, electrometric titration should be used [26].

Regarding the sample size, the method defines amounts of 50 grams if expected an acidity less than 0.2% and 25 grams if the acidity expected is in a range between 0.2 – 1%.

Autoxidation

There are various indices to determine the degree of oxidation of a fat:

Peroxide index: Milliequivalents of active oxygen contained in 1 kg of fat, calculated from iodine released from potassium iodide. The substances that oxidize potassium iodide are assumed to be peroxides or other products like fat oxidation.

It is usually accepting that the first product formed by the oxidation of an oil is hydroperoxide, so the most used method to evaluate the degree of oxidation is to determine is to determine the value of said peroxide.

The peroxide value is a good indicator of the quality of the oil, a fresh oil must have values lower than 1, some oils stored for some time after refining they can reach values of 10 before presenting flavor problems, but if have odor problems due to ketones and aldehydes into which they decompose [19].

Spectrophotometric measurements at 232 and 270 nm: Fatty acids with double Conjugated bonds absorb in the UV (dienes in the 230 nm region and trienes in the 270 nm region).

Anisidine indices: They are based on the spectrophotometric measurement between the reagent p-anisidine and the aldehydes from the oxidation of lipids.

TBA number: It is based on spectrophotometric measurements after the formation of a colored complex between the reactant 2-thiobarbituric acid and the products of lipid oxidation.

3.2.7 Parameters related to thermal stability

The determination of insoluble fatty acids in ether and the smoke point are used for their measurement.

Smoke point: It is the temperature at which compounds are produced of decomposition, visible and depends on acids free fatty and monoacylglycerols from fat. It is the temperature at which the oil can be subjected to intense heating before the synthesis of acrolein.

Cold test: The cold test aims to determine the hibernation efficiency, keeping the oil o fat to be analyzed at 0°C, measuring the time that remains transparent. The oil should remain clear for five hours and a half, so it will be of good quality [20]. This method measures the resistance of the sample to crystallization by applying low temperatures. It is applicable to all oils refined and dried vegetables and animals.

3.2.8 Microbial Decomposition of Fats, Oils and Other Lipids

Rancidity could also be because of microbial decomposition of fats, oils, and other lipids. When these processes occur in food, undesirable odors and flavors can result. Microbial contamination of food such as edible oil is the most common health risk. Edible oil is prone to contamination by microorganisms found in the environment, raw materials and equipment used for the processing, as well as those used for storage and distribution. Edible oil is prone to contamination by microorganisms found in the environment, raw materials and equipment used for the processing, as well as those used for storage and distribution. This problem is repeatedly observed in many edible oil market areas. Food handlers with poor personal hygiene and inadequate knowledge on food safety and quality could be the source of food pathogens. The microbial isolates implicated in rancid oils are Staphylococcus aureus, Pseudomonas aerugenosa, Klebsiella pneumonie, Shigella sonnei, Penicillium chrysogenum, Aspergillus niger, Aspergillus flavus, Aspergillus fumigatus, Aspergillus versicolor, Fusarium oxysporum, Candida albicans and Mucor spp. The poor microbial and physico-chemical properties are indicators of unhygienic handling practice and processing methods of edible oil sold in the retail markets.

3.3 Food Packaging and Quality Control

Another set of means to ensure the avoiding food insecurity could be considered the reglementations regarding the consumer information through the nutritional labeling. The requirements concerning the food and beverage products labeling are regularly updated, depending on the demand evaluation and on the consumer's expectations regarding the food products quality [20].

The 1990 Nutrition Labeling and Education Act mandated nutritional labeling of most foods. As a result, a large portion of food analysis is performed for nutritional labeling purposes. Now a challenge that faces the labeling of food and beverage products in EU is to find equilibrium between two main aspects:

- *The consumer's information the most comprehensive possible*
- *The avoidance of overcharging the labels with information that could be difficult to read or understand*.

3.4 National Regulations for Oils and Beverage Quality

3.4.1. Edible oils:

NORDOM 811: This standard establishes the requirements that palm olein must meet to be considered fit for human consumption.

NORDOM 706: This Standard applies to olive oils, olive pomace oils and virgin olive oils in a state fit for human consumption.

NORDOM 534: This standard establishes the quality, labeling and presentation characteristics that edible palm oil must meet. This standard will apply to refined, bleached, and deodorized (RBD) edible palm oil.

NORDOM 492: This standard aims to define the characteristics of crude palm oil as a raw material for edible products.

NORDOM 441: This standard establishes the method for the determination of insoluble volatile acids in edible oils and fats.

NORDOM 439: The purpose of this standard is to establish the general specifications that must be met by vegetable, animal and marine oils and fats, and their edible derivatives, pre-packaged and processed in such a way that they are suitable for human consumption and marketed in the national territory.

NORDOM 409: Edible oils and fats. Margarine. Determination of the content of sodium chloride.

NORDOM 413: This standard establishes the method to determine the nickel content in oils and fats.

NORDOM 394: This standard establishes the procedures to be followed for the sampling of edible, refined or crude oils and fats of animal, vegetable, or marine origin.

