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ECORFAN Journal Republic of Guatemala

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The works must be unpublished and refer to topics of Biological and Health Sciences, Medical Mycology, Dermatology, Immunology, Human Ecology, Parasitology, Pediatric Infectious Diseasesand other topics related to Medicine and Health Sciences.

Presentation of Content

In the first article we present, *Heavy metals present in Ficus benjamina leaves in the metropolitan area of Guadalajara, Mexico*, by PEÑA-GARCÍA, Laura, MACIEL-FLORES, Roberto, ROSAS-ELGUERA, José and ROBLES-MURGUÍA, Celia, with adscription at the Universidad de Guadalajara, as following article we present, *Genotypic and allelic frequencies analysis of the 19 T>G polymorphism of the UGT1A6 gene in Mexican mestizo population of the state of Puebla*, by GARCIA-SUASTEGUI, Wendy A., SANCHEZ-SANCHEZ, Katty M., MORÁN-PERALES, José L. and HANDAL-SILVA, Anabella, with adscription at the Benemérita Universidad Autónoma de Puebla, as following article we present, *Primary neuroendocrine tumor in a canine*, by BARRAGAN-CANO, Victor, ACERO-ORTEGA, Juanita, BAÑUELOS-PINEDA, Jacinto and LOEZA-CORICHI, María Eugenia, with adscription at the Universidad de Guadalajara, as following article we present, *Extraction of essential oil from - "Ricinus communis L." - higuerilla as an alternative source of insecticides* by the distillation method, by BALTIERRA-COSTEIRA, Gabriela, DE LA GARZA-DE LUNA, Jesús Roberto, MARTÍNEZ-VELA, Veronica and SAN MIGUEL-IZA, Sandra Maria, with adscription at the Instituto Tecnológico Superior de Monclova and Universidad Tecnológica de la Región Centro de Coahuila.

Content

Article **ECORFAN Journal Republic of Guatemala**
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Heavy metals present in *Ficus benjamina* leaves in the metropolitan area of Guadalajara, Mexico

Metales pesados presentes en hojas de *Ficus Benjamina* en el área metropolitana de Guadalajara, México

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Abstract

Goals: General: The collection of dust samples deposited on Ficus benjamina leaves in the Guadalajara metropolitan area (GMA) will allow the identification of heavy metals and their spatial distribution. Specific: Identify the most polluted areas of the city and the elements present by means of particle dispersion schemes (maps) made with the data obtained by the atomic absorption technique. Metodología: For the extraction of heavy metals an acid digestion was performed. The samples were previously homogenized. The determination was made on an atomic absorption spectrophotometer model Varian AA 240 FS, with a monochromator of CZERNY-TURNER design, panel of 4 lamps and inert and adjustable nebulization chamber. The technique used was flame (flame) and calibration curves were used. Contribución: The concentrations of the seven metals analyzed Cu, Zn, Co, Ni, Cd, Pb and Cr were identified, the most abundant being Cu and Pb. The maps allowed to identify that there are some patterns of distribution of the contamination, such was the case of the Cd, Pb and Zn that are distributed very homogeneously on the Lázaro Cárdenas avenue until reaching the supply market area.

Atomic absorption, Heavy metals, GMA

Resumen

Objetivos General: La recolección de muestras de polvo depositado en hojas de Ficus benjamina en el área metropolitana de Guadalajara (AMG), permitirá identificar metales pesados y su distribución especial. Específico: Identificar las zonas más contaminadas de la ciudad y los elementos presentes mediante esquemas (mapas) de dispersión de partículas elaborados con los datos obtenidos por la técnica de absorción atómica. Metodología: Para la extracción de metales pesados se realizó una digestión ácida. Las muestras se homogenizaron previamente. La determinación se realizó en un espectrofotómetro de absorción atómica modelo Varian AA 240 FS, con un monocromador de diseño CZERNY-TURNER, panel de 4 lámparas y cámara de nebulización inerte y ajustable. La técnica empleada fue de flama (llama) y se utilizaron curvas de calibración. Contribución: Se identificaron las concentraciones de los siete metales analizados Cu, Zn, Co, Ni, Cd, Pb y Cr, siendo los más abundantes el Cu y el Pb. Los mapas permitieron identificar que se tienen algunos patrones de distribución de la contaminación, tal fue el caso del Cd, Pb y Zn que se distribuyen muy homogéneamente sobre la avenida Lázaro Cárdenas hasta llegar a la zona del Mercado de abastos.

Absorción atómica, Metales pesados, AMG

Citation: PEÑA-GARCÍA, Laura, MACIEL-FLORES, Roberto, ROSAS-ELGUERA, José and ROBLES-MURGUÍA, Celia. Heavy metals present in *Ficus benjamina* leaves in the metropolitan area of Guadalajara, Mexico. ECORFAN Journal-Republic of Guatemala. 2019, 5-9: 1-12

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Introduction

One of the causes of air pollution is present with greater force in cities heavily congested by traffic and with little rainfall. This causes heavy metal accumulation that comes from the friction products of brakes, discs, wheels and the pavement itself on the communication roads. Although asbestos has been eliminated in brake ballasts, metals such as iron (Fe), manganese (Mn), copper (Cu), antimony (Sb), barium (Ba), zirconium (Zr), in addition to zinc (Zn) They are present in the tires (Querol, 2008).

Few studies have been carried out in the identification and estimation of the concentration of heavy metals using leaves of plants collected in the Guadalajara Metropolitan Area (AMG) (Gutiérrez, 2013, 2015). In this regard, it has been reported that the concentration of heavy metals (Al, Cd, Cu, Fe, Mn, Ni, Pb and Zn) accumulated in Ficus benjamina sheets that was determined by atomic absorption, depended on the season of the year and the metal (Gutiérrez, 2013). For example, in the Bosque de Los Colomos in the spring season a higher concentration of lead (10.39 ± 1.88 mg / Kg-1) was determined than in the summer (4.99 ± 1.88 mg / Kg-1) and for Cu the concentration It increased almost five times in the summer (Gutiérrez, 2013). When comparing the contaminant retention capacity of the Ficus benjamina leaf with other leaves (C. aurantium and Fraxinus uhdei), it was demonstrated that this Ficus species retains a higher concentration of Pb in spring, summer and autumn, while in the summer and winter seasons it retains higher concentrations of Cu than other leaves (Gutiérrez, 2013). The reported results suggest that Ficus benjamina leaves have a great capacity to accumulate metals and therefore can be used as bioindicators of environmental particles.

Components and origin of pollutants

The most common air pollutants are suspended particles whose components include heavy metals, nitrates and sulfates, among others. (Perez Fadul & Hdrnandez Hernandez, 2006). In particular, heavy metals are a group of elements that are found in relatively low concentrations in the earth's crust, soils and plants, have industrial and biological importance and have densities greater than 6 g / cm3 (Martinez, 2009; Virtual, 2011).

Air pollutants have the ability to generate more severe health problems if heavy metals such as lead (Pb), zinc (Zn), cadmium (Cd) and chromium (Cr) are found (David et al., 1989; Flores et al., 2013; WHO, 2006; Vargas, 2005).

Hypothesis: The particles deposited in Ficus benjamina leaves from air pollution in the AMG, consist of a wide variety of heavy metals that can affect human health

Goals: Identify heavy metals and evaluate their concentration in urban dust deposited in Ficus benjamina leaves by means of atomic absorption techniques (AA).

Health effects

Air pollution by particles has been associated with various effects, acute and chronic, in respiratory and cardiovascular diseases, given the diversity in chemical composition (Frejo et al., 2011). Women suffer greater exposure to traditional environmental risks, such as the use of solid fuels in cooking and water transport (WHO, 2016). Traffic intensity is fundamental in terms of environmental pollution. People who live or work near major communication routes are particularly affected by the high levels of contamination by particles and heavy metals associated with them (Gasser et al., 2009). Agricultural, industrial and vehicular traffic companies in large cities have released a large amount of chemical pollutants into the environment, including heavy metals that are present in soils, which are transported by wind and water. These, in the long term, come into contact with the inhabitants and have the capacity to generate health and environmental problems (Juárez et al., 2009).

Heavy metals

Cadmium (Cd)

It is a metal that is available in the earth's crust along with zinc, copper and lead. Cadmium is not found in the free state in nature, but is released into water, soil and air by various anthropic activities. Almost all cadmium is obtained during the extraction and refining of non-ferrous metals, the manufacture and application of phosphate-based fertilizers, the combustion of fossil fuels and the disposal and incineration of garbage (WHO, 2006).

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Applications

In order to protect against corrosion, a cadmium bath is provided with screws, locknuts, bolts or pins and various parts of airplanes and motor vehicles (Nordberg, 1999). It is also used in batteries (83%), pigments (8%), electrolytic coatings (7%), stabilizers for plastics (1.2%), iron-free alloys, photovoltaic instruments and other uses (0.8%).

Entrance routes to the organism:

By inhalation: through tobacco smoke or by occupational exposure to atmospheric cadmium dust, approximately 20% to 50% is absorbed via the lung. After being absorbed in the lung or digestive tract, it passes to the liver (David et al., 1989).

By supply: A small amount of cadmium (1–10%) will enter the body through food and water intake. Although in case of not consuming enough iron or other nutritional elements in the diet, the individual is likely to absorb more cadmium than normal (ATSDR, 2012; David et al. ,, 1989; Nordberg, 1999).

Health effects:

Cadmium is easy to find in manure (livestock) and pesticides, it can accumulate in aquatic organisms and during agricultural harvesting. Internationally, the United States Department of Health and Human Services (DHHS), the International Agency for Research on Cancer (IARC) and the Environmental Protection Agency (EPA) determined that cadmium and its compounds they are carcinogenic to humans (ATSDR, 2012a; Lenntech, 2008).

