Chapter 3 Used edible oils a latent threat in the contamination of water bodies

Capítulo 3 Aceites comestibles usados una amenaza latente en la contaminación de los cuerpos de agua

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Abstract

This article refers to the poor disposal of used vegetable oil management, in cheap kitchens and in homes in regions 226, 249, 238, 235, 233, New Jerusalem New Millennium, a body of water is located, an irregular settlement. It is essential to create awareness for the management and disposal of used vegetable oils, national and international legislation that departs from the importance of the impact caused by the dumping of used edible oils, but it is necessary at the local level for proper management. of used vegetable oil, a total of 100 surveys were applied on the management and disposal of used edible oils, in the regions and irregular settlement of the Municipality of Benito Juárez Quintana ROO with a snowball statistical treatment, non-probabilistic sampling. The application of the surveys shows us that 70% of the population pours residual oils into the drain, 45% have a body of water nearby, to the drain or put it in a plastic bag in the garbage, 6% take it to the center collection, used cooking oils, after receiving adequate treatment, become raw material to produce biodiesel

Disposal, Used edible oils, Spills, Water bodies

Resumen

Este artículo alude la mala disposición del manejo del aceite vegetal usado, en cocinas económicas y en los hogares de las regiones 226, 249, 238, 235,233, Nueva Jerusalén Nuevo Milenio, se sitúa un cuerpo de agua, asentamiento irregular. Es primordial crear conciencia para el manejo y disposición de los aceites vegetales usados, las legislaciones a nivel nacional e internacional que departen de la importancia del impacto que ocasiona el vertido de los aceites comestibles usados, pero hace falta en el ámbito local para el adecuado manejo del aceite vegetal usado, se aplicaron un total de 100 encuestas sobre el manejo y disposición de los aceites comestibles usados, en las regiones y asentamiento irregular del Municipio de Benito Juárez Quintana ROO con un tratamiento estadístico bola de nieve, muestreo no probabilístico. La aplicación de las encuestas nos arroja que el 70% de la población vierte los aceites residuales al drenaje, el 45% tiene cuerpo de agua cerca, al drenaje o lo ponen en bolsa de plástico en la basura, el 6% lo lleva al centro de acopio, los aceites usados de cocina, después de recibir un adecuado tratamiento se convierte en materia prima para la elaboración de biodiesel.

Disposición, Aceites comestibles usados, Contaminación, Cuerpos de agua

3.1 Introduction

Used edible oils are a latent environmental problem in this globalized world, because it is easier to dispose of them in sinks, sinks, than to take them to a collection center for treatment, without thinking about the damage that such discharges may cause to the water table, they are materials of oily type obtained as a residue of fried foods that, when they are discarded, are mostly mixtures of vegetable oils of different composition, sometimes contaminated with tallow fats, lard, during cooking, some with residues of processed foods with high moisture content, and protein, of animal origin, presents an inadequate management of used vegetable cooking oils. The application of the survey consisted of knowing if the housewives, economic kitchens where they dispose of the waste of the edible oils used in the frying process.

3.1.1 Types of fats

Fats or tallows: Solid at room temperature, formed mainly by saturated fatty acids (palmitic acid, stearic acid, etc.). The most harmful fats for man and are the main components in beef and mutton tallow.
Oils: Liquid at room temperature, formed mainly by unsaturated fatty acids (oleic acid, palmitoleic acid, linolenic acid, etc.

3.1.2 Classification of fats

Fats by their origin are divided into:

Vegetable fats: “They come from the fruits and seeds of oilseeds, not being entirely edible, especially olive oil stands out.

Animal fats: This group includes butter, lard, tallow, and oils from marine animals.

3.1.3 Fat quality

The quality of the fat depends on the content of free fatty acids, moisture, color, odor and hardness. Common fatty acids found in plant lipids range from C12 - C18. The melting point determines whether the triglyceride is liquid or solid at room temperature. The melting point depends primarily on the degree of unsaturation and to a lesser extent on the chain length of the fatty acids. Plant triglycerides typically contain 70-80% unsaturated fatty acids and tend to remain in a liquid state (oils) at room temperature. On the other hand, animal fats contain 40-50% saturated fatty acids and tend to stay in a solid state (fat or tallow).

