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FOSSIL FUELS AND IMPACTS ON MARINE LIFE[1]

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Abstract: This article, concluded in the subject Completion of Course Work (TCC II), of the graduation course in Biological Sciences of the Distance Education Center of ''Universidade Estadual de Santa Catarina", has as main objective to evaluate the consequences of the disposal of fuels fossils to marine life. The methodology used is exploratory and bibliographical research with a qualitative approach. The results indicate that marine animals are hostages of all pollution. Effects observed in the short, medium and long term, such as death, intoxication, impossibility of reproduction, lack of food, choking, among other serious problems, are consequences of anthropic actions. We conclude that some sustainable alternatives can be used as possible solutions to the replacement of raw materials based on fossil fuels and, therefore, avoid the consumption of products produced with them, that is, alternatives to reduce the pollution caused by the excessive consumption of fossil fuels. packaging, plastic bags, greenhouse gases, etc. Energy produced with non-renewable inputs has viable possibilities with other renewable sources such as wind energy, solar energy, hydroelectric energy and geothermal energy. Economic development needs to be in tune with the conservation and preservation of natural resources combined with joint actions in relation to sustainability.
Keywords: Fossil fuels. Environmental impact. Marine ecosystems.

INTRODUCTION

This article was completed in the discipline Work of Conclusion of Course II, based on the research project elaborated in the discipline of Work of Conclusion of Course I, in 2020/2, in the Degree in Biological Sciences of the Distance Education Center of ''Universidade Estadual de Santa Catarina".

In the middle of the century. In the 18th century, with the explosion of the industrial revolution, there was greater development in industrial production, with the help of machines for production and the consequent growth in the use of fossil fuels in the generation of energy and strength for the operation of machines. Population growth is also considered a potential risk as a result of the disposal and consumption of products derived from fossil fuels, such as plastic packaging, straws, oil, among others. The marine environment has rich biodiversity and provides man with food, oxygen and helps maintain the planet's climate balance, absorbing a considerable amount of carbon dioxide. The subject has been approached in the scientific community with great concern in relation to the pollution of the oceans. Based on the arguments above, we raise the following question: What consequences does the disposal of products derived from fossil fuels cause to marine life?

The approach on the subject is justified due to the environmental impacts being more and more frequent, generating destruction in all environments leaving deep changes, some irreversible. The marine biome is threatened by several polluting factors arising from human action, based on consumerist values, from the perspective of a capitalist society. The marine environment has a rich biodiversity and provides man with food, oxygen and helps maintain the balance of the planet.

The main objective was to evaluate the consequences of the disposal of fossil fuels to marine life. And as specific objectives were: to identify the weaknesses caused by the disposal of fossil materials in the environment; highlight the main inhabitants of the sea that are more sensitive to pollution from materials produced with fossil fuels; list the consequences caused by the use of fossil fuels on the quality of life of marine animals and propose alternatives to

combine the practicality of everyday life with the conscious use of products made with fossil fuels and their disposal in the environment.

This article is divided into five chapters, with the introduction as the first, followed by the theoretical foundation, which presents theories by authors such as Gouveia (2012); Piva (2010); Oliveira (2020); Turra et al. (2020); Araújo (2016); Silveira (2018); Castro(2018); Michael (2020); Macedo et al. (2011); Santos (2014) and Mesquita, (2019), among other materials that address the subject and that contributed to the elaboration of the theoretical contribution of the work.

In the sequence, the methodology appears detailing the characterization of the investigation and procedures for carrying out the research; then comes the analysis and interpretation of the data, contemplating the collected data and respective arguments.

The final considerations constitute the last chapter, highlighting the conclusions about the research on the subject in question.

THEORETICAL BACKGROUND

Fossil fuels are characterized by being raw materials used in the production of so-called non-renewable energies. Its origin comes from the decomposition of plants and animals, which, as a result of time added to the conditions of pressure, temperature and action of microorganisms, were buried in layers of the Earth's crust, formed over thousands of years, giving rise to rich compounds in carbon, such as oil, mineral coal and natural gas (FOGAÇA, 2020). Fossil fuels are prominent in nature, representing 75% of the world's energy demand used in vehicles, industries and homes (FOGAÇA, 2020).

In the world capitalist economy, the use of fossil fuels, such as oil and mineral coal, became widely used resources, contributing to the progress of many cities, streamlining the transport of goods, generating energy, and oil derivatives serving as a raw material for the production of plastic, cosmetics and pharmaceuticals.

