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Waste Water Treatment in Uk with Low Cost Technologies Using Farm Ponds

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Abstract

In general, the sanitation field seems to live the life of an orphan in many Pacific Island Countries. In many cases this important sector of public health has been left alone when major upgrading projects improved the water supply systems in many countries and provinces. This basically ignored the downstream effect of improved water supply, that of increased discharges into rivers or aquifers. Two reasons appear to be the major cause for that: firstly, wastewater collection and treatment is costly and their benefit often hard to show; and secondly, even if low-cost solutions are being implemented many projects fail to deliver the expected outcome. Without pretending to reflect the complexity of sanitation projects three principal reasons may be held accountable for the non-delivery problems: · The technology was not appropriate, · The beneficiary was not involved and consulted sufficiently, and · The responsibilities within government were not resolved to ensure the necessary support. During the last years many rural areas were provided with some kind of water supply system. The availability of water leads to wider spread use of flush toilet systems. These systems mainly use simple toilets to discard the waste water either directly into the porous underground or into simple holes. At the same time many villages still supplement their water supply from shallow wells which are often located in the direct neighbourhood of the toilets. Even if landowners consider the possible contamination of their well through their own toilet and locate them far apart they can not avoid the location of their neighbour's toilet close to their well. A similar risk of water body contamination occurs where villages situated on the banks of a small estuary/lagoon discharge their wastewater without treatment.It is expected that Small Scale Wastewater Treatment Plants (SSWTP), under certain circumstances, are the solution for these problems. More specifically the SSWTP technology could be applied where, · conventional sewage is simply too costly, · environmental conditions require a high effluent quality, · conventional on-site treatment proved to be of low community acceptance, · low technology solution, such as composting toilets seem to be inappropriate The main purpose of the project is to identify: · current wastewater disposal and treatment techniques, · ongoing sanitation initiatives and projects, · stakeholders in the sanitation sector, · the administration structures related to sanitation projects, · a possible project implementation agency, · sites for future pilot projects.

Keywords: waste water treatment, evaluation, low scale technologies.

Introduction:

Water is the most crucial natural resource on the earth and its purity decreases due to the addition of the contamination of different impure contaminants like microorganisms, calcium, magnesium salts and high turbidity due to insoluble impurities. This report discusses the design of the treatment tank to treat the water and reduce the contamination levels. The design of the tank is generated for effective and efficient flocculation, coagulation and other treatment processes. The developed design will supply water to a population of 100,000 people.

In the context of the project, these objectives mean that the project is not necessarily trying to find the best sanitation technology for a given problem but to list the conditions where SSWTP represents an efficient alternative to either conventional sewage or on-site wastewater treatment/disposal technologies. To detail these points is within the scope of the SSWTP project. As the former point basically refers to technical points the project focuses also on nontechnical problems. Here it is anticipated that the planning and implementation framework for sanitation projects will be described in a way that allows the future implementation of such projects.

Water treatment analysis

Water is the natural resource that covers more than 70% of the earth. However, only a small part of this water is available for drinking purpose. The impurities such as microorganisms, metal salts and other contaminants pollute the pure water. Therefore, water treatment plants are designed to reduce the impurities from water and making it usable for the people. The design of the treatment tank consists of impellers, inlets for water input, outlets for waste discard and finally the treated water is supplied to the people through pipelines (Spiller et al, 2015). The requirement of pure water generates because the animate and inanimate compounds cause numerous diseases like diarrhea, cholera, etc. therefore, it is very important to design an effective plant for treating the water (Marzouk and Elkadi, 2016). This water does **not** need water softening. An even weaker solvent occurs as water is mixed with co2 to form very low carbonic acid. When water passes through dirt and rock,it dissolves and retains only small concentrations of minerals in solution. The two most common minerals that make water warm are calcium and magnesium decreases, which is correlated with the concentration of multivalent cations dissolved in water.

Disinfection

The use of disinfectants like chlorine, ozone and ultraviolet rays is done to disinfect the water and remove the odor from it. This process is done after the suspended impurities are removed from water. However, a required amount of disinfectant is added to treat water because hyper amount is lethal to the body. The ozone and UV treatment kills the microorganisms in the water but they also neutralize all the minerals of the water due to which the electrolyte content of the body decreases. Therefore, chlorine is a suggested disinfectant in water treatment

Disposal of the waste

At every step of water treatment, a huge amount of waste generates. All the waste generated however, is not harmful therefore, the waste is segregated and then used for different purposes. Many people use the waste as fertilizers in agriculture to improve the quality of the soil because the waste contains high amount of minerals and salts that are good for the health of soil. It is also found that people have used the water treatment waste in production of the bricks due to high amount of gravel in the soil.