Generic term for a class of lipids produced by biosynthetic processes in animals and plants. They are formed by the union of three fatty acids with glycerin through an esterification reaction. For this reason, they are also called triglycerides or triacyl glycerides

All fats are insoluble in water, and soluble in organic solvents such as ethyl ether, n-hexane, chloroform, etc., with a density significantly less than unity (they float on water).

3.1.4 Environmental problem caused by the dumping of used edible oils

In the global environmental problem, used vegetable oil is one of the residues that is not handled correctly, due to ignorance of the environmental effects towards its surroundings, and the consequences of dumping the oils in the sinks. that goes directly to the drainage or septic tanks without receiving prior treatment, which has harmful consequences for the environment and the bodies of water that are close to their homes. This residue is generated by subjecting edible oils to high cooking temperatures, after which this oil is no longer suitable for further frying.

Used cooking oil is currently one of the main causes of contamination of urban wastewater, since once used and reused, it is discharged into the sewage network, polluting the environment, producing obstructions and bad odors in the pipes and a large number of environmental problems, as shown in Figure 3.1, when residual oils are mixed with other residues that are poured into the sinks, soaps, food scraps, water, they form solids that when mixed form large obstructions, the figure shows the solidified fat extracted from the drainage system of a neighbor's house, it generated obstruction, and its gray water was not discharged to the municipal drainage system.

Figure 3.1 Solidified grease extracted from the drainage, causing obstruction and bad odors, this was due to the direct discharge of used vegetable cooking oil from a dwelling house into the sink

Source: Own elaboration

Used edible oil and other types of fats also cause problems in the drainage pipes in our houses, clogging them and generating bad odors, and creating an ideal food for the proliferation of rodents and cockroaches, as shown in Figure 3.2 completely. clogged by large oil residue and other debris causing blockage, and damage to the drainage system.

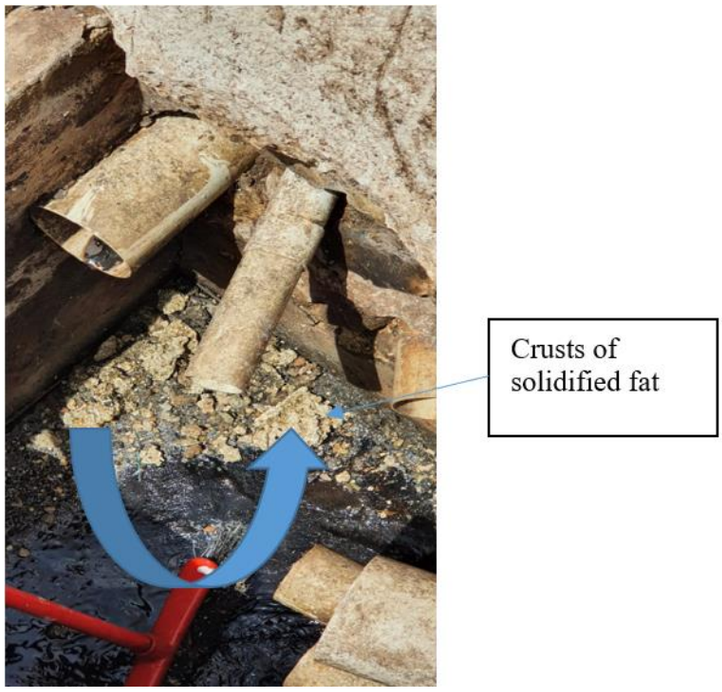
Figure 3.2 This occurs when the oil is poured directly onto the kitchen sink, it is a clear example of what this malpractice causes within the home, economic kitchens, etc.

Source: Own elaboration

And as for the drainage network, and particularly in the rainy season, the reduction in flow due to the accumulation of vegetable oil mixed with soaps and detergents (converted into a solid that adheres to the upper part of the pipes or channels), generates severe waterlogging, see Figure 3.3. The lack of adequate management of used edible oils discharged into the drainage, in the areas of invasions, irregular settlements lacking drainage, go directly to the garbage during the rainy season, leachates, runoffs go to the bodies of water, which are located in those areas, given the hydrology of the state of Quintana ROO, characteristic of the karstity of the limestone that makes it up, representing from tiny cavities to large depressions in where decalcification clays accumulate, in some of which the water table appears (locally called cenotes), it also has floodable areas, the largest of which are located in the northern portion of the state. INEGI. In our own homes, the amounts are smaller, being able to generate an approximate average of two liters per month, which happens with cheap meals, they must produce approximately 5 liters or more per month, if in the cafeteria of the weekly ITCancún a total of approximately 4 liters, this being one of the sources that provide the plant in the production of biodiesel.

