



The Impact of Air pollutants on oil industry and its relation to safety and occupational health inside the working environment (Case study in elhadisa extraction mill)

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ABSTRACT

Vegetable Oils are types of cooking oil which are suitable for human consumption including sunflower, canola, soybean, cottonseed, groundnut, linseed, sesame, and moringa oils. Vegetable oil which can be extracted from oilseed is considered one of the main components of our food. Soybeans are one of the main sources of oil crops around the world. Soybean oil and protein are major products for food, livestock feeds, and industrial applications. Soybean oil, extracted from the seeds of soybean, is one of the most widely consumed cooking oil across the world. Soybean oils are usually preferred over other vegetable oil for various health benefits including better heart health, improved immune system, improved growth, and reduced cognitive diseases. It is a resource of edible oil and has other food and industrial applications. The process for soybeans typically consists of five steps: oilseed handling/elevator operations, preparation of soybeans for solvent extraction, solvent extraction and oil desolventizing, flake desolventizing, and oil refining. In each step of manufacture, there are emissions that have effects on the environment, employees and the economics of the business.

In the industry, expelling and hexane extraction are the two typical processes for soybean oil production. But Hexane extraction is the most common method used in the industry to produce soybean oil due to its high oil recovery and lower producing cost, however, it has characteristics that make it challenging to use, including high flammability. With the demands of soybean oil increasing, either in food or industrial applications, expansion plans are being considered by many companies to increase production capacity.

Therefore, this study included a study of one of the vegetable oil extraction plants Elhadisa located at Sadat Industrial City. Where this study focused on monitoring and evaluation of air

pollutants (emissions) resulting from each stage of manufacturing and discussed their impact on health, environment and economy, Also the study discussed & represented the solutions to reduce air pollutants, emissions and the output particles, which in order provide protection for an environment, employees and economic.

Key words : Soybean extraction, Air emissions from soybean industry, Occupational health ,safety and environment

Introduction

The earth is the only planet that is suitable for life in this universe. Life exists because of its interaction with the resources the earth provides. It is this interaction that creates a balance between the living and the nonliving resources and sustains both of them. The three most important nonliving resources for us is the air we breathe, the water we drink and the land we live on. Without these three resources, we cannot exist ⁽¹⁾.

Air is a natural resource and is available abundantly. It is an essential element of nature that support life on earth. Air is equally important for living organisms for their survival just like water. Air is very useful and has many applications⁽²⁾.

Air is a mixture of gases that is composed of 78% Nitrogen, 21% Oxygen and a very small percentage of water vapor and other gases. The fact that air contains so much oxygen is not because the earth provided us the atmosphere with that composition, but because living things like plants produced oxygen for over 2 billion of years ago from carbon dioxide.

The oxygen in the air is essential for animals to survive because we use this oxygen to produce energy from the food we eat. The carbon dioxide we breathe out is in turn required for plants to trap energy from the sun and turn it into food.

The air also has another important function: it regulates the temperature of the earth and causes different weather pattern. Without the atmosphere's moderating effect, the earth would be fried during the day and would be freezing cold at night. The movements of air (wind) bring us rain in every monsoon. Polluting the air by releasing hazardous chemicals can thus threaten the existence of life and can alter climatic patterns ⁽³⁾.

While we can choose what we eat and drink, we cannot choose the air we are breathing. Thus any of us can be exposed to pollutants at one time or another, simply through the air we inhale. The effects of our exposure to air contaminants may vary based on the exposure dose: some may appear immediately, while others could develop over a long time after the exposure started. This is why it is always a good idea to evaluate possible past exposures. Air pollution can be defined as the presence

of toxic chemicals or compounds (including those of biological origin) in the air, at levels that pose a health risk. So this researcher studied the impacts of air pollution that resulted from soybean industry on the occupational health and safety inside the working environment.