3.4.2. Alcoholic beverages:

NORDOM 477: This Standard aims to establish the requirements that rum must meet and specifies the physical-chemical and organoleptic characteristics of its content.

NORDOM 499: This standard establish the test methods for the determination of the alcoholic strength in high-proof alcoholic beverages.

NORDOM 600: This standard establish the physical and chemical specifications of anhydrous ethanol of 99.5% by volume, determined by the Gay-Lussac methods; prescribes the analytical characteristics of its content.

NORDOM 498: This standard establish the test methods to determine methanol, higher alcohols and esters in distilled alcoholic beverages by means of gas chromatography, using 2-butanol as internal standard.

NORDOM 490: This standard establish a procedure for the determination of higher alcohols in all types of alcoholic beverages. Ron

NORDOM 484: This standard establish the procedures to be followed to extract and prepare the samples of distilled alcoholic beverages, except beers, on which the analyzes that serve to establish their composition and quality are carried out.

NORDOM 487: This standard establish the procedure to determine the content of aldehydes in all types of alcoholic beverages.

NORDOM 488: This standard establish the method for the quantitative determination of methyl alcohol or methanol in alcoholic beverages.

NORDOM 486: This standard establish the determination of total esters in all types of rums and spirits.

NORDOM 485: This standard establish the test method to determine total acidity in alcoholic beverages. Ron.

IV. CONCLUSION

Edible oil is prone to contamination by microorganisms found in the environment, raw materials and equipment used for the processing, as well as those used for storage and distribution. Rancid oils may produce damaging chemicals and substances that may not make you immediately ill but can cause harm over time. If oxidative rancidity is present in severe quantities, a potential health hazard may exist [23].

In conclusion, the consumption of adulterated oils and alcoholic beverages can have significant negative impacts on health. Adulterated oils may contain harmful substances that can lead to various health problems, including gastrointestinal issues, liver damage, heart disease, and increased risk of certain types of cancers. Adulterated alcoholic beverages, on the other hand, can contain toxic substances that can cause severe health complications, such as organ failure, blindness, or even death. Additionally, both adulterated oils and alcoholic beverages may disrupt the normal functioning of the digestive system and lead to digestive problems. It is essential to be cautious about the quality and source of oils and alcoholic beverages to safeguard our health and well-being.

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REFERENCES

[1] Acribia, Zaragoza. Boatella, J., Condony, R., and Rafecas, M. (1993). Strategies for substituting fats in foods. Food, 229, 27-31. Bos, F., & Ruijs, A. (2021). Quantifying the Non-Use Value of Biodiversity in Cost–Benefit Analysis: The Dutch Biodiversity Points. Journal Of Benefit-Cost Analysis, 12 (2), 287-312. doi: 10.1017/bca.2020.27

[2] Astiasarán Anchía, I. (2000). Food: composition and properties (No. 664.02 A854a). McGraw-Hill. CZucman, N., Uhel, F., Descamps, D., Roux, D., & Ricard, J. (2021). Severe Reinfection With South African Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) Variant 501Y. V2. Clinical Infectious Diseases. doi: 10.1093/cid/ciab129

[3] Atluri, P., Vasireddy, D., & Malayala, S. V. (2021). Toxic Alcohol Ingestion: A Case Report and Review of Management Pathways. Cureus, 13 (2). Hariyanto, T., Halim, D., Rosalind, J., Gunawan, C., & Kurniawan, A. (2021). Ivermectin and outcomes from Covid-19 pneumonia: A systematic review and meta-analysis of randomized clinical trial studies. Reviews In Medical Virology. doi: 10.1002/rmv.2265

[4] Badui Dergal, S. (2012). The science of food in practice (No. 664 B138c). Pearson. Klompas, M. (2021). Understanding Breakthrough Infections Following mRNA SARS-CoV-2 Vaccination. JAMA. doi: 10.1001/jama.2021.19063

[5] Belitz, H. D. and Grosch, W. (1997). Food Chemistry (2nd ed.) Ed. Kow, C., Merchant, H., Mustafa, Z., & Hasan, S. (2021). The association between the use of ivermectin and mortality in patients with COVID-19: a meta-analysis. Pharmacological Reports, 73 (5), 1473-1479. doi: 10.1007/s43440-021-00245-z

[6] Bernardino-Hernández, H. U., Mariaca-Méndez, R., Nazar-Beutelspacher, A., Álvarez-Solís, J. D., Torres-Dosal, A., & Herrera-Portugal, C. (2019). Knowledge, behaviors and symptoms of acute pesticide poisoning among producers of three agricultural production systems in the highlands of Chiapas, Mexico. International Journal of Environmental Pollution, 35 (1), 7-23. Mukarram, M. (2021). Ivermectin Use Associated with Reduced Duration of Covid-19 Febrile Illness in a Community Setting. International Journal Of Clinical Studies And Medical Case Reports, 13 (4). doi: 10.46998/ijcmcr.2021.13.000320

[7] Bonciu, F. (2017). Evaluation of the impact of the 4th industrial revolution on the labor market. Romanian Economic and Business Review, 12 (2), 7-16.