Apart from this, the waste should not be disposed directly into the water bodies because of the high amount of chemical in it. it can be stored in the areas where no leakage and breaches are present so that it does not flow during rainy days. Therefore, it should be constantly managed and maintained.

1.1 Assessment of the EBAT

Energy balance assessment tool is a software tool to estimate the total carbon emission of the treatment plant. The carbon emission is harmful for the environment as it supports global warming. The trace effluents from the water treatment plants are very high therefore, the design of the treatment tank should also consider ways to reduce the carbon emission in the treatment plant.

1.2**Emission of total carbon**

The total carbon emission in the form of COD and from other organic and inorganic sources is very high and is contributing in the environmental problems. The parameters are used to find the current emission of the carbon in the water treatment plants and it is 12560488 COD Kg/ year. The reduction in the rainfall decreases the amount of water required therefore, the total emission decreases 100%. The carbon cut was found to be -100% from the EBAT tool.

According to toolbox provided I found CO2 emission is almost **0.04** kg CO2 e/year.

1.3 Carbon emissions in 2050 when population increase is 0.2%

The population is increasing at an alarming rate and their requirements are also increasing. Therefore, the carbon emission is also increasing and affecting the environment by contributing in global warming. If the population increases by 0.2%, the water treatment plant has to be modified accordingly which can result in the increased carbon and other greenhouse gas emission like methane. However, new innovative technologies can be helpful and might result in reduction of the carbon emission (Kiss et al, 2015). Rain water harvesting technologies can be developed to reduce the energy consumption and carbon emission from these plants. **Total carbon emission would be 0.07288 kg CO2 e/year.**

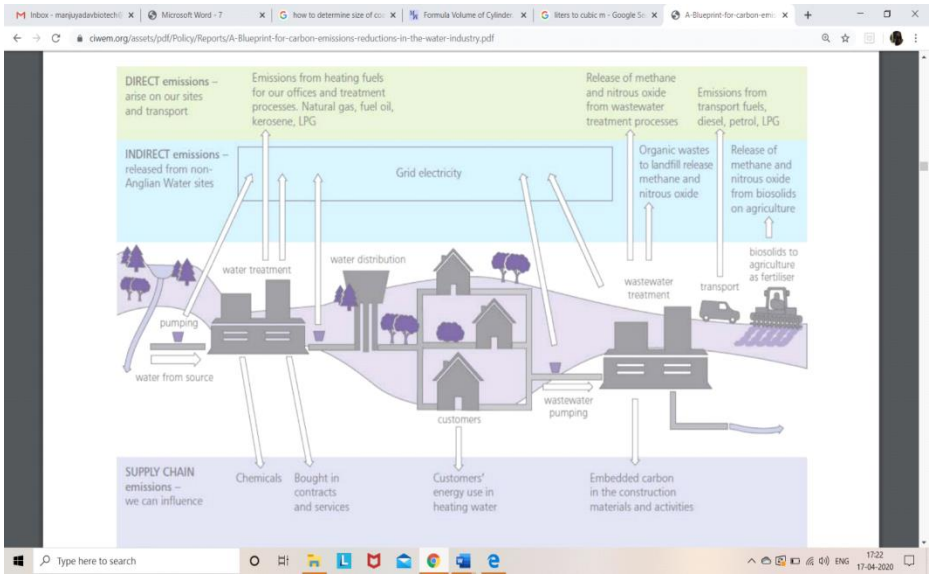


Fig: Illustration of sources of carbon from water treatment plant (CIWEM, 2013)

1.4 Solutions for carbon neutral treatment plant by 2050

As the technologies are improvising and technologies are emerging, many solutions can arise for reduction of the carbon emission (Capros et al, 2016). By finding the solutions to carbon emission the environment can be protected from the harmful effect of the greenhouse gases. The waste produced is currently used for biogas production. The biogas production is effective in managing the waste but it produces methane and other gases in large amount due to which there is dire requirement to outline solutions for the protecting the environment. Many solutions have been put forward to reduce the carbon emission till 2050 like:

- The waste produced can be used in agriculture at a large scale so that the carbon will not be released in the environment in the form of waste.
- Bricks and other gravel objects can be manufactured to decarbonize the environment.
- Desalination of the water resources can act as new sources for meeting water scarcity. Because the increasing population will require more water.