Materails And Methods

Study area

The geographical scope of the study was determined in the Modern Import, eExport and Manufacturing Company - Soy Oil, located in the 5th Industrial Zone - Sadat City - Menoufia Governorate. (Figure 1).



Figure 1: Location of the study area.

The measurements of different parameters in the scope of study:-

The parameters that have been measured were the following:-

- Total suspended particle TSP (mg/m^3), samples were taken from different locations in the factory like (Receiving area and preparation area).
- Particulate matter less than 10 micron PM10 (mg/m^3), samples were taken from different locations in the factory like (Receiving area and preparation area).
- Volatile Organic Compounds VOC (mg/m^3), samples were taken from different locations in the factory like (Extraction area).

instruments used in this study

According to the emissions from the industry, Tow types of devices were used.

- 1- Microdust Pro, that device used to measure the total suspended particle (TSP), Particulate matter less than 10 micron PM10 and Particulate matter less than 2.5 micron PM2.5.
- 2- FIRSTCHECK PID (Photoionization Detector), that device used to measure Volatile Organic Compounds (VOCs).

Methodology:-

The Methodology reflects the researcher's structured steps in dealing with the topics the study until they reach a certain conclusion.

Since it is the nature of the study that defines the methodology used, depending on what has been addressed, the approach adopted in the study is quantitative and qualitative methodology.

This study was based on a set of methods, depending on the nature of the study and the approach used, that can summarized as the following:-

Meeting :- It is one of the most widely used and widely used tools, given its characteristics and flexibility, as well as the data it provides to the researcher on the subject he is studying, and it is considered to be a means based on direct dialogue or oral talk between the researcher and other party.

Questionnaire: a model with a set of questions for the study sample members to obtain information .. The survey form was used to collect data in the current study in the light of the study's objectives and questions; and was discussed with experienced manufacturers.

Direct observation:- Like other research methods, it is to observe closely certain behavior or phenomenon under certain environmental conditions and factors in order to obtain accurate information to diagnose this behavior or phenomenon. The researcher has relied on it to provide the researcher with comprehensive and detailed information, where the observation has great potential to monitor emissions of air pollutants from factory and the extent to which it affects the components of the production process (human component, environment, equipment and machinery).

Results And Discussion

Environmental measurements:

Environmental measurements were carried out in accordance with Law (4) of 1994 regarding the protection of the environment and its amendments by Law No. (9) of 2009 and the executive regulations issued in 1995 and its amendments issued in 2005 and 2012.

3.1.1 Concentration of total suspended particles:-

Total suspended particles were measured in (7) different locations within the work environment which represent the entire site. The results showed that all concentrations are less than the permissible limits, except one point above the permitted limits in accordance with Law 4 of 1994 regarding the protection of the environment and its amendments by Law No. 9 of 2009 and the Executive Regulations issued in 1995 and its amendments issued in 2005, 2012 and 2017, which is 10 mg/m^3 .