According to Fogaça (2020), oil is considered an important and indispensable resource for the world economy. Petrol is used to produce gasoline, diesel oil and liquefied gas (LPG) used to fuel vehicles, in addition to other materials, such as jet fuel, plastic, solvents and other derivatives. The petroleum refining process consists of raising the temperature to around 400ºC, during boiling, when gas, gasoline, naphtha and kerosene are obtained; another process, whose temperature is below 400ºC, prevents the molecules from being broken, generating new fractions of this residue, and other products are formed in this part of the process, such as grease, paraffin, lubricating oils and bitumen.

Another type of fossil fuel used for energy generation is mineral coal, originating from the decomposition of plants more than 300 million years ago. Mineral coal was highlighted when used during the industrial revolution to heat water converted into steam, to drive turbines and thus generate electricity. Despite having a high calorific value, it causes the most environmental damage; it has a huge amount of advantages in terms of productivity, but it is still the most polluting of fossil fuels (SOUZA, 2020).

Natural gas is also another fuel of fossil origin, being the most promising, as it has more advantages and less pollution. Thus, natural gas points to the immense benefit provided throughout history and the technological advancement that the burning of fossil fuels has allowed, however, its use is linked to several environmental problems, due to extensive exploitation (FOGAÇA, 2020).

In general, all fuels made from fossil raw materials are characterized by the emission

of harmful gases, in addition to other environmental problems involved, such as the diffusion of polluting gases into the atmosphere, increasing the greenhouse effect; inaccuracy in the storage and extraction of natural gas and oil, leading to serious consequences for the environment and health; also pollution in different areas, oil spills in exploration zones, among others.

Because they are not renewable raw materials, their exploitation is doomed to exhaustion, in addition to the extraction process being closely linked to the violent processes of interference in the environment (FOGAÇA, 2020). In all stages of the oil extraction process, which consist of prospecting, drilling and extraction, leaks can occur, causing environmental impacts due to the characteristics of flammability, reactivity, toxicity and density.

The mining practices of petroleum hydrocarbons, such as gas and oil, both in the exploration and production stages, are strong providers of environmental impact. The seismic search interventions, well drilling, production and transfer of these compounds reflect risks to the marine ecosystem. Oil reserves, when exploited, can intervene in the orientation of routes of marine mammals leading to mortality of fish species (GOMES, et al., 2000).

Pena et al (2019) analyzed the impacts of oil pollution on the Brazilian coast by grouping bibliographic data. According to the indicated data, the values of oil concentration in sediments and bioaccumulation in fish and molluscs indicate a contamination between moderate and low, with the exception of samples collected in acute pollution events. Equally, the rocky shores, very common in the southeast region, show that they were little affected by the constant spills.

A recent example was the disaster caused by an oil spill on the Brazilian coast in August 2019, where many dead fish were found, in addition to turtles and birds covered in oil (ARAÚJO *et* al., 2019).

Mangroves seem to suffer greatly from oil pollution when hit by oil spills. They present substantial loss of leaves, increasing the number of aerial roots and weakness in the formation of leaves and fruits, and also the decrease in the production of the dissection of remains such as leaves and branches (PENA, et al., 2019). There is a natural flow between coastal ecosystems that links their nutrients, sediments, pollutants and organisms. This collectivity regulates the daily or seasonal activities of these individual ecosystems and ensures that species sustain their life cycles.

Several species of fish reproduce in the sea, and their larvae inhabit the mangroves, while the fry grow in the reefs and return to the sea as adults. Therefore, when one of these ecosystems is impacted by petroleum derivatives, such as diesel oil, interactivity is threatened, species populations are isolated and hardly survive in extreme conditions, and may be decimated in the medium and long term (ARAÚJO et al., 2019). Almost all marine life depends on this aggregate, and chemical contamination of the air, water and substrate of an ecosystem can lead to the accumulation of toxic compounds, causing disease and death in all living beings, including humans.

Another aggravating factor for marine life pervades a small part of environmental oil accidents linked to accidents with oil tankers, that is, with routine oil transport operations, causing impacts on marine communities. The greater the amount of oil, the greater the number of carbon atoms present in the carbon chain, making evaporation and biodegradation processes more difficult, making the oil stay in the sea longer. Therefore, there will be great short and long-term damage to marine fauna and flora (SOUZA, 2021).

