**A TECHNICAL REPORT ON THE**

**INTEGRATED WATSEWATER MANAGEMENT FOR AGRICULTURE AND FOOD SECURITY IN NIGERIA**

**BY**

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**ABSTRACT**

This article discusses the essentials concerning waste water and the food security and agricultural system using Nigeria as a case study. It also discusses the utilisation of waste water for the improvement of the agricultural system which would in turn improve food security.

Due to the constantly changing environmental factors, water stress tends to increase causing scarcity and unmet needs and wants. The integration of waste water can help to meet this need adequately.

* 1. **CHAPTER ONE**
  2. **INTRODUCTION**

Various studies and research works on waste water have proven that waste water can be utilised over and over again as a result of various purification processes in which these waste water can undergo in order to make it pure for use again.

Although developed and rapidly developing countries have the advanced technologies and systems to make the purification process of waste water manifest, other underdeveloped countries do not have this advantage although they can be referred to as the latter who actually need these capacity for human needs and production.

The need for water is at a high rate, and one of the most important use which fosters the high demand is the upholding of food security and the agricultural sector which is one of the major sector which contributes to any and every economy of the diverse countries of the world.

Waste water has been so utilised in developing countries for the management of agricultural and food security and this knowledge is one which every country of the world should learn and imbibe.

**STATEMENT OF PROBLEM**

The rate of food production in some parts of Nigeria, especially the no riverine areas, tend to fall below the demand rate. One of the reasons is the lack of water for the utilisation in the agricultural system which depreciates the quality of food security services being rendered.

Also, the improper disposal of waste water can serve as pollution. Water pollution has rendered a large volume of water useless and unusable for human needs.

**2.0 LITERATURE REVIEW**

**2.1 WASTE WATER**

Waste water another name which is used to refer to as used water.this is water that has been used for various purposes such as; domestic uses, industrial uses, laboratory uses, etc. according to Science for changing world(2020), waste water includes substances such as human waste, food craps, oils, soaps, and chemicals. Also according to them, in homes, water from sinks, showers, bathtubs, toilets, washing machines and dishwashers are also waste water.

**2.1.1. EFFECT OF WASTE WATER ON THE ENVIRONMENT**

When waste water is not properly treated and disposed, it has adverse effect on animals, humans, plants and also the aquatic life. Some of the effects are;

1. Decaying organic matter and debris can use up the dissolves oxygen in a lake so fish and other aquatic biota cannot survive.
2. Excessive nutrients such as phosphorus and nitrogen (including ammonia) can cause eutrophication, or over-fertilization of receiving waters, which can be toxic to aquatic organisms, promote excessive plant growth, reduce available oxygen, harm spawning grounds, alter habitat and lead to aa decline in certain species.
3. Chlorine compounds and inorganic chloramines can be toxicto aquatic invertebrates, algae and fish.
4. Bacteria, viruses and disease-causative pathogens can pollute beaches and contaminate shellfish populations, leading to restrictions on human recreation, drinking water consumption and shellfish consumption.
5. Other substances such as some pharmaceutical and personal care product, primarily entering the environment in waste water effluents, may also pose threats to human health, aquatic life, and wild life.

**2.1.2. WASTE WATER TREATMENT**

The major aim of waste water treatment is to remove as much of the suspended solids as possible before the remaining water called effluent, I discharged back to the environment. As solid materials decays, it uses up oxygen, which is needed by plants and animals living in the water.

**2.1.3 PROCESSES INVOLVED IN WASTE WATER TREATMENT**

Waste water treatment is a relatively modern practice, introduced in the 19th century. Wastewater treatment plants effectively carry out the same cleansing process that occurs naturally in oceans, lakes and rivers; but on a much quicker scale. The proper treatment of wastewater helps to protect both the environment and the people and creatures that inhabit it.The Stages of Wastewater Treatment are as follows:

1. **Preliminary screening and treatment**

First of all, wastewater has to be screened; so large objects (e.g. nappies, sanitary items, cotton buds, facial wipes, bottle lids etc.) can be removed, to prevent damage being caused to the equipment used in the following stages. This stage involves large screens that allow water to pass through, but not floating particles and other pollutants. This removes approximately 40-50% of solid materials from the wastewater, and all materials are collected and disposed of properly. Once this initial screening has been performed, the water flows on to the next stages of the treatment process.