[8] Carnero, P. R., Sánchez, M. C., Collado, Z. M., Moreno, J. D., & Sanz, N. M. (2011). The toxic oil syndrome: 30 years later. Spanish Journal of Legal Medicine, 37 (4), 155-161. Yeh, H. (2021). The Potential Declining Efficacy of the ChAdOx1 nCoV-19 Vaccine (AZD1222) on Inoculators With Nonsteroidal Anti-inflammatory Drug (NSAID) Intake. Clinical Infectious Diseases. doi: 10.1093/cid/ciab516

[9] COGUANOR Standard NGO 34 072 h2. (1982). Determination of the iodine number. in oils and edible fats. Wij's method. Guatemala: Official Gazette.

[10] Coll, L., and Gutierrez, M. L. (1989). «Determination of trans-unsaturated fatty acids in margarines and butters». Annals of Bromatology, 41, 115-128.

[11] Communications address (MH) (2021). Ministry of Health updates epidemiological alert for methanol poisoning. Available: https://www.msp.gob.do/web/?p=11196

[12] D. Banerjee, S. Chowdhary, S. Chakraborty, R. Bhattacharyya (2017). Chapter 11 - Recent advances in detection of food adulteration, Food Safety in the 21st Century. https://doi.org/10.1016/B978-0-12-801773-9.00011-X.

[13] Firestone, D. & Yurawecz, M. (Eds). (2005). Oils and fats. En Horwitz, W. & Latimer, G. (Eds),

[14] García, J. O., i Tortajada, J. F., Conesa, A. C., Claudio-Morales, L., Tornero, O. B., & Callado, P. L. (2005). Environmental neurotoxic (III). Organochlorines, organobromes and bisphenol A: adverse effects on the fetal and postnatal nervous system. Acta Pediatr Esp, 63, 429-436.

[15] Hradesky JL (1987) Productivity and Quality Improvement, A Practice Guide of Implementing Statistical Process Control; McGraw Hill.

[16] Jimaré, M. T., Bosch, C., & Rojas, F. S. (2008). Analytical Process Chemistry: Applications of Near Infrared Absorption Spectrometry to Biofuel Analysis and Food Analysis. Annals of Chemistry of the RSEQ, 104 (4), 290-290.

[17] Jimaré Benito, M. T., Bosch Ojeda, C., & Sanchez Rojas, F. (2008). Process analytical chemistry: applications of near infrared spectrometry in environmental and food analysis: an overview. Applied Spectroscopy Reviews, 43 (5), 452-484.

[18] Jahn, G., Schramm, M., & Spiller, A. (2005). The reliability of certification: Quality labels as a consumer policy tool. Journal of Consumer Policy, 28, 53-73.

[19] Kirk, R., Sawyer, R. & Egan, H. (2008). Pearson's Food Composition and Analysis. (2nd ed). Mexico: Patria Editorial Group.

[20] Kuswandi, B., Restyana, A., Abdullah, A., Heng, L. Y., & Ahmad, M. (2012). A novel colorimetric food package label for fish spoilage based on polyaniline film. Food control, 25 (1), 184-189.

[21] MP (2020). Government promulgates decree regulating methanol. Available: https://presidencia.gob.do/noticias/gobierno-promulga-decreto-que-regula-el-metanol

[22] Oficial Methods of Análisis, current through revision 1, 2006. (18va ed.) (pp,chapter 41: 1-30). USA: AOAC International.

[23] Okparanta, S., Daminabo, V., & Solomon, L. (2018). Evaluation of rancidity and other physicochemical properties of edible oils (mustard and corn oils) stored at room temperature. J Food Nutr Sci, 6 (3), 70-75.

[24] Panreac Química, S. A. (1999). Food analytics, official methods of analysis. Meat and meat products.

[25] Prichard, E., & Barwick, V. (2007). Quality assurance in analytical chemistry. John Wiley & Sons.

[26] Ramirez, M. (2008). Evaluation of the extraction yield and characterization of the fixed oil genuine old type roasted coffee obtained by the pressing process. (Thesis of Bachelor's degree). University of San Carlos of Guatemala. Faculty of Engineering. Guatemala.

[27] Santos, V., Ramos, P., Sousa, B., Almeida, N., & Valeri, M. (2022). Factors influencing touristic consumer behaviour. Journal of Organizational Change Management, 35 (3), 409-429.

[28] Stanciu, A. C., Spatariu, E. C., Lazar, C. M., & Nitu, O. (2010). Dimensions and risks associated to food security. Cancer Research and Oncology, 1 (21), 54-58.

[29] Wenclawiak, B., & Hadjicostas, E. (2010). Validation of Analytical Methods–to be Fit for the Purpose. In Quality Assurance in Analytical Chemistry: Training and Teaching (pp. 215-245). Berlin, Heidelberg: Springer Berlin Heidelberg.

[30] Vargas, S. 2005. Diagnosis of Coconut Culture (Cocos nucifera L.). Oilseeds Division, Secretary of State for Agriculture (SEA), DO.

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