Cobalt (Co)

It is a metal that is present in the environment (in air and water) and food. It has properties similar to iron and nickel. It is present in vitamin B12. It is also useful in the treatment of anemia in pregnant women as it stimulates the production of red blood cells (ATSDR, 2001). According to the international labor organization, cobalt is considered as a sensitizing agent that can cause occupational asthma. It can also generate bronco acute spasm or pneumonia; however, in the case of chronic exposure, the damage can lead to pulmonary fibrosis (David et al., 1989).

Applications:

In high concentrations, cobalt can be found in the soil near mineral deposits, phosphated rocks or sites where minerals melt, as well as in roads with high vehicular flow, such as roads, near airports or other types of industrial pollution sources . It is also possible to find small amounts of cobalt in plants and incinerators that use coal as fuel, expelled by the exhaust pipe of vehicles and in the production and use of alloys and cobalt compounds (ATSDR, 2001; Lenntech, 2008). It has been used as a glass and ceramic dye, also for nutritional uses (beer foam stabilization) or medical (anemia treatment, even in hip and knee prostheses). It has also been used in the alloy industry with other metals, as well as in mining, in pigments and bleaches (Ilundain, 2009).

Entrance routes to the organism:
By inhalation and by drinking water

Health effects:
In the case of beer drinkers it was observed that it can generate cardiac toxicity, severe pulmonary fibrosis, asthma and pneumonitis in addition to allergies such as dermatitis and asthma (Ilundain, 2009)

Chrome (Cr)

It is an element that is found naturally in rocks, animals, plants and in the soil (ATSDR, 2012b).

Applications:

It is widely used in manufacturing processes of chromed material, as well as in numerous consumer products such as:

– Wood treated with copper dichromate
– Tanned leather with chromic sulfate
– In stainless steel kitchenware
– In hip replacements

Entrance routes to the organism:

By inhalation: in the metallurgical and tanning industry, hazardous waste sites and tobacco smoke (in closed places it can reach chromium concentrations of 10 to 400 times higher than in the open air). In rural areas, air generally contains chromium concentrations <10 ng / m3 lower than urban air (30 ng / m3) (ATSDR, 2012b).

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Water and soil

Due to its low solubility, chromium is sporadically detected in samples of groundwater, drinking water or soil, so exposure to chromium can occur due to:

– Drinking water
– Dermal absorption when bathing
– Eat foods such as fruits, vegetables, nuts, drinks and meats.

Health effects:

It is important to note that not all chromium is toxic to health. Chrome with valence VI is necessary for our body to survive (ATSDR, 2012b) The airways in workers is the most common. The effects include irritation of the nasal mucosa, secretion and respiratory problems such as asthma, cough or shortness of breath, in addition to dermal lesions, skin ulcers. A higher incidence of lung cancer may also occur (ATSDR, 2012b; Nordberg, 1999; Ilundain et al., 2009).

Copper (Cu)

It is a reddish metal that occurs naturally in rocks, water, sediments and, at low levels, in the air. The average concentration in the earth's crust is approximately 50 ppm. Copper can be released into the environment through mining and from factories that use metallic copper or copper compounds. The environment can also be released from landfills, waste incineration, domestic wastewater and fossil fuels, as well as the production of wood, phosphate-based fertilizers and natural sources such as volcanoes or forest fires (Nordberg, 1999).

Applications:

In electrical cables, wire, sheets of metal, pipes and other products. Copper compounds are commonly used in agriculture to treat plant diseases such as fungi or for water treatment and as protection for wood, leather and fabrics (ATSDR, 2016b).

Entrance routes to the organism

– Eyes, respiratory or ingestion.

Health effects:

In case of ingestion, it presents with blue vomit (córric salts), hepatoxocicity, hemolysis (destruction of red blood cells) or methemoblobinemia.

In case of inhalation there is fever due to metallic vapors. The fever subsides spontaneously, the patient presents chills, cough and dyspnea (respiratory distress) (Tintinalli et al., 2013). Another condition that is associated with copper is Wilson disease, a rare inherited disorder, which causes the body to not eliminate excess copper, which can be toxic (Kowdley, 2006).

Nickel (Ni)

Nickel has properties that make it desirable to form alloys. Some of the metals with which it is combined are iron, copper, chromium and zinc. Most of the nickel is used to make stainless steel. It is also combined with elements such as chlorine, sulfur and oxygen to form nickel compounds that dissolve easily in water and are used in the synthesis of coordination complexes and for industrial applications, respectively. It is found in all soils and is released during volcanic activity (ATSDR, 2016b).

Applications:

Nickel compounds are used to color ceramics, make batteries and as catalysts (to accelerate the speed of chemical reactions). Nickel is released into the atmosphere during mining, volcanic activity and by industries that manufacture or use nickel. The industry can dispose of nickel in wastewater. Nickel is also released into the atmosphere by power plants that burn oil or coal and by garbage incinerators (ATSDR, 2016b).

Entrance routes to the organism:

– Air, water, food intake, dermal, sediments and soil,
– smoking tobacco and
– people with some type of prosthesis

When breathing air containing nickel, it goes to the lungs and passes into the bloodstream. The more soluble the nickel compounds in water, the more it is absorbed through the lungs. Some of these nickel particles can leave the lungs in the mucus that swallows or spits (Nordberg, 1999).

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Health effects:

Among the most serious health effects from exposure to nickel are allergies, rhinitis, sinusitis, chronic bronchitis, decreased lung function, cancers of the nasal cavity, lung and sinuses (ATSDR, 2016c).

Lead (Pb)

Lead is a heavy metal that is found naturally in the earth's crust. However, it is usually combined with two or more elements (tin, copper, arsenic, antimony, bismuth, cadmium and sodium) forming lead alloys that have industrial importance (ATSDR, 2016c).

Applications:

- Manufacture of accumulators,
- chemical plants,
- ship demolition,
- cutting and welding of steel structures coated with paints containing lead tetroxide,
- linings for telephone and television cables,
- building elements,
- pigments in paints,
- ceramic varnishes,
- soft welding,
- ammunition,
- glass and ceramic manufacturing,
- glass and ceramic finishes.

Entrance routes to the organism:

People who live near high-traffic roads or highways or power plants, fruit orchards, mining, industrial areas, incinerators, landfills and hazardous waste sites. People who are exposed to lead paints, stained glass or work in lead smelters and refineries, brass or bronze smelters, in plastics industries, in tinning, welding or trimming operations of steel and batteries manufacturing plants. Construction and demolition workers, municipal garbage incinerators, pottery and ceramic industries, radiator repair shops and other industries that use lead welding (ATSDR, 2016c). Workers' families may be exposed to lead levels when workers take work clothes home, as it contains residues of work material (Nordberg, 1999).

Health effects:

In the case of children, it has serious consequences for health because high exposure affects the brain and nervous system (WHO, 2018). Once lead enters the body by inhalation and is deposited in the lower respiratory tract, it is completely absorbed. In adults, the percentage absorbed by the gastrointestinal tract varies between 10 and 15%, however, in the case of pregnant women and children, this percentage increases to 50%. Once it enters the bloodstream, lead is distributed in blood, soft tissues, kidney, bone marrow, liver and brain, as well as in bones and teeth (ATSDR, 2016c).
It is important to highlight that there is no blood lead concentration level that can be considered safe (WHO, 2018).

Zinc (Zn)

Zinc is one of the most common elements in the earth's crust. The main production is from mining and the production of goods, as well as in power plants. Metallic zinc can be punched for the manufacture of auto parts, electrical equipment, light machinery tools, computer equipment, toys and ornamental items (ATSDR, 2016a; Glencore, 2019; International Zinc Association, 2017).

Applications:

- Galvanized steel,
- Zinc based alloys,
- Die casting industry,
- Brass and bronze production,
- Minting and architectural applications.

Health effects:

The EPA has determined that, due to lack of information, zinc is not classifiable in terms of carcinogenesis in humans (David et al., 1989), however, if swallowed it can cause vomiting and abdominal pain (may simulate poisoning by iron). Inhalation of zinc vapors may cause mucosal irritation and fever (Tintinalli et al., 2013).

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Entrance routes to the organism:

It is found in air, soil and water and in food (ATSDR, 2016a), in military smoke bombs, zinc tablets, and in smelting or electroplating processes such as zinc oxide (Tintinalli et. Al., 2013). The levels of heavy metals that cause damage to health, as well as the toxic effects that harm organisms have been reported in several bibliographical sources (Dreisbach, 1984). According to Food Industry (2007) it is said that the EPA has some established limits for the intake of heavy metals in humans, which should not be exceeded, since it can cause serious disorders to living beings, including death (Table 1).

Consumption by humans:	
Element	**Maximum permissible limit**
As	0.05 mg/l (+)
Cd	10 µg/l (*)
Cr	0.05 mg/l (+)
Cu	1.0 µg/l (#)
Hg	144 ng/l (*)
Ni	632.0 µg/l (*)
Pb	50.0 µg/l (*) (adults)
Zn	5.0 µg/l (*)
**: criteria for water;*	
+: maximum level of contamination;	
#: level that should never be exceeded	

Table 1 Limits for heavy metal concentrations for human consumption (Adapted from: (Food Industry, 2007))

Methodology to be developed

The AMG is located in the center of the State of Jalisco, in the Río Grande de Santiago basin, within the Valleys of Atemajac and the Tonalá Plain. The mountains that surround the area to the Northwest the Sierra de San Esteban, to the Southeast the mountainous sets Cerro Escondido-San Martín and El Tapatío-La Reyna; to the south, the Cerro del Cuatro-Gachupín-Santa María and to the west, the Sierra de la Primavera (Ramírez-Sánchez et al., 2006). For the selection of leaf samples it was necessary to discard the young or recently sown Ficus benjamina trees. For this, samples were taken of trees whose height was between 1.50 and 2 meters, which already had "mature" leaves and there was already a sufficient accumulation of dust in them. Once the tree was selected and with the protective equipment on, the gardener's scissors were taken and 30 mature leaves were collected.