In addition to exploration, the combustion of derivatives as a source of energy also entails environmental problems due to the emission of gases. During the burning of fossil fuel, carbon dioxide (CO_2) is released, which is harmful to the oceans and marine habitats (FOGAÇA, 2020). The emission of carbon dioxide gases gained importance in the mid-eighteenth century with the Industrial Revolution and the installation of industries across Europe, which increased the emission of pollutants and, consequently, increased the emission of CO_2; Carbon dioxide, when in contact with water, forms carbonic acid (H_2 CO_2) and hydrogen (H+). The greater the emission of + ions in a solution, the more acidity forms in ocean water (MATHESIUS apud AGENCIA BRASIL, 2015).

The industrial revolution provided opportunities for industries and society to develop enormously, bringing numerous benefits to European countries in terms of economics, and the great variability and acceleration of production in different ways, replacing the work of manual labor, such as the steam machines used in factories. textile industries. However, there was too much exploitation of natural resources, which accelerated the pace of product consumption, energy expenditure and, consequently, pollution in the environment, degrading natural goods. Progress has brought many benefits to society, but on the other hand, it has brought great harm to the environment. Man brought technological advances to companies, but failed to provide effective solutions to environmental preservation issues, increasing the emission of polluting gases.

In Kiel, Germany, Professor Ulf Riebesell, from the Helmholtz Center for Ocean Research (Geomar), led a study on the pH of the sea, which identified a 26% increase in the acidity of ocean water. The average pH identified on the water surface dropped from 8.2 to 8.1 (HARRABIN, 2017). In addition to the problems caused by the change in the pH of the water, about 25% of greenhouse gas emissions are absorbed in the oceans, causing the warming of the seas and acidification at a rapid pace in the oceans. "These changes interfere with the metabolism of various groups of organisms, such as corals, sponges, molluscs with shells, crustaceans, among others" (MATHESIUS apud AGENCIA BRASIL, 2015).

> At normal rates of absorption of CO_2 by the ocean, chemical reactions benefit the use of carbon in the creation of calcium carbonate (CaCO3), used by several marine animals in calcification. The acidification of marine waters makes it possible for more and more ocean carbon to bind with H+ ions, making it less accessible for the formation of calcium carbonate, essential for the development of species that form shells. Some assumptions are emerging to remedy all this problem, such as using iron to fertilize the bottom of the ocean, thus stimulating the growth of plankton. (AIRES, 2019, not paginated).

Thus, it would provide the development of plankton, which are capable of retaining CO2 in the depths of the oceans. Another way would be to add alkaline substances to the water to balance the pH, such as ground limestone. According to Professor Jean-Pierre, such a process could benefit only in bays with limited water exchange in the open sea, it would serve the local environment, but not on a large scale to reach the global region, in addition to having a high cost of implementation. Carbon emissions need many discussions in the search for appropriate solutions, in the sense of not only affecting marine life, but also villages, cities and countries dependent on fishing and maritime tourism (AIRES, 2019).

Due to the high levels of H+ ions, Mathesius (2015) reports that the transport of nutrients by phytoplankton that are in the

depths of the oceans are unable to reproduce, which, in the long term, "will threaten the marine life forms of many species, endangering biodiversity and the intricate food chains" (MATHESIUS apud AGENCIA BRASIL, 2015, not paginated). Faced with this problem, Aires (2019) reports that the legislation on CO2 emission levels needs to be revised so that they are more rigorous in application and inspection.

The recognition of the antagonistic effects of activities related to the production, transport and processing of diesel oil in Brazil has been based largely on toxicity tests carried out with macroalgae, copepod crustaceans, mysid crustaceans, shrimps and molluscs (GOMES, et al, 2000).

Bivalve marine animals are excellent filtering agents, considered excellent bioindicators of coastal marine pollutants. Toxins accumulate in the tissues of these molluscs, causing diseases that inhibit their locomotion and, thus, initiate necrosis and neoplasms (ARAÚJO et al., 2019). In oysters, the presence of oil adhered to the sediment at the bottom of the sea can seriously impact the fertilization process of gametes and larvae in the early stages, preventing the perpetuation of the species (ARAÚJO et al., 2019). And in molluscs and other benthic animals, such as corals, they are rapid bioaccumulators of pollutants. Their direct contact with the oil causes asphyxiation, resulting in death, exterminating their own populations and the animals that need these marine animals to live, in a process that lasts for many years (ARAÚJO et al., 2019).