What leads us to the lack of specific legislation for the management of oils from edible uses means that the traditional way of disposing of these used oils is to leave them together with other household waste, organic remains, plastics, glass, cardboard, paper, etc. to be removed by the garbage collection service, the destination of this waste being the municipal dumps.

Figure 3.3 Solidified used edible oils generating clogging of wastewater pipes, generated in homes causing economic losses, due to poor disposal of used edible oil residues



Source: Own elaboration

3.1.5 Problems in water treatment systems due to used cooking oils

In bodies of water, these spills form hard or oily films on the surface that prevent the passage of sunlight, which limits photosynthesis and thus the lack of oxygen causing eutrophication, excess organic matter, bad odors, causing alterations in ecosystems, even the disappearance of these. (NADF-012-AMBT-2015). When improperly, used cooking oils are poured down the sink or into the garbage, or due to spills on the ground, it is absorbed and reaches the groundwater, due to runoff generated by leachates, they are a source of contamination of bodies of water. that are inserted in areas of high population, where some are irregular settlements, that do not have drinking water, electricity and therefore drainage, causing problems in the sanitation networks in the Wastewater Treatment plants in the pretreatment they receive the water the fats, sometimes it is necessary to clean with a degreaser since the fat can clog the holes that are very small, preventing this phase from being adequate and costly to remove the adhesions due to the direct pouring of used cooking oils directly to the sewage system.

The removal of fats and oils can be carried out in primary settlers; dissolved air flotation systems are also used for this purpose, (National Water Commission) they are a source of latent contamination which has not been given enough attention, that this discharge causes that for each liter of used oil can to contaminate 40,000 liters of water, in addition, once cold it hardens and can clog pipes or tubes, as shown in figure No. 2, it is essential that the inhabitants of the Benito Juárez municipality (Cancún), separate the fats and Used edible oils, whether of animal or vegetable origin, fats, rancid or expired oils, and those from grease traps in large restaurant chains, hotel kitchens, also harm the soil, making it less fertile and eroding it, which is why it is It is extremely important to deposit them directly in properly closed containers with lids, in the collection centers destined to be subjected to treatment and disposal (data.se dema.cdmx.gob.mx), González-Canal, Iñigo et all (2015) mention that a liter of used oil has the following average composition of used edible oil:

- 85% oil.
- 10% is water with traces of oil and organic matter.
- 5% are sludge whose composition is 60% oil, 30% organic matter and 10% Water.
- Relative density: 0.91.

Uses of used edible oils.

Used edible oils are used in the production of soap, liquid soap as a recycling method and why not generate a circular economy for them.

Development of biodiesel as a clean alternative energy at the international level, this is since it reduces the environmental impact as an alternative to contribute to reducing the carbon footprint in the reduction of fossil fuel consumption day by day new research is carried out to improve production and improve the methods of obtaining.

Glycerin is a by-product of the production of biodiesel, which can also be used in the soap industry, giving it a purification treatment to eliminate traces of soda and alcohol. Waxes, candles, organic fertilizer among others.

Regulations governing the disposal of used edible oils

The Secretariat of the Environment (SEDEMA) of the Government of Mexico City published on June 12, 2018, in the Official Gazette of the capital, the Environmental Standard for the Federal District NADF-012-AMBT-015, which establishes the conditions and technical specifications for the comprehensive management of waste fats and oils of animal and/or vegetable origin in the territory of Mexico City.

Official Mexican STANDARD NOM-068-ECOL-1994, which establishes the maximum permissible limits of contaminants in wastewater discharges to receiving bodies from the edible oil and fat industry of animal and vegetable origin.