For the extraction of heavy metals, samples of Ficus benjamina leaves were taken to the laboratory, and acid digestion was performed. The samples were previously homogenized. The determination was made in an atomic absorption spectrophotometer model Varian AA 240 FS, with a monochromator of CZERNY-TURNER design, panel of 4 lamps and inert and adjustable nebulization chamber. The technique used was flame (flame) and calibration curves were used. All samples were treated in duplicate. The elements analyzed were Cd, Co, Cr, Cu, Ni, Pb and Zn with detection limits in ppb. The curve starts at zero, which is distilled water, which calibrates the equipment in each element. The ranges represent the concentration that was used in the first and last standard to form the curve.

Results

The average concentration values for Cu, Zn, Co, Ni, Cd, Pb and Cr from all sites. The most abundant elements were Cu, Pb and Zn, (14.58-24.72 mg / Kg) and in lower concentrations are Cd, Cr, Co and Ni (3.46-5.93 mg / Kg). The average concentration of all heavy metals (except Zn) was higher than the value reported in the "reference plant" proposed by Market (1992). The concentration values for Cd, Co, Pb Ni, Cr and Cu were 69, 26, 20, 3.9, 3.6 and 2.47 times higher than the reference values, respectively. High concentrations can be attributed to the progressive accumulation of metals in the leaves over time.

When comparing the concentration of heavy metals in Ficus benjamina sheets with the normal concentration value reported by other authors, contamination (except Zn) is also inferred, although more moderately. Highlight the case for Ni and Cd, since the concentration ranges that exceed the reference are between 12 and 17 times higher than normal values. The average concentrations for heavy metals deposited in Ficus benjamina sheets collected in the AMG and reported in 2013 for Cu, Zn, Pb, Cd and Ni were 21.83, 19.50, 5.82, 1.60 and 0.97 mg / Kg, respectively (Gutierrez, 2013). The comparison of these data with those obtained in this work indicates that our metal concentration values were similar, except for Cd, Pb and Ni, which were 2.1, 3.4 and 6 times higher. In both cases, heavy metal contamination was inferred in the AMG.

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Correlations were made which reflect an anthropic origin of pollutants from common sources (Machado et al., 2008). For example, Cr and Cd are mainly related to emissions from motor oils and Zn and Cu are associated with industrial activities and the wear and tear of metal parts from automobiles (Akgüç, Özyiğit, & Yarci, 2008; Machado et al., 2008; Trujillo-González & Torres-Mora, 2015).

Heavy Metal Distribution

Next, the distribution of Cd, Co, Cr, Cu, Ni, Pb and Zn is schematized for each element analyzed by the AA technique. They were added economic activities (DENUE) (INEGI, 2018) that take place in the city and their location in the AMG.

Cadmium (Cd)

This element is associated with the manufacture of accumulators, fertilizer manufacturing, casting of parts and recycling sites. The minimum concentration of Cd observed was 0.18 ppm and the maximum was 9.20 ppm. The area where the highest concentration was observed was at the height of the Revolution division, on Lázaro Cárdenas Avenue and along this road. Industrial activities related to recycling, fertilizer manufacturing, casting of parts and manufacturing of accumulators predominate. Other points of interest are at the height of the Green Cross Leonardo Oliva on the Cruz del Sur Avenue, the zone of the Guadalajara International Airport "Miguel Hidalgo y Costilla" and at the height of the Fractionation Forests Vallarta Residential (Figure 1).

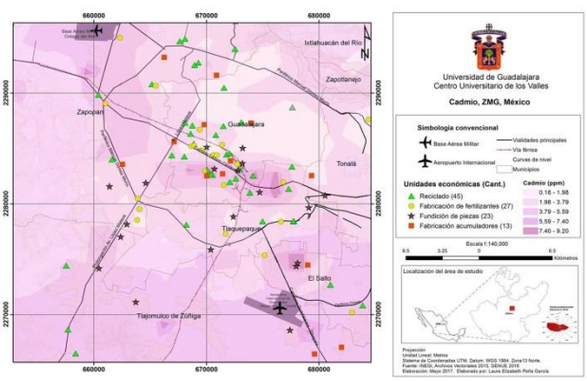

Figure 1 Cadmium distribution map

Cobalt (Co)

This element is associated with the manufacture of glass and aircraft by-products (engine repair). The minimum concentration of Co was 1.0 ppm and the maximum was 8.0 ppm. In general, the AMG has a homogeneous distribution between 3.98 and 6.10 ppm. The South-East area of the city is the one with the highest concentrations of Co, as well as some spots within the city.

In the first case bricks predominate that can be a source of contamination by Co and in the second case, the transport of pollutants by wind could explain the presence of this metal in the urban area. Similarly, Lázaro Cárdenas Avenue and the northern part of the city presented contamination by Co (Figure 2).

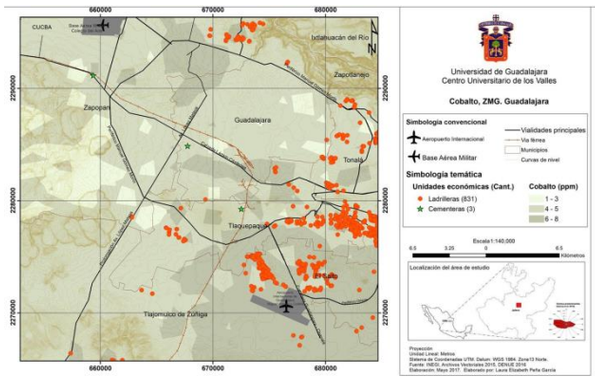

Figure 2 Cobalt distribution map

Chrome (Cr)

This element is associated with mills, lathes, cast iron parts, iron and steel products and recycling sites. The minimum concentration ranges of Cr were between 0.01 to 1.43 ppm and maximum between 5.69 and 7.11 ppm. The area with the highest concentration is Tonalá, on the New Peripheral East, the eastern part of the city, where you would predominate.

The rest of the AMG has concentrations between 2.85 ppm and 4.27 ppm (Figure 3). In the North zone of the AMG there are recycling activities that can be a source of Cr and Cd emissions, confirming a common origin.

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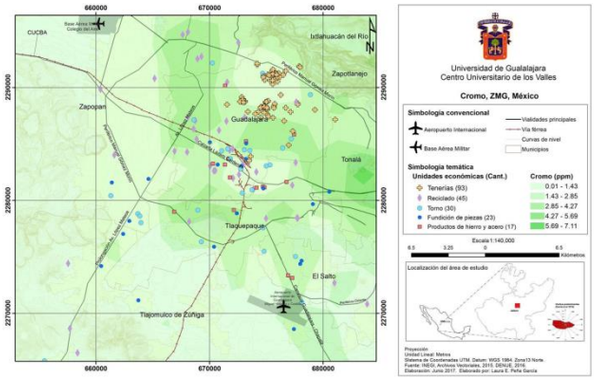

Figure 3 Chrome distribution map

Copper (Cu)

This element is associated with agricultural products, construction of transport vehicles, power lines, trains and cables. The minimum concentration of Cu in the AMG was between 1.6 and 9.2 ppm, the highest was between 32.1 and 39.8 ppm. The areas where Cu is less present in the Zapopan (NW) area, the Camichines area and the Tlajomulco de Zúñiga (Southwest) area of the city (Figure 4). High concentration areas include Guadalajara, Tonalá, Tlaquepaque and El Salto. Among the possible sources of copper predominate activities inherent to the manufacture and lamination of this metal.

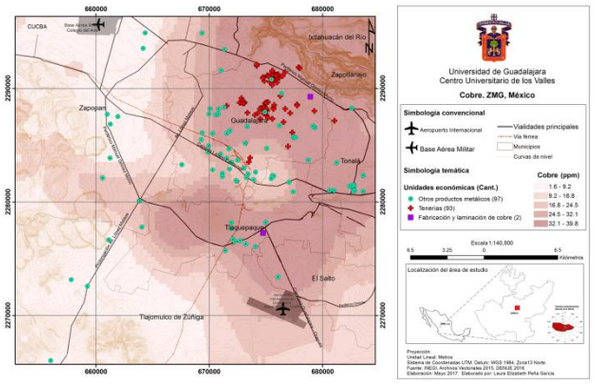

Figure 4 Copper distribution map

Nickel (Ni)

This element is used in chrome plating machines, for the production of bearings, casting of parts, iron and steel products, generation, transmission and distribution of electrical energy. The minimum value observed was between 0.9 and 4.2 ppm and the maximum between 14.1 and 17.4 ppm.

The latter was located in the Spring Forest, agricultural area. It is likely that the use of agrochemicals or Ni bound to iron ores is the origin of this contamination, since no industrial activities were registered in the area. The minimum values were observed from Lázaro Cárdenas Avenue towards the NE of the city, as well as isolated points within the AMG (Figure 5).

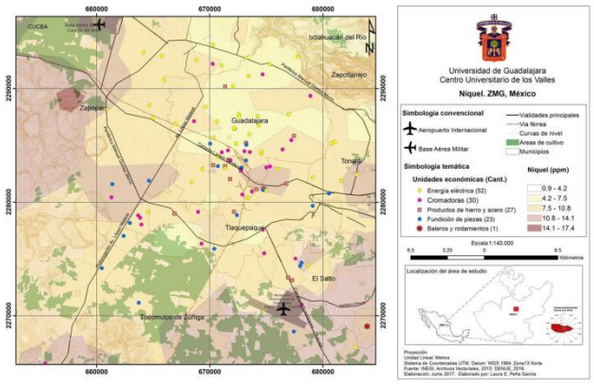

Figure 5 Nickel distribution map

Lead (Pb)

For the elaboration of the map the data of the DENUE of:

- Casting of parts,
- Iron and steel products,
- Paint factories,
- Accumulator factories,
- Cement plants,
- Stained glass and leaded and
- Recyclers.