In addition to fuels, plastic, raw material resulting from the refining of crude oil, and natural gas, at the present time, cause great concern due to improper disposal in the environment, which changes the composition of ocean water and becomes harmful. to the region's ecosystem. Very small plastic particles, the so-called microplastics, are one of the main pollutants in the oceans (AIRES, 2019). Microplastics are plastic materials exposed to the sun, resulting in particles that are dispersed in the sea, mixing with the food of marine animals. The absorption and storage of these plastics in the food chain can reach toxic concentration levels, harming marine species (FAGUNDES; MISSIO, 2020).

Many legal instruments, documents, declarations and commitments, assumed in major world events by governments, related to the exploration and extraction of fossil fuels, must be put into practice urgently and rigorously, to slow down the advance of the damage caused to the environment. Such as, for example, Law nº 9.966, of April 28, 2000, which provides for the supervision of oil exploration under control and prevention of pollution by spillage, among other harmful or dangerous materials, in maritime waters under national jurisdiction (SILVA, 2013). Another example is the commitment made by countries to comply with the 2030 Agenda, published in 2015. 2030, not paged), based on the 17 goals and 169 targets that must be met by 2030.

Progress must be allied to the three main pillars of sustainable development, that is, social, economic and environmental. These must be harmoniously articulated to restore people's quality of life, in the present and in the future, guaranteeing the survival of the planet.

Goal 14 entails conserving and sustainably using the oceans, seas and marine resources for sustainable development. And one of the goals to be achieved is 14.3, which concerns minimizing and addressing the impacts of ocean acidification, including through strengthening scientific cooperation at all levels (UNITED NATIONS ORGANIZATION, 2015).

So that the purposes of the social, environmental, institutional and economic areas are actually achieved, the government must act according to the objectives, through inspection and public protection and recovery policies; Furthermore, it is important to emphasize the responsibility of popular participation and conscious consumption.

Population growth has been increasing significantly and, consequently, the increase in the consumption of fossil fuels indirectly, whether in transport, energy generation and even in the widely used plastic packaging. Therefore, readjustment is required with regard to the consumption of these products so that they have conscious consumption and proper disposal of waste. Man has appropriated this ecosystem so much that he does not see his own limits. Such an attitude of improper disposal in the environment has a great impact on the maintenance and protection of the soil, air, rivers, seas and the inhabitants of the entire biosystem.

People need to change their attitudes and be held accountable with effective actions, such as using public transport, using bicycles, walking instead of using the vehicle to go to the bakery on the corner, using vehicles powered by renewable energy sources, using returnable bags at the supermarket, consume organic food from low-carbon agriculture; and industries must have priority in the production of goods with sustainable raw materials; wind energy production would be another issue of paramount importance.

METHODOLOGY

The methodology of this research work project is characterized as exploratory and bibliographical, with a qualitative approach. Exploratory research allows the researcher greater familiarity with the topic, exploring existing publications. According to Gil (2002, p. 41) "It can be said that these researches have as their main objective the improvement of ideas or the discovery of intuitions."

Marconi and Lakatos (2017) explain that bibliographical research is carried out based on sources available in printed documents, scientific articles, books, theses, dissertations, but we must not forget that all research involves collecting data from various sources, whatever they may be. the methods or techniques employed. Any scientific research has as a first step the bibliographical research, the selection and reading of the materials.

According to Cunha and Dias Brasil (2012), the qualitative approach considers that the interpretation is linked to the researcher's understanding, which can lead to the same different interpretations, with a subjective character.

The collected data came from websites, scientific articles, published from 2010 to 2021, from authors who discuss the subject addressed in this article. Authors such as Luiz Aires, Elizabeth Araújo et al, Maria Christina Barbosa de Araújo et al, Alejandra Borunda, Carla Sofia Dias Brasil, Carol Castro, Lena Fagundes and Eloir Missio, Jennifer Rocha Vargas Fogaça, Antônio Carlos Gil, Nelson Gouveia, Grupo Primus, Roger Harrabin, Ana Paula Miguel Landim, Stela Legnaioli, Rodamilans Gustavo Macedo et al, Agencia Brasil apud Mathesius, among others.

DATA ANALYSIS AND INTERPRETATION

The data presented below (Table 1 and 2) were taken from various materials, such as scientific articles, published in specialized scientific journals, and relevant and reliable publications from websites that denounce the problem, dated in the period from 2010 to 2021.