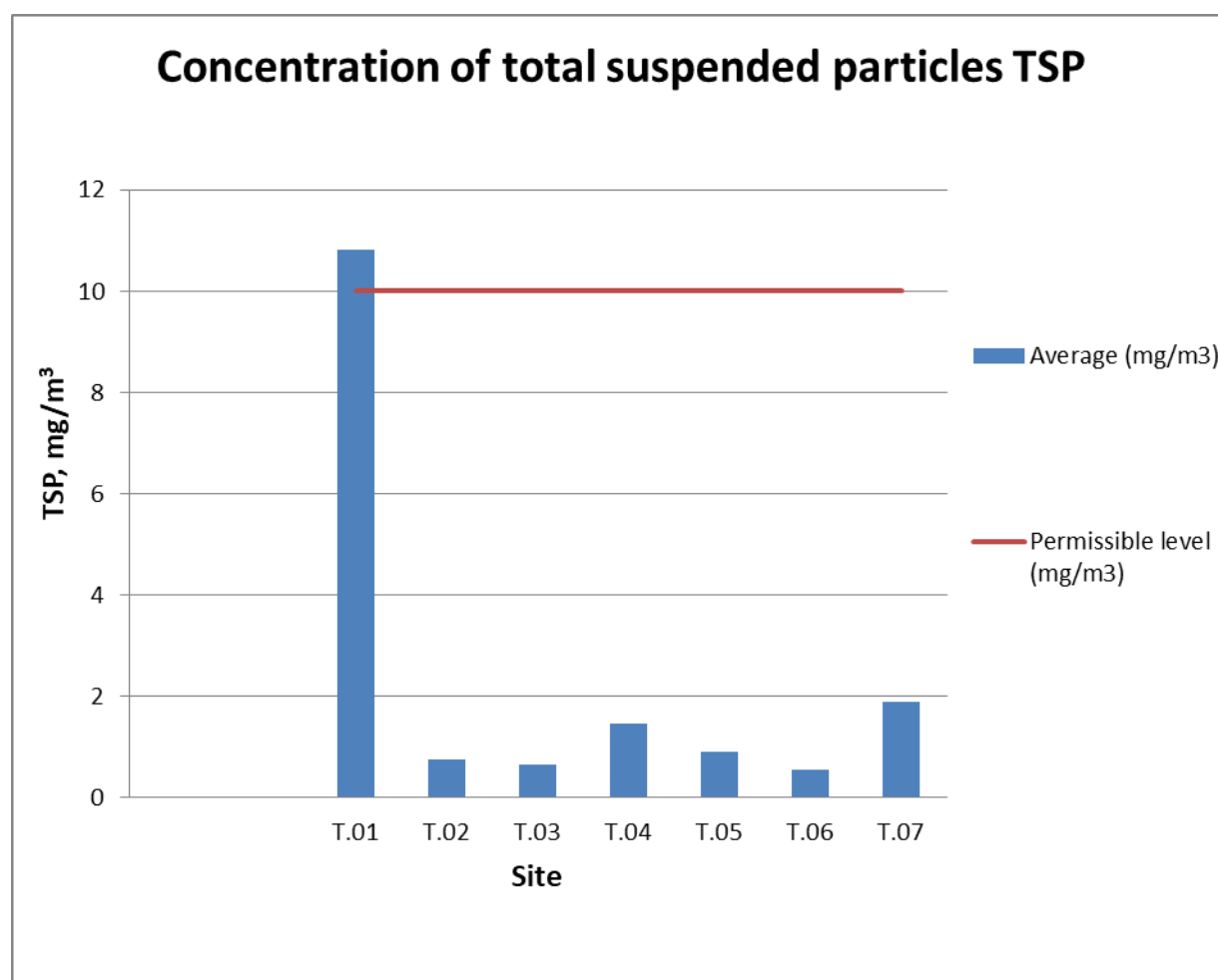


Figure No.2: shows the levels of concentration total suspended particles (TDS) in different locations within the factory and the study area Jan 2022.

Concentration of inhaled particles:-

The inhaled particles were measured in (3) different locations within the work environment which represent the entire site. The results showed in the figure No.3 which indicate that all concentrations are less than the permissible limits in accordance with Law 4 of 1994 regarding the protection of the environment and its amendments by Law No. 9 of 2009 and the executive regulations issued in 1995 and its amendments issued in 2005, 2012 and 2017, which is ($3 \text{ mg} / \text{m}^3$).

