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Air and Water Characteristics and their Environmental Impact Case Study: Dalahmo Village - Menoufiya, Egypt

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Abstract

Environmental pollution is a major problem encountered in cities as well as in rural communities. The environmental pollution in the village represents a real danger having negative effects on the products of villages such as plants, vegetables and fruits; their effects are then conveyed to animals that feed on these plants, and to human beings who consume these products, in addition to the meat of the animals coming from these villages. Therefore, there is an imminent need for us to use all our efforts in order to make the environment, in the village, unpolluted and healthy.

Since the village provides Egypt with different agricultural products, it is of tremendous importance to the Egyptian economy. Nevertheless, the environment in rural areas does not get as much attention, from environmentalists, compared to urban communities. The villages suffer from the lack of systems for collection of solid wastes and of sewage disposal. This leads to an increase in pollution in these villages.

This paper studies the environment of many villages in Egypt. One village was chosen to represent some of these villages. This was Dalahmo village in Menoufiya governorate.

Using an analytical approach and field study, the paper displays the economic conditions of the village. The paper covers three environmental parameters. These are air, water and soil. It indicates the pollution encountered in rural communities. The paper also reviews the negative effects that this resulting pollution has on the health of human beings. It also points out the role of the individual behavior that causes the aggravation of the problem of environmental pollution. It illustrates, then, the quantities and types of solid wastes resulting in the village.

The paper finally presents suggestions for the management of different types of solid wastes. It also presents suggestions to solve the water pollution problem and consequently the soil problem in order to make the village environment pollution free.

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1. Introduction

Importance of rural communities in Egypt:

The village is the basic unit in the structure of the Egyptian Society. The inhabitants of the village constitute the majority of the population in Egypt. This illustrates the importance of the rural communities and consequently the need for paying more attention to the Egyptian village.

Environmental pollution can be considered as one of the most important problems for the sustainable development of the Egyptian village.

1.1 Classification of Pollution in most of the Villages

1.1.1 Air Pollution, air pollution in the village is due to:

Burning solid wastes, this can be divided into

- a) Burning of household wastes.

Due to the lack of any effective system of garbage collection, these wastes, which are composed of daily life disposals, such as plastic bags, paper...etc. constitute a serious environmental problem despite their relatively small quantity.

- b) Burning fields wastes

During the planting process, fields are being cleaned from grass and harmful plants. The resulting wastes are burned by the peasants. After harvesting the crops, the fields are cleaned from the residuals and the roots left. Again, these wastes are burned. This process is still widely used until now to get rid of the fields wastes that cannot be used as fuel or anything useful. Several gases which are harmful to human health, are the outcome of the burning process. The most important air pollutants usually encountered in the village and their effects are carbon monoxide, smoke, sulphur oxides, carbon dioxide, total suspended particulates and nitrogen oxides. [10,13]:

1.1.2 Water Pollution, water pollution is due to the following reasons:

Getting rid of sanitary sewage water in canals and draining canals. This affects the underground water and contaminates the soil. Throwing solid and organic wastes and even rubles and dead animals in canals and draining canals.

1.1.3 Land Pollution, land pollution is caused by:

Using contaminated water and sanitary sewage water in irrigation, -Sewage reservoirs are located in different parts of the village. Leakages occur from these tanks carrying different organic and inorganic pollutants to the soil. Contaminants are transmitted to plants and trees and consequently to fruits and vegetables, and hence to the human being.

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2. Study conducted:

To conduct this research, a quick survey was performed on the Egyptian villages in Menoufiya governorate; the survey indicated that the villages suffer from more or less the same environmental pollution.

Next, one village was chosen to better study its environmental characteristics. Dalahmo village was the one chosen as a representative of all villages in Menoufiya. A field study was conducted, the economic, social and environmental impact conditions in the village were studied. Emphasis was made on air and water characteristics. People's behaviour was observed to correlate it to the encountered environmental situation.

2.1 Site of the village:

Dalahmo is situated in the governorate of Menoufiya which lies at the middle part of the Nile Delta. Dalahmo belongs to Ashmoun district. It is situated at about 16 km from Ashmoun city, the capital of the district and at about 31 km from Shebeen El kome, the capital of the governorate. Dalahmo consists of Dalahmo village and three hamlets. These are Al Tagui al Baharia, Al Tagui al Quebliya and Sidi Abd El Halim. The village receives water from Tahwai, a neighbouring village.

3. Results and Discussion

Survey Conducted

People and their behavior

The people:

The population of Dalahmo amounts to about 18000 citizens. Educated people constitute about 55% of the total population. The inhabitants of the village live a simple life. The majority still use the village simple oven. The cultivated area constitutes 96 % of the total area of the village. 82% of the population works in agriculture. The rest works in public services and activities related to the agricultural activities. 20% of the population suffers from liver diseases. About 1% has kidney failure.