The problem of used oil waste, as well as that of urban solid waste in general, should address the recommendations of the Waste chapter of the so-called Agenda 21, Rio 92 Earth Summit, regarding the "Ecologically Sound Management of Solid Waste and Sewage Related Issues (Earth Summit 2002)

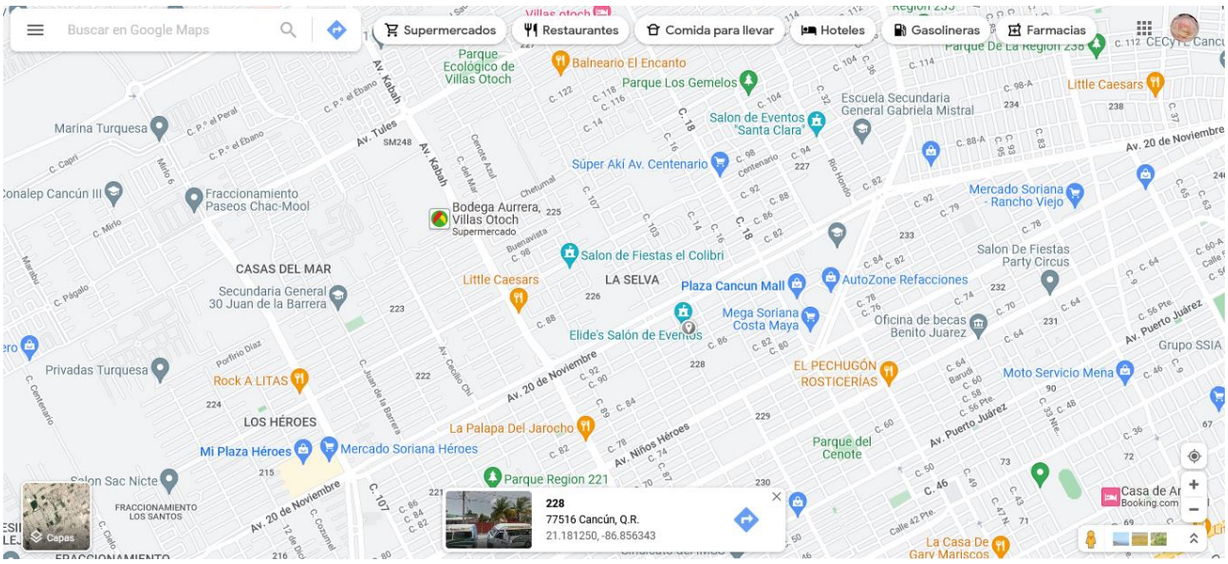
3.2 Methodology

The application of the surveys was carried out using the snowball statistical treatment, non-probabilistic sampling. And convenience sampling, non-probabilistic sampling, for low-incidence populations and on this occasion for individuals that are difficult to access because they are areas of irregular settlements New Millennium, New Jerusalem, and the selected individuals allow the sample size to grow as that the selected individuals invite their acquaintances to participate, regions 226, 249, 238, 235,233, see the location map, this was the treatment carried out on the samples from these regions, given the epidemiological conditions that emerged in the years 2020-2021, they are practically newly created regions, with a lack of environmental policies, the lack of regulation directly affects nature, causing environmental damage in its surroundings. A total of 100 surveys were applied, supported by the students who lived in those areas, using the statistical treatment.

Which consisted of a total of 10 questions, in situ, to the people in charge of the household, economic kitchen business, which allowed to collect information in a clear way in both sampled points in order to know the disposal and elimination of waste of edible oils. with a type of qualitative and quantitative approach forging an analysis of the field work carried out. With the participation and collaboration of students who live on the outskirts of the regions, superblock settlements, in an organized fifteen-day process given the health contingency conditions due to COVID-19.

The objective of this work was to know the management of edible oil residues in households and economic food. The information derived from this survey made us aware of the management of this waste that generates high pollution due to spills in kitchen drains and thrown in the garbage. Generating environmental problems due to the poor disposal of the edible oils used in the frying process.

Figure 3.4 Map of the regions that served as a sample for the application of the surveys



Source: Own elaboration

3.2.1 Survey design

The collection and analysis of data was carried out a survey with 10 questions, addressed to housewives, people in charge of economic kitchens, and the disposal, storage of used edible oils, if there is a body of water close to their home which, due to runoff, may be contaminated by the poor disposal of oils and/or discharges, as well as knowing the area or region where there is a poor disposal of used edible oils and therefore the location of said cenotes if they were close to their homes.

3.2.2 Analysis of the applied instrument

Once the interviews were carried out, the respective diagnosis of the problem was carried out, the processing and interpretation of the information obtained was carried out, to determine if the stated objective, as well as the proposed hypothesis, is accepted or rejected, and in this way give an answer. to the question about the final disposal of used edible oils.