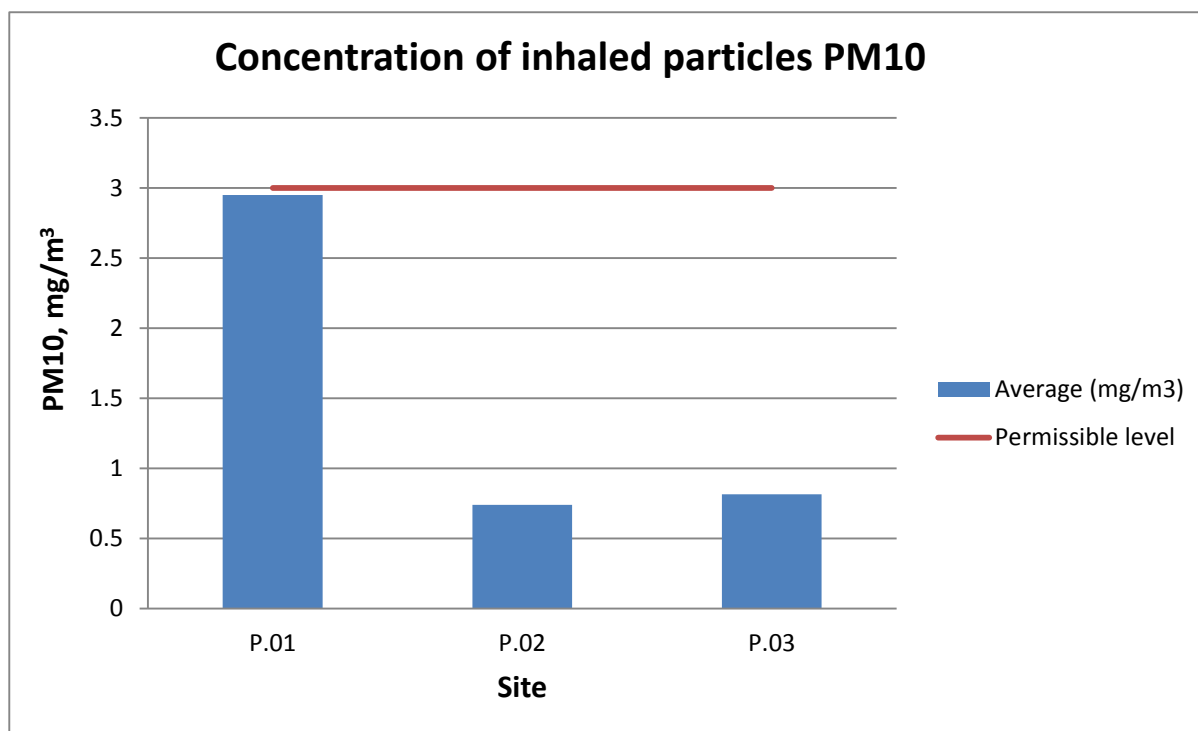


Figure No.3 shows the levels of concentration of inhaled particle (PM10) in different locations within the study area, Jan 2022.

Concentration of Volatile Hexane:-

The volatile hexane was measured in (10) different locations within the work environment which represent the entire site. The results showed as shown in Figure No.4 that all concentrations are less than the permissible limits, except (3) points were above the permitted limits $176 \text{ mg}/\text{m}^3$. and the three points recorded were more than 240, 270 and $290 \text{ mg}/\text{m}^3$; that in accordance with Law 4 of 1994 regarding the protection of the environment and its amendments by Law No. 9 of 2009 and the executive regulations issued and 1995 and its amendments issued in 2005, 2012 and 2017, which is $176 \text{ mg} / \text{m}^3$.