The minimum lead values were between 4.9 and 15.6 ppm, the highest concentrations were between 47.6 and 58.2 ppm. One of the highest points was located on England Avenue at the height of Regency Park, near North Peripheral. The Air Base area and the Guadalajara International Airport, in addition to certain points on Lázaro Cárdenas Avenue (Figure 6).

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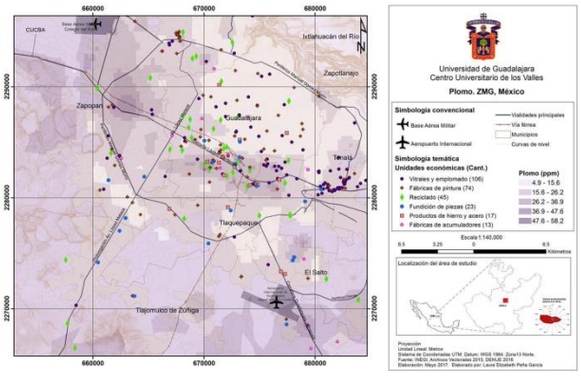

Figure 6 Lead distribution map

Zinc (Zn)

For the elaboration of the map the data of the DENUE of:

- Thick gauge metal molding,
- Foundry,
- Glass manufacturing,
- Manufacture of accumulators and
- Paint manufacturing.

The minimum concentrations of Zinc were between 0.9 and 16.2 ppm and the maximum between 62.2 and 77.5 ppm. The points where the highest levels were presented were on the roads of Guadalajara-El Salto, at the height of the IBM company and the other point Guadalajara-Chapala at the height of Revolution Street. In the rest of the city the zone NE, N and NO presented maximum concentrations of 46.9 ppm (Figure 7).

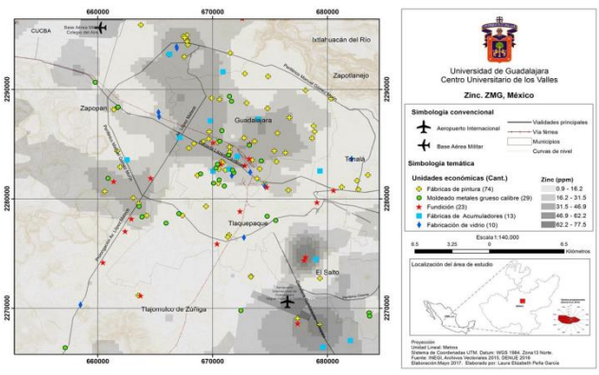

Figure 7 Zinc distribution map

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Conclusions

The concentrations of the seven metals analyzed were identified by AA, of which the most abundant were Cu and Pb. Heavy metal maps allowed us to know that there are some patterns of distribution of pollution. Such was the case of the Cd, Pb and Zn that are distributed very homogeneously on the Lázaro Cárdenas avenue until reaching the supply market area. The above correlates with the heavy metal distribution map obtained by AA, urban dust and with the magnetic characterization maps. The concentration values of Cd, Co, Cr, Cu, Ni and Pb deposited in sheets, exceeded the reference values. The high concentration of heavy metals found shows that the quality of the ambient air in the AMG is unhealthy. It follows that there must be a correlation between this aspect and the health of the population.

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Genotypic and allelic frequencies analysis of the 19 T>G polymorphism of the UGT1A6 gene in Mexican mestizo population of the state of Puebla

Análisis de las frecuencias genotípicas y alélicas del polimorfismo 19 T>G del gen UGT1A6 en población mestiza mexicana del estado de Puebla

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Abstract

UGT1A6 catalyzes the glucuronidation of several xenobiotics and drugs widely used. Changes in the glucuronidation rate are attributed to inter-personal and inter-ethnic variations, that can impact the expression or enzyme function. Frequencies of genetic polymorphisms of UGT1A6 have been reported in another countries; however, there are no date of frequencies in the Mexican population. The aim of this work was to determine the genotypic and allelic frequencies of UGT1A6 19T>G in a Mexican mestizo population of the state of Puebla and compare them with the frequencies observed in other populations. Peripheral blood DNA was obtained from 60 healthy adults and 19 T>G alleles were identified by the PCR-RFLP technique. Our results were compared with those observed in other ethnic groups, and we observed that our frequencies were lower than those reported in Chinese, Korean, Japanese, Hindu, and Greek populations. These results must be considered to make decisions when choosing the drugs administered to different ethnic groups.

UGT1A6, polymorphisms, Glucuronidation

Resumen

UGT1A6 cataliza la glucuronidación de diversos xenobióticos y fármacos ampliamente utilizados. Hay evidencia de que los cambios en la tasa de glucuronidación se atribuyen a variaciones interpersonales e interétnicas, que pueden impactar la expresión o la funcionalidad de las enzimas. Se han reportado frecuencias de distintos polimorfismos genéticos de UGT1A6; sin embargo, no hay reportes de sus frecuencias en población mexicana. El objetivo de este trabajo fue determinar las frecuencias genotípicas y alélicas de UGT1A6 19T>G en una población mestiza mexicana del estado de Puebla y compararlas con las frecuencias observadas en otras poblaciones. Se obtuvo ADN de sangre periférica de 60 adultos sanos y se identificaron los alelos 19 T>G mediante la técnica de PCR-RFLP. Al comparar los resultados obtenidos con los observados en otros grupos étnicos, se observó que las frecuencias del polimorfismo fueron menores a las reportadas en poblaciones chinas, coreanas, japonesas, hindús, y griegas. Estos resultados deben considerarse al momento de elegir los fármacos y sus dosis y ajustarlos al origen étnico de cada población.

UGT1A6, polimorfismos, Glucuronidación

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Introduction

UDP-glucuronosyl transferases (UGTs) are members of a super family of endoplasmic reticulum enzymes that catalyze the conjugation of glucuronic acid with a nucleophilic substrate. Glucuronic acid conjugates are rapidly removed from hepatocytes to be excreted primarily through bile. Glucuronidation is important for the detoxification and elimination of both endobiotic and xenobiotic compounds [1].

The organisms are constantly exposed to xenobiotic compounds, both natural (secondary metabolites of plants and toxins produced by molds and other organisms), as of anthropogenic origin, drugs, industrial chemicals, pesticides, pyrolysis products of cooked foods, alkaloids, pollutants, etc.

Liposolubility that allows many xenobiotics to be absorbed through the skin, lungs and digestive tract, is an obstacle to their elimination because lipophilic compounds can be easily reabsorbed. Consequently, the removal of lipophilic xenobiotics often depends on their conversion into water-soluble compounds by a process known as biotransformation. Enzyme-catalyzed reactions that produce biotransformation of xenobiotics are divided into two groups.

Phase I reactions comprise hydrolysis, reduction and oxidation. These rections expose or induce a functional group (-OH, NH2, _SH or COOH), and regularly only cause a small increase in hydrophobicity. Phase II biotransformation reactions include glucuronidation, sulfation, acetylation, methylation, glutathione conjugation and conjugation with amino acids (such as glycine, taurine, and glutamic acid).

The cofactors for these reactions act on functional groups that are in the xenobiotic or are induced or exposed during phase I of the biotransformation. Almost all phase II biotransformation reactions result in a large increase in the hydrophobicity of the xenobiotic, thus favoring its excretion. Phase II of biotransformation of xenobiotics may or may not be preceded by phase I [2].

UGTs are expressed in liver, lung, bile ducts, stomach, colon, kidney and brain [3, 4]. It has been observed that multiple compounds induce the activity of UGTs in humans. UGT 1A6 is the only isoform of UGT1A that is expressed in lung, is responsible for the detoxification of carcinogens such as benzo [a] pyrene (BaP) of tobacco smoke and 4 (Methylnitrosamino) -1- (3-pyridyl) -1-butanone (NNK, figure 1) [5-8].

Xenobiotic metabolism enzymes are highly polymorphic [9], single-nucleotide variations (SNPs) can induce changes in the phenotype, if they are located in non-coding regions they can alter genetic expression, while being in coding regions can alter the function of proteins by an amino acid change.

Genetic polymorphisms in UGTs have been associated with risk of suffering from different types of cancer, it has also been observed that some polymorphic variants are associated with reduction in plasma drug concentrations, which could affect the pharmacokinetics of medications. The allelic variant UGT1A6 19 T> G has been associated with an increased risk of lung cancer in the Chinese population, so it has been proposed as a marker of genetic susceptibility [10].

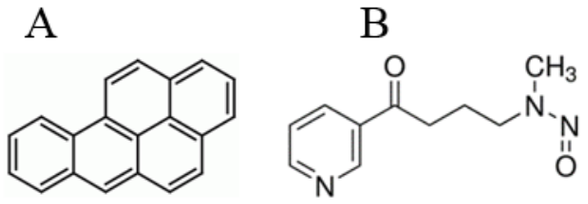

Figure 1 Chemical structure of: A) benzo [a] pyrene and B) 4 (Methylnitrosamino) -1- (3-pyridyl) -1-butanone, both compounds are metabolized for excretion by the enzyme UGT1A6

UGT1A6 also participates in the metabolism of valproic acid (VPA, figure 2), an antiepileptic drug consumed particularly in less developed countries. The antiepileptic effects of VPA require stable plasma concentrations, which are associated with genetic polymorphisms that affect the pharmacokinetics and pharmacodynamics of VPA.