Derivative products of fossil fuels	Improper disposal of products on environment	Consequences
Plastic (plastic tablets raw material for the production of plastic)	Transported irregularly	Contamination of the terrestrial and marine environment.
Micro Plastic	In dumps	It affects the food chain of invertebrates such as sponges, corals, anemones, starfish, polychaetes, lobsters, crabs.
Petroleum	Spillage by transport vessels.	Contamination of the oceans.
Styrofoam	Dispose of in the environment	Non-biodegradable product tends to break forming microplastic
Plastic bags	Played in the middle environment	Pollute seas and rivers
Solid waste (urban waste) plastic packaging and slurry	Dispose of in landfills.	Compromise soil, water and air quality
Plastic straws	Dispose of in the environment	Pollution in the seas and lead to the death of marine animals
Oil	Cleaning of ship tanks	Severe damage to the oceans.
Natural gas	Burning in production activities at power plants and companies	Dispersion of polluting gases in the atmosphere, causes greenhouse effect
Mineral coal	Burning of mineral coal, exploration in mining companies	It causes acid rain by changing the pH of ocean water

Table 1- Disposal of products derived from fossil fuels into the environment and consequences

Source: Prepared by the authors (2021), based in GOUVEIA (2012); EQUIPE ECYCLE (2021); LEGNAIOLI (2021); AMBIENTAL BRASIL (2021); GRUPO PRIMUS (2016); PIVA (2010); OLIVEIRA (2020).

It appears (Table 1) that there is a lot of damage to the environment when the disposal of products derived from fossil fuels is not done correctly. The consequences are drastic in the medium and long term, affecting the air, land and sea for a long time.

As is the case with plastic (plastic pellets, raw material for plastic production), which, when transported irregularly by ships and trucks, that is, without proper storage, fall from these means of transport and contaminate large areas of the terrestrial environment. and the oceans (GOUVEIA, 2012). Micro plastics are residues that accumulate in the depths of the oceans due to disposal in plastic dumps, affecting the food chain of invertebrates such as sponges, corals, anemones, starfish, polychaetes, lobsters, crabs. (ECYCLE, 2012).

Accidents on oil platforms and spillage by vessels, causes oil dispersed in the oceans to form films in the water layer, making it impossible to disperse gases and causing toxicological effects on marine animals (LEGNAIOLI, 2021). When Styrofoam is disposed of in the environment by means of garbage, it does not degrade and tends to break down and turn into microplastics (BRASIL AMBIENTAL, 2021). The same happens with plastic bags, when discarded in the trash, they travel long distances, reaching rivers and seas. In the seas, plastic bags look like jellyfish and are swallowed by turtles, that is, they are mistaken for food (GRUPO PRIMUS, 2016).

Solid waste, which consists of plastics and packaging, when discarded in landfills, compromises the quality of the soil, water and air, causing damage to the environment in the short and long term (GOUVEIA, 2012). Plastic straws, discarded in the streets, on sidewalks, with the action of rains reach the oceans, covering long distances (GOUVEIA, 2012).

Accidents with transport vessels cause oil spills in the ocean, causing serious consequences for marine life (OLIVEIRA, 2020). Natural gas causes pollution with burning in industrial boilers, incorrect production activity and precarious conditions, with low chimneys causing the dispersion of polluting gases into the atmosphere causing acid rain, leading to a change in the pH of water in the oceans (PIVA, 2010). The burning of mineral coal, which occurs in mining companies and coal plants, causes the formation of acid rain (OLIVEIRA, 2020).

Considering the entire approach (Chart 1) of improper disposal of products derived from fossil fuels, the consequences are immense for the environment, these materials cause pollution in all spheres of the environment. All garbage discarded in the environment has devastating effects on the entire marine chain, such as plastic, styrofoam, plastic bags, plastic straws are materials that take years to decompose, when they reach the sea, they cause irreversible damage to marine animals. It is known that oil is a source of energy that moves the world, but that, in its processing, accidents can occur, whether in its removal from oil platforms or in its transport, the environmental impacts on the oceans are inevitable, which compromises the life of the inhabitants of this ecosystem.

We live in a hectic world, where the frantic transport of cars in large urban centers and highways moves the economy, but brings with it the elimination of gases by burning fossil fuels. This air pollution has altered the temperature of the planet and the pH of the sea. The consequences are changes in the structure and way of life of marine beings.