The behavior:

The people's behavior plays an important role in the environmental situation taking place in the village due to their lack of awareness of its danger and the harm it causes. Example of this behavior is their way of handling animal manure in order to use it as fertilizer in agriculture. Agricultural wastes are used as fuel in their village ovens. Besides, some of them wash their utensils and clothes in canals, bathe, and throw solid wastes in the river.

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People sometimes use excessive fertilizers, insecticides, pesticides and herbicides due to lack of awareness of the severely harmful consequences. This leads to contamination of food including vegetables and fruits that man eat. This causes serious diseases especially in children. Besides, these insecticides and pesticides spread on plants in soil. This is harmful to small infants.

The excessive use of herbicides causes poisoning. This has also led to the evolution of new species of agricultural pests. In addition, these herbicides are left in the soil and affect the land fertility with time. The reason for this lack of awareness is their illiteracy.

On the other hand, some of the population who are aware of the pollution problem are trying to solve the environmental problems. By donating the land and purchasing apparatus and instruments, two water plants were constructed.

Crops Cultivated:

Theses are clover, potatoes, wheat, beans, maize, cotton.

The Characteristics of Dalahmo Village

The environmental characteristics of Dalahmo Village could be summarized using the commonly used SWOT analysis.

The SWOT analysis:

The SWOT analysis (alternatively SWOT matrix) is defined as a structured planning method used to evaluate the points of strengths, weaknesses, opportunities and threats for a project. For the sustainable development of the village, it was found as follows:

Strengths:

The awarness of the educated people of the environmental issue encountered in the village. The willingness of some people to donate a part of their land for public utilities. The Government has already started erecting a sewage project for the village in 2011(though still not functioning).

Opportiunities:

The possibility of applying new and renewable energy technologies such as biogas technology, solar energy. The possibility of providing a dumpsite and a landfill to serve the village and a sewage network. The opportunity to invest in environmental projects to recycle the agricultural wastes in a mass and clean production way by providing presses to better utilize the wastes as fertilizers and foddors.

Weaknesses:

Some of the people obtain water from canals.
The existence of a relatively high percentage of illiterate people.

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Lack of a system for collection and disposal of wastes. Water and land pollution due to existing methods of disposal of garbage and sewage. The wastewater treatment plant erected by the government did not function yet, the sewage pipes are starting to be broken and buried by solid wastes thrown upon.

Threats

The inability of public services vehicles such as fire engines, ambulances, garbage collection trucks to reach the different locations in the village in an adequate time. The possibility of spreading of contagious diseases due to the use of polluted water. Accumulation of solid wastes on the banks of canals and draining canals due to the lack of a dumpsite. This leads to pollution of water courses and spreading of insects and diminishes the water courses area. The possibility of self ignition of the wastes which could lead to setting fire in the neighbouring fields.

Environmental Characteristics of Dalahmo village

According to the latest reports, 14.7 % of the villages in Egypt have sanitary sewer. The rest of the villages amounting to 85.3% do not obtain this service. Dalahmo belongs to the last percent [8].

Management of Sewage

Each house has a tank built below the floor in a special room where waste is collected. It is then collected from the houses by suction vehicles. The sewage leaks from the houses. It reaches the underground water causing its pollution. Cracks are found at the walls and floors of the houses which can lead to their collapse.

Often, it also leaks from the suction vehicles tanks causing pollution of the land.

Types of Solid Wastes:

Types of solid wastes in the village were specified, their quantities were determined and found to be as follows:

Household Wastes

Examples are paper, plastic bags, remains of food,..etc

Quantities of solid wastes collected from the houses: 0.27 Kg/person per day.

Total quantity per day 4860 kg/day.

Total quantity of solid wastes per year:1774 ton /year

Agricultural Wastes

These were found to be mainly remains of wheat, maize and cotton stacks. Also smaller quantities of remains of vegetables and fruit crops wastes are present. The wastes of each crop per feddan was obtained based on agricultural statistics [15]. The amount of the waste of

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each crop was multiplied by the number of feddans cultivated. By summation, the quantities were as follows: 3990 ton/year.

Similarly, the quantities of remains of vegetables and fruit crops were obtained. The amounts were found to be 93 ton/year [2].

By summation of the last two figures, it can be found that the total agricultural wastes amounts to 4083 ton/year. Accordingly, the total household and agricultural waste are equal to: 5857ton / year.

Solid waste management

The wastes used to be collected from the houses by the local authority unit. The operation is not continuous. Most of the time the people find themselves responsible for collecting these wastes by themselves.

Recycling of Solid wastes:

Animal manure is used as fertilizers. Most of the agricultural wastes such as maize and cotton stalks are used as fuel in the simple traditional ovens that are still used in the village.

Air quality in the Village

Air quality was detected using air volume sampler (Airport MD8 model), the specifications including the suction rate details are given in appendix 1. The operating conditions were 25C, 1 atmosphere. Measurements were chosen to be taken at two locations in the village. The first was near the road leading to the village, the second at the center of the village, Table 1 shows the average of the results.