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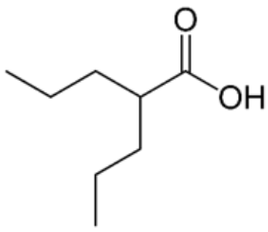

Figure 2 Chemical structure of valproic acid (di-n-propylacetic acid)

Polymorphisms 19T> G / 541A> G / 552A> C in UGT1A6, have been associated with an increase in enzymatic activity. In patients with single nucleotide polymorphisms (SNPs), an increase in glucuronidation of VPA is observed. Patients with double heterozygosity at nucleotide positions 19T> G / 541A> G / 552A> C, have significantly lower plasma VPA concentrations than those with wild genotype or single heterozygosity. Consequently, these patients required higher daily doses of VPA in the following treatment to increase plasma VPA concentrations and prevent seizures [11].

Given the clinical importance of the 19T> G polymorphism in the UGT1A6 gene (figure 3), the objective of this work is to investigate its genotypic and allelic frequencies in the Mexican mestizo population of the state of Puebla and compare them with the frequencies observed in other populations. This information will help to understand the genetic susceptibility to diseases due to exposure to xenobiotics, as well as the therapeutic efficacy of drugs metabolized by UGT1A6, in this ethnic group.

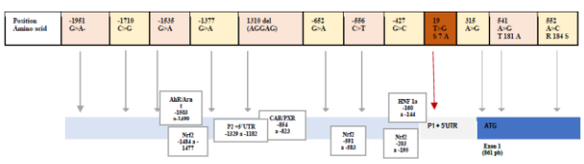

Figure 3 Genetic polymorphisms identified in exon 1 and regulatory region 5 '(-2052pb) of the UGT1A6 gene. The location of the experimentally identified transcription factor binding sites (for the Ah / Aril receptor translocating nuclear receptor and Nrf2 receptor [12-13] or by computer homology analysis (nuclear hepatocyte factor 1α and CAR / PXR) is shown. , MatInspector, [14] The position of the gene is given according to the first nucleotide predicted for the start codon of UGT1A6 (nucleotide 108, 262 of the GenBank sequence with reference NG_002601.1). Modified from Krishnaswamy S. et al. 2005 [15]

Methods

Sampling of individuals

60 samples of 4 mL of peripheral blood were collected from healthy individuals in lilac vacuette tubes with EDTA (Greiner bio-one 454209H) 45 women and 15 unrelated men among them between 16 and 87 years, inhabitants of the state of Puebla with three lines ascending generational born within Mexican territory, who signed an informed consent and completed a questionnaire with their demographic data. The institutional ethics committee reviewed and approved the research protocol.

DNA purification

The DNA was purified with the sucrose and sodium perchlorate method described by Daly et al. 1996 [16]. Cell nuclei were isolated by adding 36 mL of lysis buffer (320 mM sucrose, 5 mM MgCl2, 1% Triton X-100, 10 mM Tris-HCl, pH 7.4) to 4 mL of blood. The mixture was vigorously stirred in a vortex and centrifuged at 2000g for 20 minutes at 4 ° C. The button was resuspended in 2 ml of suspension buffer (150 mM NaCl, 60 mM EDTA, 1% SDS, 400 mM Tris-HCl, pH 7.4) and 0.5 mL of 5M sodium perchlorate (NaClO4). This suspension was mixed by rotation 15 minutes at room temperature and subsequently incubated at 65 ° for 30 minutes. 2 mL of cold chloroform (at -20 ° C) was added and mixed again by rotation at room temperature for 10 minutes followed by centrifugation at 1400g for 10 minutes.

The aqueous phase containing the DNA (the highest phase) was transferred to a 15 mL tube and 2 volumes of cold ethanol (at 4 ° C) were added. The tube was inverted several times to precipitate the DNA and transfer it to a 2 mL Eppendorf tube. The DNA was washed twice with 70% ethanol and allowed to dry at room temperature in a laminar flow hood, once dry, 200 µL of TE buffer (10 mM tris-HCl, 1 mM EDTA pH 7.4) was added and incubated 16 hours at 60 ° C to resuspend it, subsequently its concentration was quantified on a NanoDrop 1000 (Thermo Scientific) spectrophotometer and stored at -20 ° C until used for genotyping of the 19 T>G polymorphism of the UGT1A6 gene.

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Genotyping of UGT1A6 19 T>G by PCR-RFLP

Genotyping was performed using the Restriction Fragment Length Polymorphism (PCR-RFLP) technique. The amplification of the polymorphic segments by Polymerase Chain Reaction (PCR) was carried out in a Bio-Rad T100 thermocycler, placing 100 ng of genomic DNA, 1X Taq buffer, 1 unit of Taq Polymerase (Qiagen Cat No. 201203), 50 µM dNTPs (Qiagen Cat. No. 201901), 500 nM oligonucleotides described by Nagar S. et al 2014 Forward F-51 5 'GAT TTG GAG AGT GAA AAC TCT TT 3' and Reverse R 184 5 ' CAG GCA CCA CCA CTA CAA TCT C 3 '[17].

The conditions used for amplification were the following: a first denaturation step at 94 ° C for three minutes, followed by 40 cycles of denaturation at 94 ° C for 30 seconds, alignment at 58 ° C for 30 seconds, extension at 72 ° C for 30 seconds and one last step of 72 ° C for 3 minutes. An amplicon of 237bp was obtained.

The restriction with the FastDigest HhaI enzyme (Thermo Scientific FD1854) was incubated for 12 h at 37 ° C. Digestion products were separated by horizontal electrophoresis on 3% agarose gels containing a fluorescent nucleic acid dye with UV light (SmartGlow Pre-Stain E4500-PS Accuris).

The wild allele (19 T) does not have a cut-off site for the HhaI enzyme so that in a homozygous condition a single band of 237 bp is observed, the mutant allele (19 G) does have the cut-off site, so in condition homozygous, two bands are observed, one of 165 bp and another of 72 bp, in the heterozygous individuals three bands are observed 237 bp, 165 bp and 72 bp (figure 4).

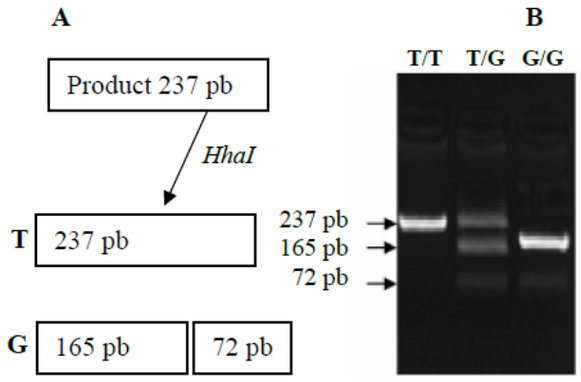

Figure 4 Determination of the UGT1A6 19T>G polymorphism by the PCR-RFLP assay. A) the 237 bp PCR amplification product (amplicon) digested with the HhaI endonuclease for the identification of the 19 T> G alleles by restriction patterns. B) The wild allele (19 T) does not have a cut-off site for the HhaI enzyme, so in a homozygous condition a single band of 237 bp is observed, the mutant allele (19 G) does show the cut-off site, so in Homozygous condition two bands are observed, one of 165 bp and another of 72 bp, in heterozygous condition T / G three bands are observed, modified from Nagar S. et al 2004 [17]

Results

This study included 60 healthy individuals, 75% women and 25% men between 16 and 87 years, inhabitants of the state of Puebla. The DNA amplification segment that was obtained by PCR had a size of 237 bp, in Figure 5, its sequence is shown in the mRNA transcript [18] delimited by the hybridization position of the oligonucleotide primers we used (PCR in silico), the position of the SNP is also observed.

The allelic and genotypic frequencies of UGT1A6 19 T>G identified by PCR-RFLP in the mestizo population of the state of Puebla are reported in Table 1. The most common genotypic frequency was the wild homozygous (T / T) 0.683 (41 individuals) , followed by heterozygous (T / G) with a genotypic frequency of 0.30 (18 individuals), only one homozygous mutant individual (G / G), genotypic frequency 0.016 was observed. The frequency of the mutant allele (G) in our population was 0.166 and is below that reported for other populations: In the Chinese Dong ethnicity a frequency of 0.17 [19] was reported, in the Chinese ethnicity She 0.189 [19], in the Korean population 0.2 [20], in the Japanese population 0.226 [21], in the Chinese ethnic group Han 0.38 [19], in the Hindu population 0.356 [22] and the population that reported the highest frequency of the mutant allele was the Greek with 0.37 [2. 3].

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aaagggtaaaattcagagcaagggagaggtagacaggacctgtgaaaagcagtggtta
gtttagggaaaatacctaggagccctgtgatttggagagtgaaaactctttattaccgttgtt
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tcttcttagcactttggggcatggttgtaggtgacaagctgctggtggtccctcaggacgg
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tggtcagtcctcatctctgtcgtgcttcataggtgccaccttgtgtgtttaaagaagggaag
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agtgctgggcaagtttacttttttttctgatgtttcctacaactaaaaataaattaataaatttata
taaattctatttaaaaaaaaaaaaa

Figure 5 Human UGT1A6 UDP glucuronosyl transferase messenger RNA transcript obtained from GenBank, NCBI sequence reference: NM_001072.3 2495 bp [18], the yellow amplified segment, delimited by the turquoise priming oligonucleotides and the polymorphism of a single nucleotide 19 T>G in red color

Country	N	Frequencies Genotypic			Allelic Frequencies		Appointment
		T/T	T/G	G/G	T	G	
Puebla Mexico	**60**	**0.683 (41)**	**0.30 (18)**	**0.016 (1)**	**0.834**	**0.166**	**This studio**
China	531 (Han)	0.586 (311)	0.352 (187)	0.062 (33)	0.762	0.238	[19]
	268 (Dong)	0.687 (184)	0.287 (77)	0.026 (7)	0.83	0.17	[19]
	259 (She)	0.654 (167)	0.332 (86)	0.023 (6)	0.811	0.189	[19]
Korea	50	0.64 (32)	0.32 (16)	0.04 (2)	0.8	0.2	[20]
Japan	195	0.6 (117)	0.348 (68)	0.051 (10)	0.774	0.226	[21]
India	80	0.45 (36)	0.388 (31)	0.162 (13)	0.644	0.356	[22]
Greece	134	0.381 (51)	0.492 (66)	0.127 (17)	0.63	0.37	[23]

Table 1 Genotype and allelic frequencies of AUG1A6 19 T>G observed in this population and reported in previous work in different populations

Population genetic balance analysis using an X^2 test

All frequencies of the analyzed locus are in Hardy Weinberg equilibrium by presenting values of X2 lower than the critical value (the critical value of X2 for the analysis with two degrees of freedom and an $\alpha = 0.05$ is 3.84), which indicates that the genetic composition of our population remains in equilibrium, that is, natural selection is not acting on it and therefore an evolutionary change is not being generated.