Sustainable attitudes on the part of governments and society in general are necessary to change or alleviate the current reality of the harm that the use of fossil fuels has caused. There are already laws and bodies that oversee compliance with safety standards, but they need to be strict and active to avoid environmental damage. It is necessary to invest in new less polluting energy sources, which guarantee quality of life for all living beings. Behavioral changes in our daily lives, such as, for example, reducing plastic consumption, can help in the recovery process of affected ecosystems. The human being uses all the resources that nature can enjoy, but forgets about conservation for the sustainability of this exploited treasure. The approach of the three pillars of sustainability raises this question with great awareness of environmental preservation, looking after this heritage, which is also a treasured asset for future generations.

In (Table 2), we see disastrous consequences for several inhabitants of the sea, due to inadequate pollution of materials. Like, for example, turtles that ingest plastic along with algae, or when they confuse plastic bags with jellyfish. Plastic together with organic remains, when they decompose, have a similar smell of fish, and this attracts turtles, who do not know how to distinguish garbage from their food. Ingested plastic can cause starvation, malnutrition, damage internal organs and death (MIGUEL, 2020).

Turtles served by the Tamar project (2021), some alive and some dead, have plastic and other waste in their digestive tract. Among the most affected species are the green and leatherback turtles.

Marine inhabitants	Pollution	Consequences
Sea turtles	Plastics discard	Choking
	Fishing supplies	Entanglement in fishing nets
Whales	Plastic disposal	Intoxication
		Death
Albatross	Plastic disposal	Intoxication
		Difficulty walking death
Corals	Greenhouse Gases	Bleaching
	Sea acidification	
	Oil in the sea	Death
		weakening
Seaweed	Oil in the sea	Difficulty carrying out photosynthesis

Table 2- Main inhabitants of the sea most affected by the pollution of materials derived from fossil fuels and consequences.

Source: Prepared by the authors (2021), based on TURRA (2020); ARAÚJO (2016); SILVEIRA (2018); CASTRO (2018); TAMAR (2021); MIGUEL (2020); MACEDO et al.(2011); SANTOS (2014, p.1); (MESQUITA (2019); NATGEO (2019); BBC BRITISH BROADCASTING CORPORATION, (2019); ARAÚJO (2016); SANTOS (2012); ECODEBATE (2021).

This project was created in 1980, in Rio Grande do Norte, aimed at marine preservation and recovery of turtles, and develops research with the participation of the coastal community. It is present in 25 locations in Brazil, distributed in 9 states (Bahia, Sergipe, Pernambuco, Rio Grande do Norte, Ceará, Espírito Santo, Rio de Janeiro, São Paulo and Santa Catarina), with feeding, spawning, growing and resting areas sea turtles of various species, which annually visit our Brazilian coast (TAMAR, 2021).

Other residues of fishing origin, such as nylon threads, boat ropes and nets, compromise the health of sea turtles, which become entangled in these anthropogenic materials. (MACEDO et al, 2011).

> The use of rare feeding areas by green turtles suggests that this species is more susceptible to fishing activities that occur close to the coast, especially gillnets, which are commonly used in artisanal fishing (SANTOS, 2014 p.1).

Whales of various species also suffer from the presence of garbage in the oceans. Scientists from Iceland organized an expedition in the region to discover the causes of the ingestion of enormous amounts of plastic by these animals. They claim that this region is an arm of the sea that enters the continent between high mountains, formations that are very characteristic of the coasts of Norway, Greenland and Chile, among others, scenarios carved by the erosion of the mountains due to ice; It has cold waters, rich in nutrients, algae, plankton and fish, which attracts whales. A collection made with specialized instruments showed a lot of plastic and microplastic at the site. Humpback whales filter 19,000 liters of water, half a ton of krill a day and, together, a lot of microplastic. There are few studies on the harm that this pollution can bring to the health of whales (MESQUITA, 2019).

In the media there are tragic news of deaths of whales that had solid waste inside, including plastic, ropes, fishing nets. In 2019, Darrell Blatchley, a specialist in marine mammals in Davao, Philippines, was called by the local marine agency to check the body of a beaked whale, whose cause of death was 40 kg of plastics in its stomach. Among the material removed from the interior of the animal were plastic bags, 16 bags of rice, packages of snacks and nylon thread. Blatchley reported that he has collected 61 corpses of whales killed in the Gulf of Davao, and 45 he estimates the cause of death was the ingestion of plastics. Intense fishing decreases the amount of food for whales, which causes them to eat plastic that floats nearby (NATGEO, 2019). In December of the same year, a sperm whale was found on Harris Island, Scotland, which died after running aground and had 100 kg of garbage in its stomach (BBC BRITISH BROADCASTING CORPORATION, 2019).