1. **Primary treatment**

The primary treatment stage starts by filtering the wastewater through a grit chamber, which removes coarse solids, like rock sediment, metal, bone, and other larger particles of debris from the water. Once this has been completed, the sewage water moves on to a sedimentation tank, where minute particles of organic and inorganic matter are removed. The flow of the water is slowed down, causing the suspended materials to gradually sink to the bottom of the tank. This process is often aided by the addition of coagulants and flocculants. Read more about the role of flocculants and the role of coagulants in wastewater treatment, in our wastewater treatment chemicals series.

1. **Secondary treatment**

The secondary stage of treatment for wastewater generally removes 85-90% of the remaining pollutants present, and is a biological process that uses oxidation to purify the water further. This can be carried out using one of three methods:

Biofiltration uses sand filters, contact filters or tricking filters to remove additional sediment from wastewater. Of these three filters, trickling filters are typically the most effective for small-batch wastewater treatment.

Aeration involves mixing wastewater with a solution of microorganisms. The resulting mixture is then aerated for up to 30 hours at a time to ensure optimum results. A part of this mixture of solid wastes and microorganisms joined together can often be combined with air and reused. This ‘activated sludge’ can improve the fertility of soil for growing crops, or be used as a component in the process of producing methane gas.

Oxidation Ponds are generally used in warmer climates, and they use natural bodies of water, like lakes and lagoons. The wastewater is allowed to pass through the body of water for a period of time, before being retained for a period of up to three weeks.

Tertiary treatment

At one time, primary and secondary treatment processes would have been sufficient to purify wastewater for reuse. However, new pollutants have created more work for wastewater treatment systems. These additional pollutants include pathogens, heavy metals, chemical compounds and other toxic substances, and they can persist in wastewater solutions after the first two treatment processes have been completed, as they are more difficult to remove from water.

Tertiary treatment tends to either consist of a type of physical or chemical process, or sometimes a combination of the two. Wastewater treatment chemicals, like chlorine and sodium hypochlorite, are added to the wastewater to remove harmful pathogens that cause cholera, polio, typhoid, and other diseases.

Phosphorus removal, as well as nitrogen removal, can be carried out using biological treatment methods; although sand or mixed media filters, cloth discs, membranes, or other treatment units, like reverse osmosis filters, can also reduce suspended solids and phosphorus to very low levels.

Air stripping or activated carbons (carbon adsorption) are also sometimes used for the removal of volatile organic chemicals (VOCs) from wastewater. You can learn more about the role of activated carbons in water treatment here.

1. **Post treatment**

Once these wastewater treatment processes, either alone or in combination, have been performed, almost any degree of pollution control can be achieved. Wastewater that has been purified by these treatments can be used for industrial, agricultural, or recreational purposes, including drinking water supplies.

**BENEFITS OF TREATING WASTE WATER**

Below are three essential reasons why waste management is important.

1. **Recycling Materials**

One significant benefit of waste management is the fact that you can recycle the material and use it in different ways. What this means is that, when the waste is recycled for more uses, the same garbage won’t need to be taken from the environment to make the same product again.

The environment benefits from recycling because there is less waste which is thrown in the designated areas. This won’t cause harm to the people who live in the surrounding areas near the dump site.

Another good thing about recycling is that a business opportunity can come out of it. People can recycle the materials and sell them for other purposes. What this will do, is attract other people who are conscious about conserving the environment and will want to help in keeping it clean.

1. **Health**

When trash is dumped without any regulations, it can cause health hazards, and it is an eyesore. Garbage which has been stored for some time emits toxic chemicals when it mixes with other waste components. What this means is that if the trash is not taken care of immediately, that toxic material can enter the soil and in the water resources making it pollute the water and food that people consume. This will be harmful to the public health and a hazard to the environment.

People usually burn their trash as a way of disposing of it. However, this emits greenhouse gases that contribute to global warming by affecting the ozone layer. This has adverse effects on the environment and the lives of all living things.

Proper waste management means that the toxic chemicals are filtered using liners to make sure that it doesn’t enter into the ground.