Discussion

UGT1A6 is an enzyme that catalyzes the glucuronidation of various substrates including environmental pollutants such as BaP and drugs such as VPA, acetaminophen and other non-steroidal anti-inflammatory drugs. There is evidence to support the idea that changes in the glucuronidation rate are attributed to interpersonal and inter-ethnic variations, which may impact the expression or functionality of enzymes [24].

About a dozen polymorphisms have been identified in exon 1 of the UGT1A6 gene and its adjacent 5 'regulatory region [14], in this study the frequency of 19 T 19G polymorphism was analyzed in 60 mestizo individuals from the state of Puebla and It was observed that the incidence of the mutant allele is lower than that reported for other populations. Although the 19 T>G polymorphism is not located in the coding region but in the 5'UTR region, it has been observed that when combined with the 541 A>G and 552 A>G polymorphisms, it increases the risk of lung cancer due to its Participation in the metabolism of carcinogenic compounds such as BaP and NNK [10]. On the other hand, it has been reported that it increases the enzymatic activity, modifying the pharmacokinetics of some medications, reducing the plasma time of compounds metabolized by this enzyme [11].

Unlike other reported populations, in our population we observed few individuals carrying the G allele in a homozygous condition, indicating low risk of loss of medication functionality due to an increase in glucuronidation rate.

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It is important to mention that in the metabolism of drugs and other xenobiotics, in addition to UGT1A6, other highly polymorphic enzymes such as cytochrome P450 and Sulfotransferases participate, so it is necessary to evaluate the additive effect conferred by allelic variations in metabolic enzymes. Determining the allelic frequency of these variants in our population will serve to explain their role in the disposition and toxicity of medications and other compounds, generating useful pharmacogenetic information to predict therapeutic results.

Conclusion

Our work is the first to report genotypic and allelic frequencies of the 19 T>G polymorphism of the UGT1A6 enzyme in the Mexican population. The frequency we found for the mutant allele (0.166) is lower than that reported in other populations (Chinese, Korean, Japanese, Hindu and Greek). Due to the size of the population sample (n = 60) and the low frequency of this allele, we only find it in a homozygous condition in an individual. Studies are needed to estimate genetic frequencies with a greater number of individuals, as well as patients suffering from diseases that have been associated with this polymorphism in other populations.

Studying how genetic variations between individuals affect the metabolism of drugs producing a variable response with respect to their efficacy or adverse effects profile will allow us to make decisions when choosing the administered drugs and adjust them to the ethnic origin of a given population.

Financing

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Primary neuroendocrine tumor in a canine

Tumor neuroendocrino primario en un canino

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Abstract

The objective know the cause of death of the pet. Pulmonary neoplasms can arise from all parts of the lung, with a histological pattern. Tumors derived from the epithelium of the large airways are located near the lyle of the lung. The majority of canine tumors are adenocarcinomas and progressions from a bronchiole-alveolar pattern to one of mucus-secreting glands or papillary growth. This case was presented, at the University of Guadalajara Animal Pathology Research Center, Canberman cadaver, female, 10 years old and weighing 19 kg, the clinical history indicates that the animal had 12 days of bronchopneumonia; At necropsy he presented Lungs: Severe diffuse emphysema, moderate congestion, discrete diffuse thickening of the pleura and moderate edema, characteristic of the tumor, is classified as anaplasic small cell carcinoma fusiform type. Some lymph nodes have invasion of tumor cells of the lung. Small cell lung tumors are currently classified as neuroendocrine or carcinoid tumors. Their contribution sensitize animal owners so that they attend them on time, and have a better quality of life.

Neoplasia, Tumor, Lun

Resumen

El objetivo saber la causa de muerte de la mascota. Las neoplasias pulmonares pueden surgir de todas las partes que componen el pulmón, con un patrón histológico. Los tumores derivados del epitelio de las vías respiratorias grandes son localizados cerca del hílio del pulmón. La mayoría de los tumores caninos son adenocarcinomas y progresiones de un patrón bronquiolo-alveolar a uno de glándulas secretoras de moco o de crecimiento papilar. Este caso se presento, en el Centro de Investigación en Patología Animal Universidad de Guadalajara, cadáver de canino, Doberman, hembra, de 10 años de edad y 19 kg de peso, la historia clínica refiere que el animal tenía 12 días padeciendo bronconeumonía; A la necropsia presentó Pulmones: Enfisema severo difuso, congestión moderada, engrosamiento discreto difuso de la pleura y edema moderado, características el tumor, se clasifica como carcinoma anaplásico de células pequeñas tipo fusiforme. Algunos linfonodos presentan invasión de células tumorales del pulmón. Los tumores pulmonares de células pequeñas se clasifican actualmente como tumores neuroendocrinos o carcinoides. Su contribución sensibilizar a dueños de animales para que los atiendan a tiempo, y tengan mejor calidad de vida.

Neoplasia, Tumor, Pulmón

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Introduction

Pulmonary neoplasms can arise from all the parts that make up the lung. Tumors of significant clinical incidence mostly arise from the epithelium of the airways or alveolar parenchyma. Several approaches for the classification of lung tumors, both in humans and animals, have used the site of origin (bronchogenic, bronchial or bronchioalveolar gland), histological pattern (adenoid, squamous, large cell, small cell) or combinations of these.

Unfortunately there is an overlap in the histological pattern of tumors from various sites of origin within the lung. Other complications arise because the site of origin is often being hidden, by the aggressive growth of the tumors when they are being examined and by the differentiation from one phenotype to another at various stages of the neoplastic process. The phenotype, therefore, is not a completely reliable indication for histogenesis (Wilson, 2017).

Tumors derived from the epithelium of the large airways are more frequently located near the lung's lung, while tumors of parenchymal origin tend to be peripheral. Although the increase in the incidence of tumors in both places is associated with cigarette smoking, peripheral lung tumors are more common in non-smokers (Wilson and Doungworth, 2002).

It has been thought that primary lung tumors in dogs arise from terminal bronchio-alveolar regions. Most canine tumors are adenocarcinomas and progressions of a bronchio-alveolar pattern to one of mucus-secreting or papillary growth glands that can often be discerned in different regions of the tumor. In addition, squamous differentiation in canine lung tumors is often evident as progression within glandular or solid carcinomas. There is no convincing evidence of small cell carcinomas in domestic animals and in the few tumors that express neuroendocrine markers they are better classified as carcinoids (Wilson, 2017).

With the exception of dogs and cats, lung malignancies are a rare finding in domestic animals (Ogilvie et al. 1989). The prevalence of lung cancer in cats seems to be the same or slightly higher than in dogs.

A review of case records submitted for pathological evaluation at the University of California found that lung neoplasm accounted for 0.75% of feline cases, compared with 0.58% of all canine cases (D, Costa et al., 2012). The reported average age of dogs with primary lung tumors in several studies in the last four decades is consistent with an average of 10.8 years, lung tumors are rare in dogs under 6 years (Choi et al. 2008).

Although they are still rare, neuroendocrine-like cell tumors occur in dogs and are diagnosed as neuroendocrine or carcinoid tumors. They are characterized by their histological similarity with neuroendocrine growths with round to polygonal cells, grouped into small solid aggregates by thin fibrovascular stroma. The neoplastic cells have regular size, spherical and central nucleus, their cytoplasm is modest and slightly amphophilic. They are positive for chromogranin A. It is proposed that these tumors arise from neuroendocrine cells of the airway epithelium, although immunohistochemical stains for markers such as the bombesin and calcitonin peptide regulatory gene are negative and electron microscopy has not been done to demonstrate intracytoplasmic granules (Harkema et al., 1992).

Clinical case description

The carcass of a canine, Doberman breed, female, 10 years old and 19 kg in weight, with a medical history that indicates that the animal was presented for necropsy, at the Center for Research in Animal Pathology at the University of Guadalajara I had 12 days suffering from bronchopneumonia; It also refers that the animal had its complete vaccination and deworming chart, that it lived with 2 cats and that it was fed only with croquettes and tap water.

I applied as initial treatment amoxacillin + clavulanic acid, ambroxol and nimesulide; then he was exchanged for enroflaxacin and liquid bisolbon, and finally he was finished supplying lincomycin, dexamethasone and salbutamol. None of the above medications specified the dose, frequency or duration of treatment. It is also mentioned that the owner is an active smoker who smoked in the presence of the canine.

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The findings found at the autopsy were:

External inspection: Bad, conjunctive, oral and vulvar mucous condition with moderate congestion, discreet presence of tartar in dental pieces.

Internal inspection: Hydrothorax and moderate hydropericardium.

Lymph nodes: Submandibular and subscapularis enlarged, severe congestion.
Spleen: Moderately diffuse pale.