3.3 Results

With respect to the data collected from the regions, superblock, and irregular settlements, the results obtained from the application of the survey are presented, which consists of 6 questions, which are quick response, we are interested in the response of housewives who generate waste. of the edible oils used in the cooking or frying process and of some economic kitchens located near the home of the students who supported us with the application of said survey, see table No. 1, due to the health contingency we only refer to some regions, and 2 irregular settlements, we leave the superblocks for another job, and for protocol and protection of the students. See table 3.1.

Table 3.1 Surveys applied by IT Cancún students, according to the area where their home is located, the questions of interest for the stated objectives are shown

Questions	Answer
What do you do for a living?	a) Housewife b) sale of food (cheap kitchens)
The cooking oil once it has been used in the frying process where it is disposed of or disposed of	a) I take it to a collection center b) I throw it in the drain c) throw it in the trash
What type of container do you use to keep (store) the oil once it has been reused	a) Glass jars b) Plastic bottles c) I reuse detergent bottles e) I reuse large mayonnaise jars d) I don't store it
How long do you store cooking oil before discarding	a) One week b) One month until the container is full c) 15 days d) I don't store it
How many liters of oil do you use per week approximately	a) 1 to 2 liters per week b) 4 to 5 liters per week
Near your house there is a cenote, wetland	a) Yes b) No

Source: Own elaboration

The disposal of used edible oils, and if there are bodies of water close to their homes, obtaining 45% of the total population that, if there is any body of water, and by runoff and the type of hydrogeology of the Yucatan Peninsula there are leachates that are filtering directly towards said bodies as can be seen in figure no.5, due to the disposition they make of them, it is shown in Table 3.2 and the corresponding graph of question no. two.

Cooking oil once it has been used in the frying process where it is disposed of or disposed of, obtaining that 70% of the total population surveyed disposes of it in the kitchen sink. Table 3.2 shows us the results obtained by the selected regions and the two irregular settlements, which have 0% of taking the used edible oil to the collection centers due to the distance where they are located every 2 months, which is in the recycling case.

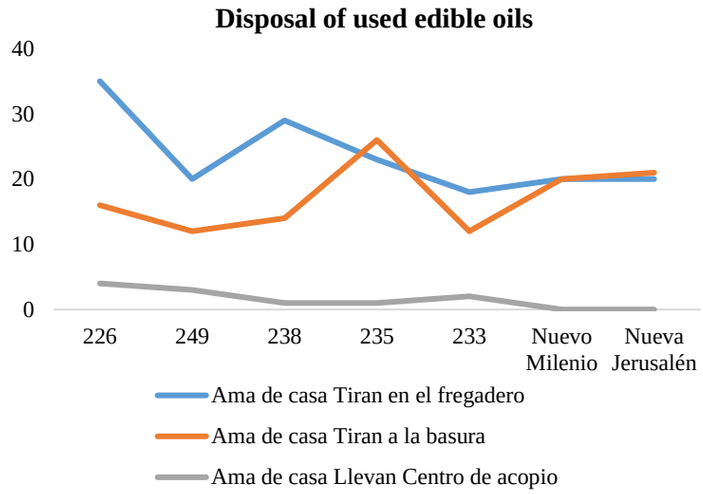
Table 3.2 Disposal of used edible oils generated by region and irregular settlement

Irregular settlement region	Ítems	226	249	238	235	233	Nuevo Milenio	Nueva Jerusalén
Housewives	They throw in the sink	32	20	29	23	18	30	34
	They throw it away	16	12	14	26	12	20	21
	Collection center	4	2	1	1	2	0	0
Economic kitchens	They throw in the sink	8	8	4	3	6	6	8
	They throw it away	12	15	10	3	4	6	5
	Collection center	4	3	8	4	5	0	0

Source: Own elaboration

According to the response obtained from the people surveyed, they answered that approximately 70% or more of them throw the oil in the sink once it has been used in the process of frying food, in the region 235 housewives throw the oil to the trash in bags, or they pour it directly on their organic trash, or they leave it outside their house until the trash pick-up. In the irregular settlements they do not have the basic services to cover the minimum needs, so it is the same for them to throw the oil in the sink as it is to throw it in the garbage, see Graphic 3.1.