- Result and discussion

- The results show that the requirement of the effective design is important to treat water and reduce the carbon emission. The carbon emission results from the energy used in operation of the tank and the generation of COD. For coagulation tanks, it is advised that the slow rotation is required for interacting the colloidal and suspended particles. The application of the Stokes's law and other equations are used to determine the interaction efficiency of the particles and power required for operating the treatment tank. The calculated values for the coagulation and flocculation tank with carbon emission is shown in the table 1 and the separation of the impurities through different processes is shown in table 2.

- Table 1

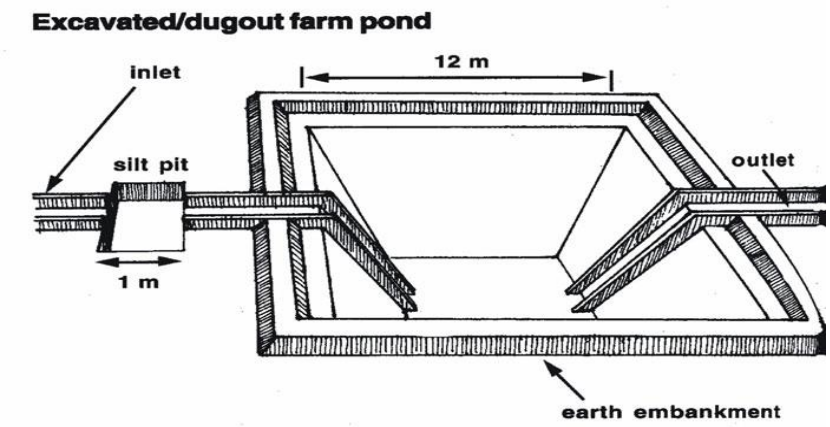
No. of tanks	10
Power for mixing	55,803W
diameter of the tank	1.4 m
Total volume for one cycle of treatment	500 liters
Total water treatment if consumption is 20 liter/ person	50,000 gallons/day
Size of the tank	6 meters approximately
Carbon Emission by 2050	0.07288 kg CO2 e/yr

- Table 2

E. coli	Flocculation 900per 100ml
Calcium ions	Coagulation
Magnesium ions	Coagulation
Iron	Aeration followed by flocculation 100-300mg/l
Turbidity	Clarification and filtration less than 4 NTU

1.2 Farm Pond

A farm pond is a large hole dug out in the earth, usually square or rectangular in shape, which harvests rainwater and stores it for future use. It has an inlet to regulate inflow and an outlet to discharge excess water. The pond is surrounded by a small bund, which prevents erosion on the banks of the pond. The size and depth depend on the amount of land available, the type of soil, the farmer's water requirements, the cost of excavation, and the possible uses of the excavated earth. Water from the farm pond is conveyed to the fields manually, by pumping, or by both methods.



Surface pond

Surface ponds are considered to collect surface runoff from farm area into a local depression or the lowest portion of the farm so that the excavation is minimum expect to construct the earthen bund surrounding the water body (Fig.3a) These are possible in highly eroded farm areas with undulating topography. Such farm ponds do not require inlet provision but is should have outlet provision in the earthen bund to remove the excess flow.

FIG . FARM POUND

Spring or Creek Fed Ponds

In the ridge portions of the farm area, particularly hilly catchments, after saturation of the soil, there will be a flow from the subsurface layers drawing water into the pond (Fig.3b) The sub surface flow is called base flow. It may be a perennial source for water within a farm.

Off Stream Storage Ponds

The streams are seasonal from which water is drawn into the farm pond by diversion (Fig.3c). When the stream flows are the source of storage, the farm ponds should never be constructed across the streams and the structure must be located off the stream with proper diversion of water through pipe or channel.