Trachea, and bronchi: Discreet presence of bloody mucus in the light.

Lungs: Diffuse severe emphysema, moderate congestion, diffuse diffuse thickening of the pleura and moderate edema. Presence of tumors, one of them is observed on the dorsal surface of the right cranial lobe, with an oval shape of 8 x 3 cm, well defined, soft consistency, pus and a reddish coloration are observed at the cut. Others are located in the branches of the bronchi, causing severe thickening of the wall of the bronchi, with little defined delimitation, firm consistency and the cut is reddish white.

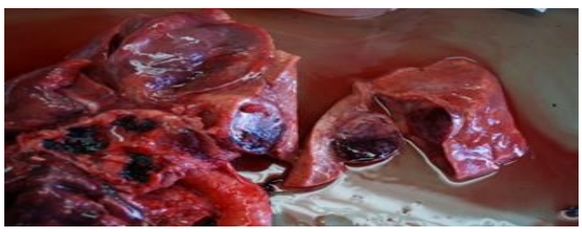

Figure 1

Figure 2

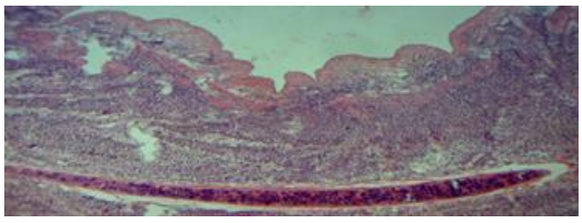

Figure 3

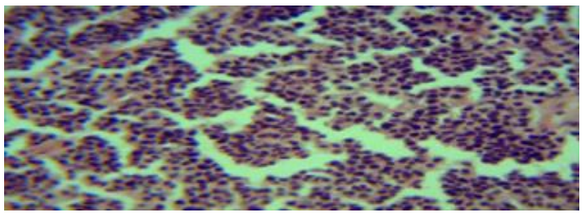

Figure 4

Heart: Discreet dilatation of the right ventricle, discrete congestion, bicuspid valve with discrete endocardiosis and discrete hemorrhage.

Esophagus: Moderate diffuse congestion.

Stomach: Containing yellowish liquid, thickened wall and severe diffuse congestion in the mucosa.

Intestine: Presence of a whitish modulation of irregular edge, firm consistency of 1.7 cm in diameter over the jejunum serosa. Bloody catarrhal content in the duodenum and jejunum, yellowish in the ileum and pasty green in the colon and rectum, thickened walls with the formation of transverse folds, reactive Peyer plates.

Liver: Severe congestion.

Pancreas: No apparent changes.

Kidney: Severe congestion, whitish areas of radiated appearance in the cortex.

Brain: Moderate congestion.

Samples were taken during the necropsy for a histopathological study.

The most important results of the histopathological study were the following:

Lung: Newly formed cells are observed that originate from the epithelium of the bronchial tubes and bronchioles that accommodate forming packages or plates of cells separated by discrete connective tissue fibers. The neoplastic cells fill their own lamia and displace all other structures, respecting only the cartilage plates. Neoplastic cells leave the bronchus and invade the pulmonary alveoli, filling their lumen.

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Tumor cells are small, hyperchromatic, round to oval nucleus, very few show nucleoli, the amount of cytoplasm is poor and the number of mitosis per field is 1.

Bowel: moderate to severe diffuse catarrhal enteritis with lymphoplasmocytic infiltration in the lamina propria. A cut presents invasion of tumor cells in serous, muscular and submucosa.

Spleen: diffuse severe splenic lymphoid deplasion.

Kidney: hydropic degeneration of some renal tubules, swollen glomeruli.

Lymph nodes: some lymph nodes have invasion (metastasis) of lung tumor cells.

Brain: cloudy degeneration and necrosis of some brain neurons.

Diagnosis

Based on the microscopic characteristics of the newly formed tissue and according to the classification of lung tumors of the Fifth Edition of the book "Tumors in Domestic Animals" it is concluded that the lung tumor found in the Doberman canine reason for the case, corresponds to a neoplasm called "neuroendocrine or carcinoid tumor".

Discussion

The case discussion will mainly focus on how the classification of this lung tumor has changed since 1974 to date. In 1974 the World Health Organization published a Bulletin in the form of a book called "International Histological Classification of Tumors of Domestic Animals" in which a grouping and classification of tumors of domestic animals is offered (WHO, 1974). In this bulletin, a so-called "anaplastic carcinoma" appears in the classification of lung tumors, which is divided into A) Anaplastic small cell carcinoma with three subdivisions 1. Lymphocyte-like type (oat cell carcinoma), 2. Fusiform type and 3. Polygonal type and B) Anaplastic large cell carcinoma. Due to its characteristics, the tumor discussed here would be classified as anaplastic small cell fusiform cell carcinoma.

In 1990 in the third edition of the book "Tumors in Domestic Animals" the tumor in question would be classified as "Anaplastic small cell carcinoma", but in this book this tumor is no longer subdivided; but division continues with anaplastic large cell carcinoma. In 2002, the fourth edition of the book "Tumors in Domestic Animals" disappeared the term "anaplastic carcinoma" and separated as independent tumors, leaving the classification as small cell carcinoma and large cell carcinoma.

With this classification our tumor in question would fall within the classification of small cell carcinoma, without any subdivision. In 2017, the fifth edition of "Tumors in Domestic Animals" appears in this edition the small cell carcinoma disappears, being included in the classification of "Neuroendocrine or carcinoid tumor". In all bibliographies it is mentioned that this tumor is very rare and that in humans it is very common in smokers. The above is very important since the canine that suffered the tumor would be considered as a passive smoker, because the owner smoked in the presence of the dog, exposed to all cigar chemicals and with a high probability of suffering from lung cancer.

In this same bibliography and as of 1974 the carcinoid already appears as a tumor independent of anaplastic small cell carcinoma. The carcinoid disappears in 1990 in the third edition of Tumor in Domestic Animals; but it reappears in the fourth edition and remains in the fifth edition of 2017.

Conclusions

Small cell lung tumors have undergone numerous changes in their classification and are currently classified as neuroendocrine or carcinoid tumors.

The 1974 classification (anaplastic small cell fusiform cell carcinoma) is the one that fully adapts to the description of the tumor found in the canber doberman under study; but the changes over the years make it currently classified as a neuroendocrine tumor.

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Article **ECORFAN Journal Republic of Guatemala**
December 2019 Vol.5 No.9 26-29

Extraction of essential oil from - "*Ricinus communis L.*" - higuerilla as an alternative source of insecticides by the distillation method

Extracción de aceite esencial de -*"Ricinus communis L."*- higuerilla como fuente alterna de insecticidas por el método de destilación

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Abstract

At present, the toxic effect of synthetic insecticides influences great importance in the development of organic alternatives derived from natural oils. Fig oil (castor) is one of the most important products worldwide, due to the many applications that include uses in medicine, cosmetics, inks, soaps, disinfectants, lubricants, varnishes and enamels. The fig tree is historically native to Africa, however it is common in Latin American countries because it is said that I arrive to this continent from the conquest, it is currently in abundance in the state of Coahuila. It has been shown that fig oil contains compounds with insecticidal activity. Therefore, the toxicity of fig oil (Ricinus communis) was evaluated based on the NOM-098-SEMARNAT-2002 standard, Environmental protection-waste incineration, operation specifications and pollutant emission limits.

Extraction, Distillation, Insecticide

Resumen

En la actualidad el efecto tóxico de los insecticidas sintéticos influye gran importancia en el desarrollo de alternativas orgánicas derivados de aceites naturales. El aceite de higuerilla (ricino) es uno de los productos de mayor importancia a nivel mundial, debido a las muchas aplicaciones que incluyen usos en medicina, cosméticos, tintas, jabones, desinfectantes, lubricantes, barnices y esmaltes. La higuerilla históricamente es originaria de África, sin embargo es común en países de América Latina pues se dice que llego a este continente a partir de la conquista, actualmente se encuentra en abundancia en el estado de Coahuila. Se ha demostrado que el aceite de higuerilla contiene compuestos con actividad insecticida. Por lo anterior se evaluó la toxicidad del aceite de higuerilla (Ricinus communis) con base en la norma NOM-098-SEMARNAT-2002, Protección ambiental-incineración de residuos, especificaciones de operación y límites de emisión de contaminantes**.**

Extracción, Destilación, Insecticida

Citation: BALTIERRA-COSTEIRA, Gabriela, DE LA GARZA-DE LUNA, Jesús Roberto, MARTÍNEZ-VELA, Veronica and SAN MIGUEL-IZA, Sandra Maria. Extraction of essential oil from - "*Ricinus communis L.*" - higuerilla as an alternative source of insecticides by the distillation method. ECORFAN Journal-Republic of Guatemala. 2019, 5-9: 26-29

† Researcher contributing first author.

Introduction

Steam distillation is one of the most used methods to extract essential oils from natural materials such as flowers, fruits and resins; The result is a 100% pure essential oil that preserves the complexity of the original smell and is much more intense than the aroma of the raw material itself. (Vasquez Ribeiro, Alva, & Marreros Valles, 2001) One of its main functions is to act as an insecticide, which are substances widely used in the agricultural environment to control and eradicate disease vectors that improve agricultural production and protect stored products.

They are classified in several ways, either by their chemical composition, toxicological action or their method of penetration, in our research we will focus on organic since one of our main purposes is in the contribution of environmental care (Cronquist, 1981) Worldwide, the fig tree is commonly known as “fig tree of hell”, “tartar”, “castor”, “palm of Christ”, “mamoneira”, “mamona”, “castor vean” and “castor oil plant”, among others (Falasca, Ulberich, C., & Ulberich, E, 2012)

Justification

Nowadays synthetic insecticides are very expensive and the damage to the environment is very high. The use of alternative sources of insecticides from natural oils has generated importance. In Coahuila, the higuerilla is found in an extensive proportion which benefits for its experimental use and obtaining bioinsecticides. The main function is the use of pest control. The substances present in the oil are of the utmost importance for this investigation to avoid contamination to the environment.