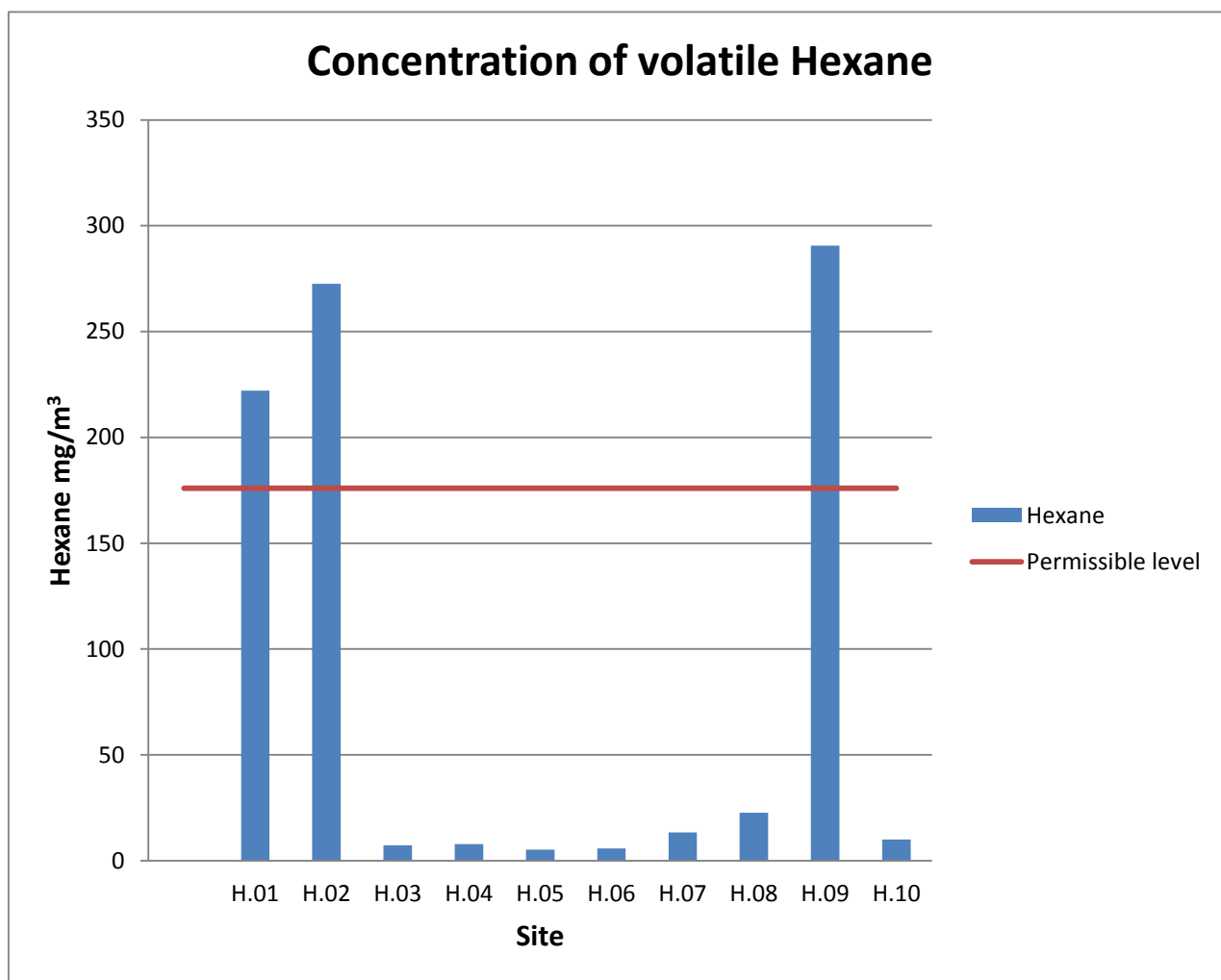


Figure No.4 shows the levels of hexane at different locations within the study area Jan 2022.

From the previous results we can conclude that there are one point above the permitted limits of concentration of total suspended particle accordance and three points above the permitted limits of concentration of Volatile Hexane in accordance with Law 4 of 1994 regarding the protection of the environment and its amendments by Law No. 9 of 2009 and the executive regulations issued in 1995 and its amendments issued in 2005, 2012 and 2017.

Impact on the employees

Inhaling dust

This dust can create breathing problems. The health effects of breathing in dust can take many years to develop. Inhalable dust is visible to the naked eye. This dust may consist of larger or heavier particles that tend to get trapped in the nose, mouth, throat or upper respiratory tract where they can cause damage. Respirable dust is fine enough to be invisible to the naked eye and can be breathed deeply into the lungs and cause harm. That obtains clearly in the two stages of manufacturing (receiving section & preparation section).