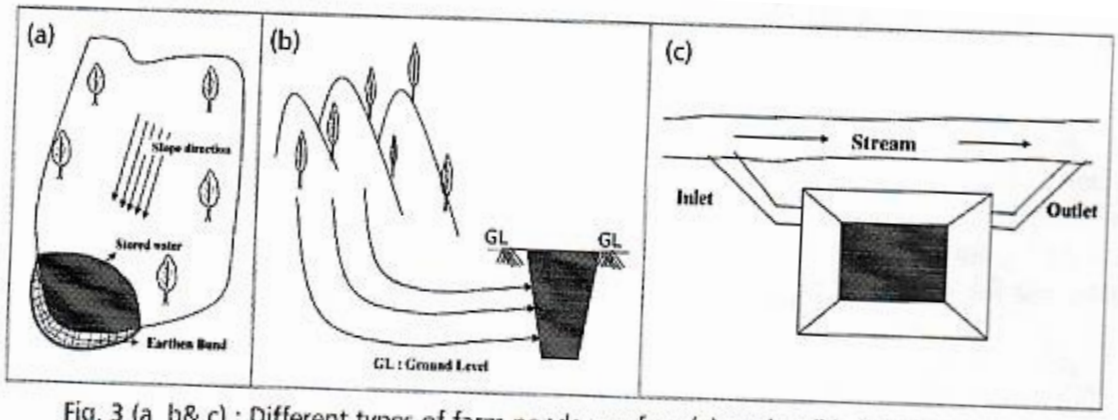


Fig. 3 (a, b& c) : Different types of farm ponds : surface (a), spring (b) and offstream (c) and their location in the catchment

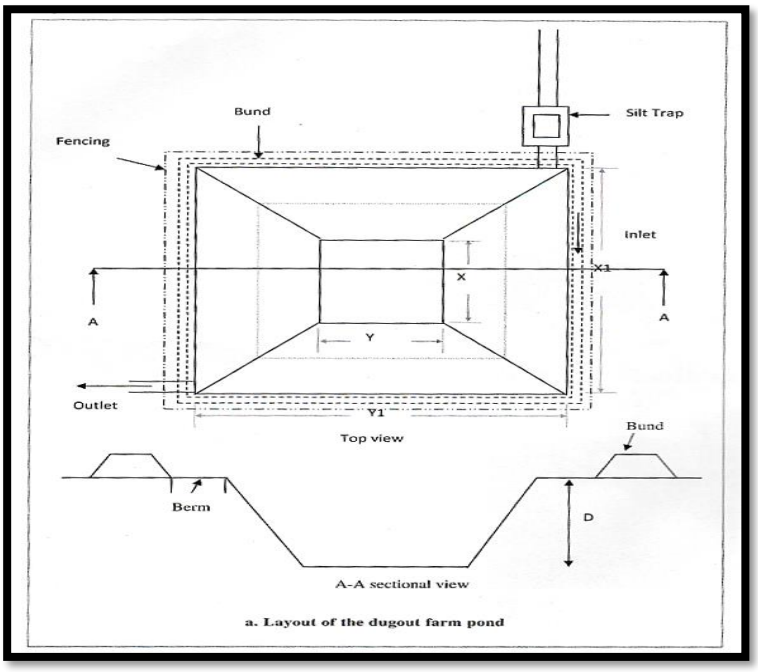


Fig:layout of farmpound

FIG:FARM POUND

Advantages of Farm Ponds

- They provide water to start growing crops, without waiting for rain to fall.
- They provide irrigation water during dry spells between rainfalls. This increases the yield, the number of crops in one year, and the diversity of crops that can be grown.
- Bunds can be used to raise vegetables and fruit trees,thus supplying the farm household with an additional source of income and of nutritious food.
- Farmers are able to apply adequate farm inputs and perform farming operations at the appropriate time, thus increasing their productivity and their confidence in farming.
- They check soil erosion and minimizes siltation of waterways and reservoirs.
- They supplies water for domestic purposes and livestock
- They promote fish rearing.

Conclusion

- It can be concluded from the above project that the design of the treatment tank is important to treat the water effectively. The water contamination can result in number of diseases therefore, it is very essential to treat the water. It can also be concluded that the energy balance is important to maintain by reducing the carbon emission in the environment. The waste disposal management is equally important to maintain the environment and to stop the leakage of the waste into water reservoirs.We got field knowledge about the farm pond and pond structures like surface pond, sub surface ponds and various types of ponds
- The farm ponds is useful to the farmers in agricultural areas. Once the farm pond project is completed it may irrigated few acres of land and it can provide drinking water facility to few villages .
- Farm ponds are also used in industrial areas, residential buildings etc..
- Although farm ponds are costly but saves water and nutrient rich top soil from permanent loss.
- There is a need to have active and holding mechanism for making any programme a success.

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