Problem

In recent years the use of synthetic insecticides damages the environment due to the toxic effect of harmful substances present in their chemical composition. A natural alternative is sought for the use of insecticides in which its chemical composition has non-polluting elements.

General objective

Extraction of fig oil using steam distillation to determine its main chemical compounds.

Specific objectives

– Analyze the substances present in the fig tree and evaluate its environmental approach through literature.
– Evaluate if it acts as an organic insecticide

Methodology

When saturated or superheated steam is used, generated outside the main equipment, either by a boiler, a pressure cooker or a suitable flask, this technique is called "steam distillation with steam", as such. Figure 1. (Pavia, Lampmam, G. M., & Kriz, G. S., 1988)

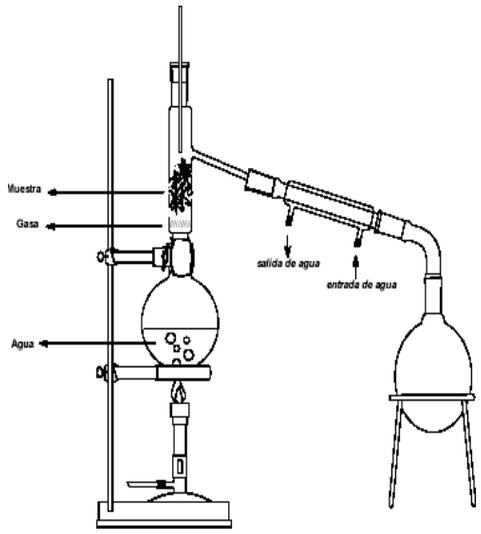

Figure 1 Steam Trailer Distiller

Method and preparation

The fig acquired from the region was used as raw material, with an average density of 0.96 gr / cm3 and an average mass of 200 g. In order to adapt the raw material for the extraction process, the following previous operations were carried out:

Cleaning: Roots and adhering soil are carefully removed and seeds that also contain oil are separated.

Washing: Its purpose is to eliminate the last traces of soil and it is carried out by means of a continuous flow of drinking water at room temperature and then it is allowed to drain and it is given an ear for six (06) hours to eliminate excess moisture.

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Cutting: Because the sample must be dried, it is recommended to cut them into 1 cm thick flakes to facilitate the drying operation. This was done manually with the help of stainless steel knives.

Drying: It is done to facilitate the extraction process and also achieve a longer storage time if it is not going to be extracted immediately. In this case, tests were carried out with a tray dryer at 60 ° C, natural drying under the sun and natural drying under a shed. The total drying time is between one to two weeks and the final humidity of the raw material varies between 12 and 13%. Grinding. An intermediate mesh hammer mill was used to obtain a greater number of particles that will make extraction more efficient by increasing the contact surface.

Figure 2 shows the flow chart of the operational process to extract the essential oil, used in this work. Extraction time varies between 18 to 20 hours.

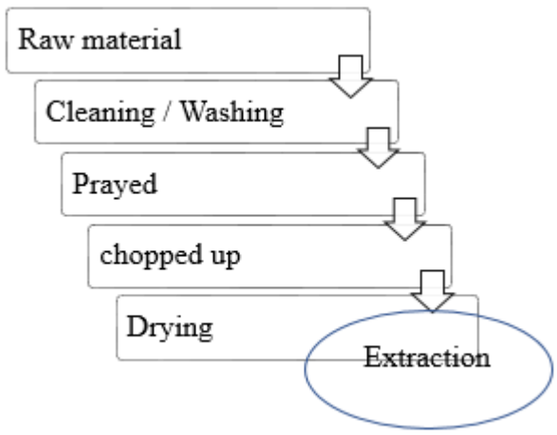

Figure 2 Flowchart for the extraction of ginger essential oil

Characterization of fig oil

The physical-chemical analyzes performed on the fig oil were: Acidity index or Total Acidity: By titration, the sample is dissolved in a mixture of toluene / ethanol, titrating with NaOH and using phenolphthalein as an indicator (Diaz, et al., 2009). viscosity a conventional BROOKFIELD LV, RV brand viscometer was used. The chemical analysis was performed by means of gas chromatography with a flame ionization detector (FID).

Hypothesis

Once analyzed by this method the chemical composition of oil must present organic substances which do not emit pollution to develop in the area of pesticides.

Theoretical framework

The fig tree is an oleaginous plant that is intensively cultivated, mainly to extract the oil from the seed and process it to obtain the methyl esters corresponding to the fatty acids of the oil, this is biodiesel (Simulation in Aspen of the Combustion of diesel mixtures - biodiesel, Juanuary - March, 2015) presents a growth in the form of a shrub, whose oil is used in various branches of the industry such as fertilizers, personal care, plastics, paints and about two hundred more products just to name a few; Although the origin has not been determined, it is speculated that it is native to Africa, India or China (Guerci A. & Scarpa A., 1982) is one of the most common plants in Mexico, it has great diversity in height, color and size both of the grain as the plant with a wide adaptation, since this is distributed in 80% in the territory of the country.

In the National Institute of Forestry, Agricultural and Livestock Research (INIFAP) projects are carried out for the technification and genetic improvement of the higuerilla, with the objective of developing genotypes that offer higher oil yields and greater resistance to extreme climates such as those presented in the region (Guerci A. & Scarpa A., 1982). Currently the effects of climate change are a constant concern for humanity for this reason the governments of countries worldwide make efforts in research and development of technology for the use of alternative energy from biomass in crops. (A. & Domínguez S., X. A., 1990)

In general, this technique is used when the compounds meet the conditions of being volatile, immiscible in water, having low vapor pressure and high boiling point.

Essential oils are characterized by their physical properties such as density, viscosity, refractive index and optical activity. Most have a lower density than water except almond oils. (Ortuño, 2006)

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Results

Peak	Retention time (min)	Compound	% Area	%
1	7.9	1 ethyl, 2 methylbenzene	0.1 0.1	3.4
2	11	Propanoic acid, 2-oxy	0.1	3.4
3	18.4	Glycerol	0.1	3.4
4	39.5	Hexadecanoic acid	0.1	3.4
5	43.2	Linoleic acid	0.1	3.4
6	43.3	Trans-2,8-dimethyl-1,1- bis (methylthio) -2-phenyl-1,2-diidroazeto (2,1-b) quinazoline	0.2	6.8
7	43.9	Stearic acid	0.1	3.4
8	47.5	Ricinolic acid	0.1	89

Table 1 Chemical composition

As we can see in Table 1, ricinolic acid is the major component present in the fig seed, approximately 89%, followed by Trans-2,8-dimethyl-1,1-bis (methylthio) -2-phenyl- 1,2-diidroazeto (2,1-b) quinazoline This compound has insecticidal and acaricidal properties (Oda, Katsurada, Shiga, Fukuchi, & Kato, 2004).

Physicochemical Parameter	Value for oil
Acidity index	0.5 mg/KOH
Density	0.86 gr/cm^3
Viscosity (25 ° C)	9 Pa.s

Table 2 Data of the physicochemical characterization of fig oil

Contribution

By means of the extraction of the oil of higuerilla it is proposed the realization of an organic insecticide avoiding the contamination of the environment thanks to its natural decomposition (Cerpa, 2007), since the oil has with great applications; As for the plant to be used, the aforementioned is chosen since it is given in abundance in the region, facilitating oil extraction tests. At the moment the chemical composition was obtained indicating that the level of toxicity is very low. On the productive level, the use of fertilizers, pesticides and insecticides has allowed increasing the productivity of the area cultivated in the world, to meet the demands of the population that grows exponentially, for this the main premise is to design new products that are useful and commercially viable but whose toxicity is minimal and that does not contribute to contamination for such a product, we will rely on NOM-098-SEMARNAT-2002 Environmental protection-waste incineration, operation specifications and pollutant emission limits whose main function is to reduce or eliminate the impact of pests on agricultural production, on the health of human beings, among others.

Acknowledgments

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Objectives
Methodology
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Introduction

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What is your added value with respect to other techniques?

Clearly focus each of its features

Clearly explain the problem to be solved and the central hypothesis.

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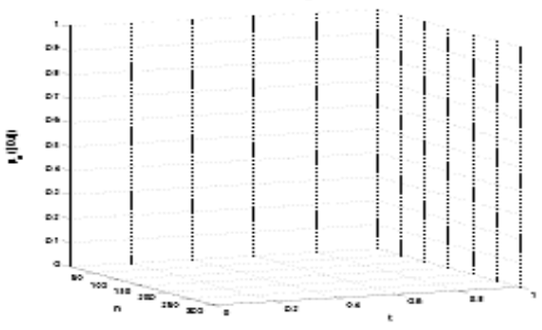

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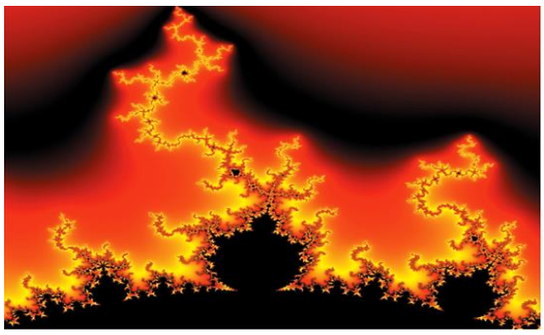

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Tables and adequate sources thanks to indicate if were funded by any institution, University or company.

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Explain clearly the results and possibilities of improvement.

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