Table 1: Average Measurements of Air Constituents
(Units are in micrograms/cubic meter unless otherwise stated)

	TSP	Smoke	Lead	CO *	NO₂
Dalahmo 1	74	41.2	0.1	9	120
Dalahmo 2	73	59.2	0.3	5	130
Average	73.5	50.2	0.2	7	125
Egyptian Standard[14]	90 annual mean	60 annual mean	1.0 annual mean	10 8- hr mean	150 24- hr mean

*mg/cubic meter

It can be seen from the previous results that the values of all air constituents measured are less than those set by WHO and the Egyptian standards due to the non existence of large industries that emits these constituents. However, TSP and smoke values are higher than those expected, but still lower than the Egyptian standards.

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Water quality in the village

Using the standard methods for water analysis, the water characteristics of the village were obtained. Table 2 presents these results. Measurements were carried out at two locations; the first at the water treatment plant, the second at one of the houses in the village.

Table 2: Characteristics of Water Samples Collected from Dalahmo Water Treatment Plant and Received by Village Consumers

Parameters	Treatment Plant	House
Total Solids (mg/l)	350	720
Dissolved Solids (mg/l)	250	500
Fixed (mg/l)	145	300
Volatile (mg/l)	105	200
Suspended Solids (mg/l)	50	120
Fixed (mg/l)	10	20
Volatile (mg/l)	40	100
Settleable(mg/l)	50	100
Turbidity (NTU)	3	5
Nitrogen (mg/l)	8.2	38
Organic(mg/l)	8	35
NH ₃ mg/l(mg/l)	0.2	3
Nitrite (mg/l)	0	0
Nitrate (mg/l)	0	0
Phosphorous (mg/l)	3	4
Fe (mg/l)	0.05	0.8
Lead (mg/l)	0.4	0.5
Manganese (mg/l)	1.9	2.0
Chloride (mg/l)	30	40
Ca ⁺⁺ (mg/l)	112	116
Magnesium (mg/l)	27.6	24
Alkalinity (CaCO ₃) (mg/l)	150	200
Probable count for coliform group (cell/100 ml)	3x 10 ⁵	5 x 10 ⁵

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It can be seen by comparing the values in the table above that water used in houses has higher values of many parameters such as the total solids and turbidity than those collected from the water treatment plant. It is also noted that the bacterial count is above the standard values.

4. Conclusions

The agricultural and economic conditions of Dalahmo village were studied, in order to better investigate the environmental situation in the village. The following were concluded:

- The village suffers from social, economic and pollution problems.
- One of the main pollution problems is caused by wastes.
- The Solid agricultural wastes are accumulated in the fields and on the banks of canals and draining canals.
- The amounts of the household wastes are 1774 ton/year, while the total agricultural waste amounts to 4083 ton/year. This makes the total solid wastes 5857 ton/year.
- These wastes are used by the farmers as fuel and fertilizers. Any solid wastes not used such as remains of buildings are thrown in the canals and on their banks which block them.
- Air constituents are within the standard values set by the Egyptian standards; nevertheless some of them are close to the limits.
- The total bacterial count indicates pollution of water, consequently soil pollution. It is also noted that at the arrival of water to the consumer in the village, its bacterial properties are more deteriorated from 3×10^5 to 5×10^5 cell/100ml. This indicates the lack of maintenance of the distribution system used. However, Both values indicate pollution of the water at the two locations

This result is also in agreement with the results of the total solids present in the water sample which also increased from 350 mg/l for water going out of the treatment plant to 720 mg/l in water collected from the tap of the houses. The result justifies the presence of liver diseases in the village.

Suggestions to solve the sanitary sewage problem

To solve the sanitary sewage problem in Dalahmo, the government should complete the sanitary sewage system almost already built and replace its damaged parts. By that time, the village needs to be connected to the principal network in a region already having sanitary sewage. In case of Dalahmo, it should be connected to the sanitary sewage system in Tahwai village

5. Recommendations

Therefore, we conclude that rural communities in general need more environmental concern. This could be achieved through the following:

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- Developing the rural communities socially and economically
- Paving the roads in the villages
- The regional universities and non governmental organizations should play a pronounced role in increasing the farmer's awareness of the environmental problems
- Water networks should be supervised and maintained [5, 7].
- Introducing a system for collection and sorting of solid wastes.
- Erecting a plant to recycle the solid wastes to serve the village and the neighbouring ones [4, 12]
- Using biogas technology to benefit from solid wastes in obtaining biogas fuel [1, 6, 11] which could be used for energy. The remaining of the wastes is to be used as fertilizers and fodders [3, 4, 9]
- Constructing a landfill for the remainder of the wastes

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Appendix 1

Specifications of Airport MD8 Battery-Powered Portable Air Sampler

Volume flow adjustable in three steps	30l/min, 40l/min, 50l/min
Fixed given sample volumes	25,50, 100, 250, 500, 750 and 1000 liters
Operational life with one battery charge	Approx. 4.5 hours
Dimensions (L x W x H)	300x135x165 mm
Weight	2.5 kg