Swallowing dust

The dust can become trapped in the mucus that lines the respiratory tract. This mucus tends to be either spat out or swallowed. Inhaled dusts can get into the digestive tract, where they can cause local effects such as gastrointestinal tract irritation.

Eye contact with dust

Dust particles produced during the manufacturing process can cause eye damage or irritation.

Health hazard of volatile Hexane emission in the soybean industry:-

Acute Effects

Acute inhalation exposure of humans to high levels of hexane causes dizziness, giddiness, slight nausea, and headache in humans.

Chronic Effects (Non cancer):

Chronic inhalation exposure to hexane is associated with sensorimotor polyneuropathy in humans, with chronic inhalation exposure to hexane is associated with sensorimotor polyneuropathy in humans, with numbness in the extremities, muscular weakness, blurred vision, headache, and fatigue observed.

Environmental Effects:

Impacts of dust emission on oil extraction environment:-

Poor air quality – This is due to increase in contaminant loads and dangerously high level of breathable suspended particles in the air during the working.

Increase in environmental hazards relating to building and health.

Impacts of volatile hexane emissions on oil extraction environment:-

There is no observed impact of hexane on the environment where hexane enters air, water and soil and the hexane evaporates easily into the air.

If it spills into a lake or river, a very small portion of the water will melt, but most of it will float on the surface. Then it evaporates into the air. Solute Fracture In water by certain types of bacteria.

Business Effects

Impacts of dust emissions from industry on oil extraction business:-

Dust emissions from soybean extraction industry cause significant negative impacts on business of the factory. While dust may not seem like a threat to many business owners, much can go awry without a proper dust collection system.

When dust accumulates in equipment and motors during operations, that lead to increase the temperature of motor which decrease the efficiency of them and it can act as fuel for accidental fires and explosions. Also it damage the equipment dust can contaminate not only the air but also equipment.

Impacts of hexane volatile emission from industry on oil extraction business:-

Hexane is highly flammable, and its vapors can be explosive. Heat, sparks, and flames may ignite it. Flammable vapor may spread away from a spill or leakage. Hexane can be the main cause of total destruction of the plant, if the hexane leak is neglected.

Loss of hexane from different sources (leakage, Spill, etc.). This mean loss of money also means increasing the cost of production.

Conclusion

Various emissions are produced in soy oil processing that could pose environmental problems if not properly controlled and disposed of, So the environment measurements conducted in every step of manufacturing in the soybean factory to assess the air emissions and compare their concentration with air quality limit according to Egyptian Environmental Law and its impacts on employees, environment and economic, the results were the following:-

- 1- Total suspended particles were measured in seven different locations within the work environment of soybean factory. where all concentrations are less than the permissible limits, except one point above the permitted limits in accordance with Law 4 of 1994 regarding the protection of the environment and its amendments by Law No. 9 of 2009 and the Executive Regulations issued in 1995 and its amendments issued in 2005, 2012 and 2017, which is 10 mg/m³.
- 2- The inhaled particles were measured in three different locations within the work environment of soybean factory. where all concentrations are less than the permissible limits in accordance with Law 4 of 1994 regarding the protection of the environment and its amendments by Law No. 9 of 2009 and the executive regulations issued in 1995 and its amendments issued in 2005, 2012 and 2017, which is (3 mg / m³).
- 3- The volatile hexane was measured in ten different locations within the work environment of soybean factory which represent the entire site. Where all concentrations are less than the permissible limits, except three points above the permitted limits that in accordance with Law 4 of 1994 regarding the protection of the environment and its amendments by Law No. 9 of 2009 and the executive regulations issued in 1995 and its amendments issued in 2005, 2012 and 2017, which is 176 mg / m³.

These emissions from Soybean extraction industry affected on the employees, environment, and economic.

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