Giants by nature, the whales that inhabit the oceans, even far from the coast, suffer from human imprudence in the disposal of garbage.

Seabirds, such as albatrosses, are affected by plastic damage to their health. Photographer Chris Jordan recorded them in Midway atoll, in the Pacific Ocean, and in the photographic records the amount of plastic was visible, which was the cause of their death. He commented that looking at albatross carcasses was like looking into a macabre mirror that reflected the collective trance of consumerism and uncontrolled industrial growth (ARAÚJO, 2016).

Plastic, derived from oil, causes a lot of harm to marine life, but oil itself is also harmful when it spreads in the sea. In its removal from the environment in the case of drilling, even with all the technology, accidents beyond human control may occur. Most accidents with oil spills occur in the transportation of the product. A spill can cause pollution to the environment, bringing problems to marine fauna and flora. Due to its compounds, petroleum is highly polluting (SANTOS, 2012).

In the case of corals in contact with oil, they do not resist and die. On the Earth's coast, the burning of fossil fuels has generated an increase in the greenhouse gas, CO2, causing major environmental impacts, including global warming and ocean acidification. The marine pH becomes acidic and many marine life, such as corals, suffer structural weakening and bleaching. Coral reefs represent a great biodiversity, and their degeneration compromises the entire marine aquatic food chain (ECODEBATE, 2021).

For marine algae, photosynthesis is compromised, as the oil slick does not allow sunlight to enter, thus interfering in this chemical process and in the natural course of the food chain. According to Santos (2012 p. 159), the most drastic example of oil contamination is what happens to birds. Just a small amount of oil on their feathers causes their immobility to fly, destroying their natural feather waterproofing, leading to hyperthermia or overheating and causing death.

To combine the use of products derived from fossil fuels with practicality, it is necessary to use them consciously. For Santos (2021), economic development based on sustainability allows for the conservation of fundamental natural resources to meet the current needs of this and future generations. Sustainable development requires planning and participation of all citizens (SANTOS, 2021). "Sustainability is the understanding of human beings to suppress their current needs, without jeopardizing the future of the next generations" (SANTIAGO, 2020, not paginated).

The ocean is very important for all living beings. It covers a large area of the Earth's surface, it provides part of fossil fuels, it is a source of food, and it contributes to human survival. Phytoplankton present in the oceans transform greenhouse gases, especially carbon dioxide, into oxygen through the chemical process of photosynthesis. Tthis way, it regulates the climate of our planet, providing conditions for the survival of marine and terrestrial beings (TURRA et al., 2020 p.6).

Man also uses the beaches as a place of leisure, unfortunately, many times, without concern for preserving this so valuable asset of nature, as he leaves his traces in the sand, marking the human presence through the garbage scattered everywhere.

> In Brazil, the Coastal Zone comprises a strip of 8,698 km in length, which concentrates almost a quarter of the population in about 400 municipalities. Many of the Brazilian beaches are subject to intense environmental degradation. (ARAÚJO, 2016, not paginated).

In the 1980s, the Great Spot of the Pacific was discovered, between the west coast of the United States and Hawaii, composed of solid waste, mostly plastic, brought by ocean currents. Sample analyzes identified decades-old plastics and many half-centimeter plastic fragments that make up most of the 1.8 trillion pieces floating in the slick. These solid residues cause damage to marine fauna (SILVEIRA, 2018).

According to research, 8 million tons of garbage are thrown into the oceans annually. Estimates from the British Foresight Future of the Sea Report indicate that the amount of plastic in the oceans could triple by 2025 (CASTRO, 2018).

The sad news lights an alert. The concern of environmentalists, biologists and animal protection projects is growing, as they seek to help in some way the inhabitants of the sea who are most vulnerable to this situation.

Renewable energies are derived from natural processes and do not require non-renewable resources such as fossil fuels (PIVA, 2010). In the search for alternatives for sustainable development, we find indications of renewable energies generated by natural processes: hydroelectric energy, wind energy, solar energy and geothermal energy, as well as energy produced from renewable fuels such as landfill gas, incineration of waste, solid biomass, liquid biofuels. As an example of a viable alternative, hydroelectric energy offers energy of low value to the consumer, produced in a dam with the use of water power, generating power in the turbines.