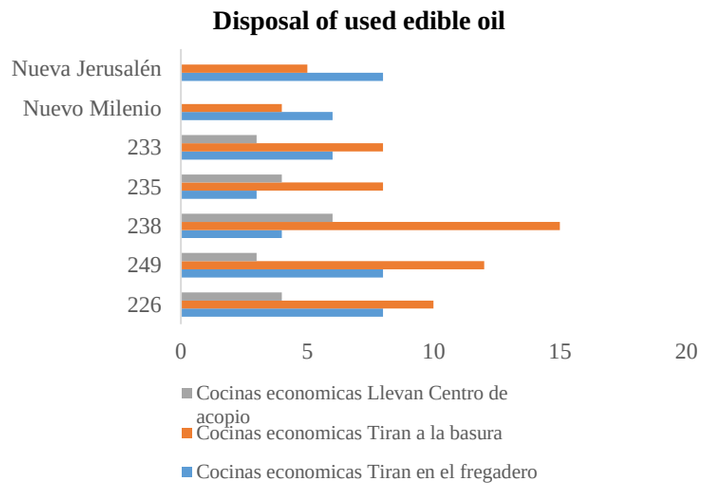
Graphic 3.1 Disposal of used edible oils by housewives and economic kitchens



Source: Own elaboration

In Graphic 3.2 it indicates the disposal of used edible oils generated by economic kitchens, the number of economic kitchens surveyed was between 3 to 4 since due to the 2020-2021 health contingency the economy was affected by closing small businesses established, giving rise to the sale of food in residential homes, generating twice the amount of used edible oil that is poured into sinks and thrown away, and a null disposal in the collection centers.

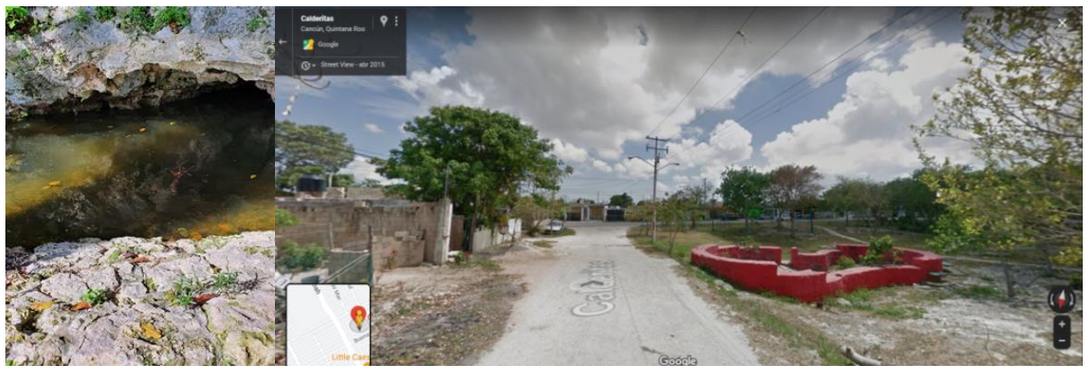
Graphic 3.2 Disposal of the edible oils used by the economic kitchens in the regions, irregular settlements, it is observed that said residues are thrown in the garbage, in bottles, in plastic bags, or dumped directly into the garbage



Source: Own elaboration

The answers to the question near where you live is there a body of water, was that 60% were affirmative. in region 235 there is a cenote that is located in the urban area as shown in Figure 3.5, which are areas that have adequate drainage for which the dumping of used edible oils in the sinks, or they throw it into garbage, reach the bodies of water by leachates, filtrations by the cavernous type of Geology.

Figure 3.5 Cenote located in region 235 which is within the populated area and lacks environmental policy, there is no drainage system so the disposal of used edible oils should not be adequate



Source: Own elaboration with Google maps

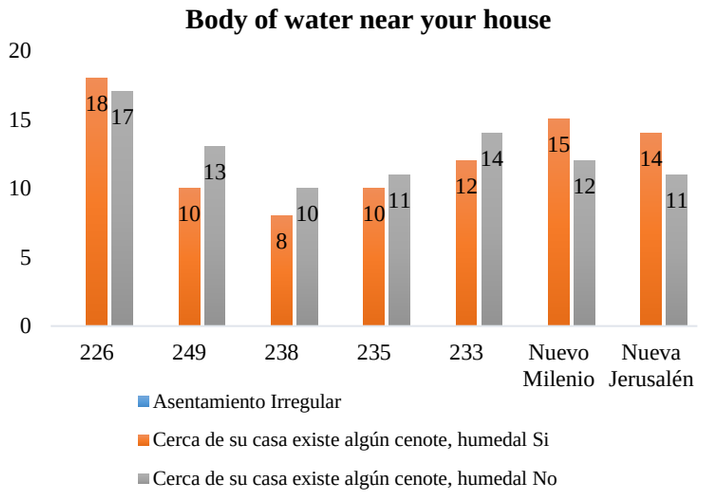
The question about whether they find a body of water near their homes. in region 233 there is a cenote that is located in the urban area as shown in Figure 3.6, which are areas that have adequate drainage through which the dumping of used edible oils in the sinks, or what throw them away, electrical appliances in irregular settlements do not have basic services such as the lack of drainage, they reach bodies of water by leachate, leaks into the cenotes that are cavernous type that can be closed or open.

Figure 3.6 Cenote located at 233 which is within the populated area and lacks environmental policy, there is no drainage system so the region for disposal of used edible oils should not be adequate

Source: Own elaboration

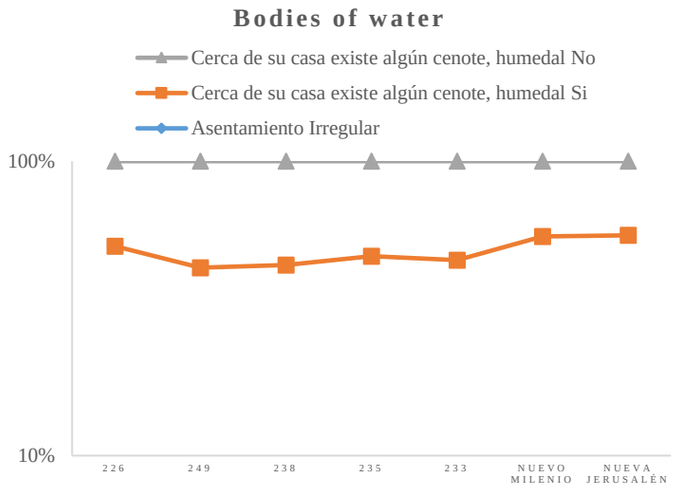
Graphics 3.3 and 3.4 there are bodies of water in the different regions and irregular settlements that, on many occasions, are used as garbage dumps. Causing damage to the ecosystem of water bodies.

Graphic 3.3 Bodies of water (Cenotes, Wetlands) located in the regions, irregular settlements