The energy produced from biomass promotes the use of agricultural and cattle waste, wood from trees with planting rotation, organic waste and urban solids. They are used in energy transforming raw materials in the form of solid, liquid and gaseous fuels in the generation of electricity and heat.

Solar energy, another important source of natural energy, takes advantage of the sun's heat where it manufactures clean energy.

Wind energy, a source of mechanical energy, also makes use of a renewable natural resource: the power of the wind. Another source of clean energy, which dispenses with the use of non-renewable sources, is geothermal energy, a sustainable source, using the heat of the earth to generate energy.

To achieve the maintenance of the global economy combined with a healthy environment, the search for diversified alternatives for energy generation is essential, but perhaps the most urgent thing in the short term is the expansion of advanced technologies to replace fossil fuel (PIVA, 2010).

Much has been discussed about the amount of waste produced and discarded in an erroneous way in the environment. Materials produced with material from fossil

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fuels, such as plastic, are highly harmful to marine animals when they reach the oceans. To avoid such damage to the environment, an alternative and very positive ally is the manufacture of biodegradable packaging based on renewable sources, that is, with biomaterials. The possibility of manufacturing packages with cereal or oat starch, a product with a low price and availability on the market, is also attractive.

> Recycling is the process in which there is the transformation of solid waste that would not be used, with changes in its physical, physical-chemical or biological state, in order to attribute characteristics to the waste so that it becomes raw material or product again, according to the National Solid Waste Policy" (PNRS) (EQUIPE CYCLE, 2021, not paginated).

Selective collection is an alternative that has been announced for a long time and its purpose is recycling. Transforming a discarded material that is no longer useful to manufacture a new usable product contributes to significant impacts on the environment. Recycling also linked in the order of the three "R's" is to recycle, reuse and reduce. As recycling consists of reprocessing a material, it is different from reuse, in which there is only the use of the product for another purpose and the reduction is consistent with reducing the consumption of certain products.

For Tokarski (2019) the industry has been showing interest and availability of raw materials to produce clean energy, consolidating the use of biodiesel and ethanol. Biodiesel produced from vegetable oils, soy, palm oil, corn, peanuts, cotton, algae, among others.

Mello (2017) states that the school plays an important role as an instrument for changing attitudes through environmental education, aiming at sustainable development and preparing citizens to be more responsible for the conservation and preservation of the environment. The school's work focused on the environmental issue has an important value, considering that, from a very early age, children absorb the information received aimed at saving the environment, such as the conscious use of water, the proper disposal of garbage, recycling, composting, among other relevant topics.

Based on such knowledge, they will be able to pass on all the information mediated in the school to their family, neighbors and friends, spreading the seed of environmental education and collaborating to change the behavior of the population, a very important factor for the local and global environment. Currently, schools work with projects related to cross-cutting themes, encompassing issues related to the environment. Mello (2017) emphasizes the importance of teachers updating their knowledge through continuing education, in view of the constant and rapid changes surrounding environmental issues.

FINAL CONSIDERATIONS

Using renewable natural resources with prudence, respecting the available limit, with responsible use to take into account the sustainability of the planet, as well as adopting correct attitudes to return them as waste to the environment is an essential condition for guaranteeing the sustainability of present and future generations.

The fragility of marine animals as the main hostages of all pollution, effects observed in the short, medium and long term, such as death, intoxication, impossibility of reproduction, lack of food, choking, among other serious problems, are consequences of anthropic actions.

Some sustainable alternatives can be used as possible solutions to replace raw materials based on fossil fuels and, therefore, avoid the consumption of products produced

with them, that is, alternatives to reduce pollution caused by excessive consumption of packaging, plastic bags, greenhouse gases, etc. Energy produced with non-renewable inputs has viable possibilities with other renewable sources such as wind energy, solar energy, hydroelectric energy and geothermal energy.

Economic development needs to be in tune with the conservation and preservation of natural resources, combined with joint actions in relation to sustainability, individual and collective responsibilities, in addition to public policies, must converge in the same direction so that results are achieved in a balanced and respectful manner. with natural resources. Another important action is the development of environmental education projects in educational spaces, as they enable the formation of more responsible and aware citizens, with the aim of building sustainable societies.

In view of what was exposed in this research, we found that the listed objectives were achieved and that the results obtained showed that the path is the change of attitudes and the development of human actions for the benefit of the environment.

The discussion on the subject addressed does not end here, but it can serve as a source for other researchers to continue in further exploration and deepening of the subject, as there is a vast publication on the subject, impossible to finalize the discussion in this article.

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