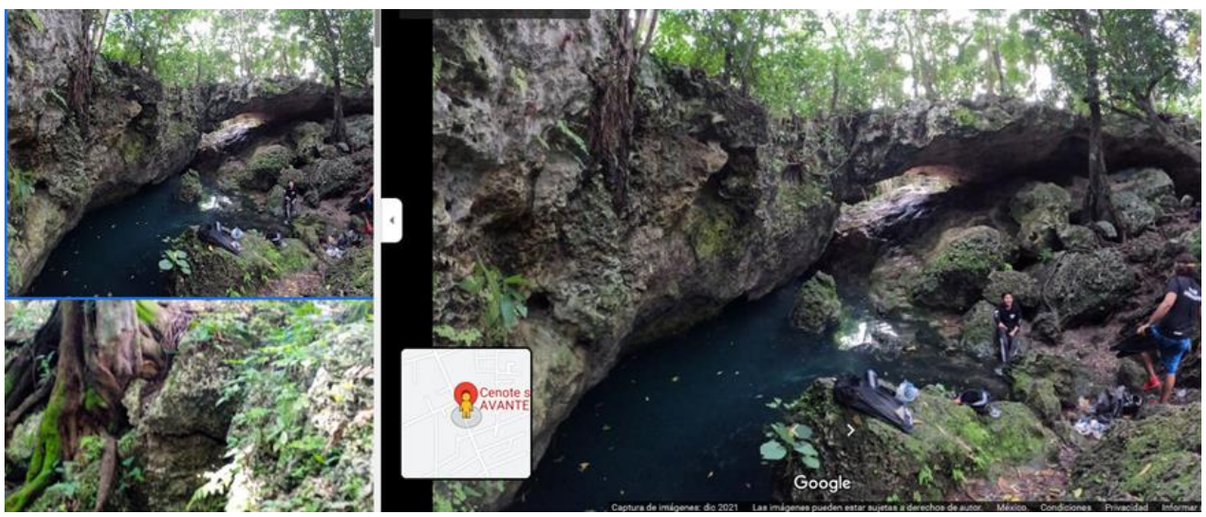
Source: Own elaboration

Graphic 3.4 Bodies of water near your home



Source: Own elaboration

Figure 3.7 Body of water located within the urban area, region 226



Source: Own elaboration

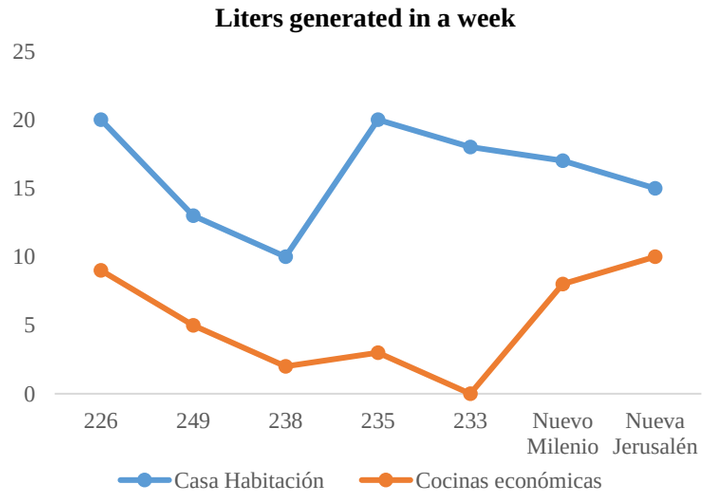
The number of liters of edible oil during the COVID-19 pandemic increased due to quarantine confinement, the family was at home 24 hours a day. the consumption of food was increasing, as well as fried foods, being one of the responses given by those surveyed, both housewives and those in charge of economic kitchens.

All the people surveyed indicated that they knew the effects of dumping the oil in the drain. The people of the irregular settlements 19 respondents indicated knowing such consequences and 21 said they did not know. Finally, in the regions 223 233 235,226 if they knew and 30 revealed that they did not know them.

The main effects, according to those surveyed, are damage to the pipeline, undervaluing the effects in the waters or the environment in general (Figure 3.1, 3.2 and 3.3). This indicates the need to generate information for housewives as well as those in charge of cheap kitchens, which proliferated as a means of livelihood during the Pandemic, not only about how to manage waste, but also about the reasons why a good disposition of this must be made.

41.81% of those surveyed indicated that space should be allocated for the disposal of used edible oil. 36.88% answered that only a radio campaign be carried out on the disposal of used vegetable oil and not pour it into the drain, kitchen sinks, thus avoiding contaminating the bodies of water that are within the urban sprawl of their regions and irregular settlements, and 16.48% that they be given a workshop on how to take advantage of that oil that they no longer use 65% of those surveyed indicated that they do not store it to later leave it in the collection centers, the disposal of used edible oil is made by pouring it directly into garbage bags or placing it in containers to throw it in the garbage and/or throw it in kitchen clothes. 36.88% answered that they only do not know if throwing away the used edible oil contaminates the cenote that is close to their home.

Graphic 3.5 Liters of oils used in a week by economic kitchens and home



Source: Own elaboration

3.4 Gratitude

To the TECNM/Instituto Tecnológico de Cancún, for the support received to carry out the project, Characterization of edible oils used in the production of biodiesel.

3.5 Conclusions

The degree of affectation caused by the poor disposal of used vegetable oils is very high, this is increased during the COVID 19 health contingency, since the families were locked up, the existence of bodies of water near their home is almost 50%. of those surveyed that if there is a body of water, the other 40% there are no bodies of water near their home, 10% do not know if there is any body of water, cenotes or wetlands, sometimes they are used as garbage dumps, and therefore residues of the oils used in the frying of food that are poured directly into the sinks, few are the people who take the residues of oils to a collection center, another 40% throw it away in plastic bags, or they just throw it straight into the dumpster. The lack of knowledge of the proper management of frying oils, the absence of legislation and the lack of supervision by those charged with environmental sanitation, we are experiencing a problem of lack of water, we must take care of it, and protect the bodies of water since in the medium term they will be sources of water supply. We do not throw garbage, nor use them as a system to eliminate sewage where there are no sanitary drainage services.

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