1. **Make Money**

There are various ways to make money from the waste management. If you live in an area where there are large amounts of waste, you can start a waste collection business. Homeowners and companies are willing to pay someone to get rid of their waste. So why not use this to your advantage?

Another way to make money is by selling the recyclable products and industrial paper to manufacturers. These products include plastic, paper, metal, rubber, and textiles.

You could also decide to process the organic waste and convert it to compost which can be used as organic fertilizer. Some companies make their organic fertilizer from compost and as such, you can sell the compost to them if you produce vast amounts of it. If you decide to recycle compost, you can use it in your farm to feed your soil with nutrients

**2.2 FOOD SECURITY**

Food security is defined as the availability of food and one's access to it. A household is considered food secure when its occupants do not live in hunger or fear of starvation.

Things affecting food security today include:

1. Global Water Crisis - Water table reserves are falling in many countries due to widespread over-pumping and irrigation.
2. Climate Change - Rising global temperatures are beginning to have a ripple effect on crop yields, forest resources, water supplies and altering the balance of nature.
3. Land Degradation - Intensive farming leads to a vicious cycle of exhaustion of soil fertility and decline of agricultural yields.
4. Greedy Land Deals - Corporations and Governments buying rights to millions of acres of agricultural land in developing countries to secure their own long-term food supplies

**2.2.1.** **Importance of food security**

While most of them might seem quite obvious, let’s list all the reasons why food security is important for Nigeria:

1. Everyone has to eat. It goes without saying that we all need food to survive, and if there is food security, then everyone can worry about things other than from where to get food or how to get it.
2. Food is considered a basic human right. Every person is entitled to food, and food security means that everyone can execute this right without too much hassle.
3. Food security is the backbone of the economy. As long as there is food security, the economy has a chance to grow. Many people are involved in all forms of food production, and it is one of the industries that cannot fail.
4. Good food is necessary for people’s good health. As we have mentioned before, food security is when people have access to good food that keeps them healthy. When there is food security, all people get necessary nutrition and keep their health in check.

If a person cannot pay for food, they should not go hungry. Even if someone cannot afford to buy high quality foods, they should at least be able to have access to nutritious food, and when there is food security, they have that ability.

A Country that cannot provide food for its people is at mercy of those who can. If a country is struggling to feed its citizens, the only thing it has to rely on is the mercy of other countries. It is a very unstable option, and it can be used against the country in need.

Hunger is an issue for many Nigerians. As a result of constant conflicts, many people from the Northern Nigeria go hungry because of limited staple harvests, poor labour opportunities and high food prices.

* 1. **CHAPTER THREE**
  2. **USE OF WASTE WATER IN AGRICULTURAL SECTOR TO ENHANCE FOOD SECURITY**

Wastewater is being increasingly used for irrigation in agriculture, both in developing as well as industrialized countries, and is driven by a range of multiple and complementary key drivers. Rapid population growth and high urbanization rates, particularly in cities of the developing world, increased water scarcity and stress and agricultural water demand

for urban and peri-urban food production are, among others, key interacting factors whose interdependencies influence current and future magnitudes of wastewater production, treatment and use in several ways.

Water for irrigation and food production constitutes one of the greatest pressures on fresh water resources. The daily drinking water requirement per person is 2-4 litres, but it takes 2,000 to 5,000 litres of water to produce one person’s daily food. Agriculture is by far the largest consumer of fresh water resources, currently accounting for over 70 per cent of global withdrawals and 86 per cent of the world’s total fresh water consumption.

Despite its apparent high level of usage, the value of wastewater as a potential resource is often underestimated. If managed properly and guidelines for utilization are adhered to, instead of being a source of problems, well-managed wastewater can provide beneficial effects for society, the economy and the environment, ensuring social equity and enhancing food security.

First of all, components found in wastewater can contain useful and valuable nutrients that are required by plants. These nutrients and fertilizers can reduce the input of artificial fertilizers, which not only results in a reduction of the environmental impacts associated with the use and production of artificial fertilizers, but also has positive impacts on farmers’ incomes

Farmers therefore benefit through increased productivity and yields and faster growing cycles, while decreasing their needs for artificial fertilizers and additional water sources (Corcoran et al., 2010).

Another benefit of wastewater lies in its availability. In urban areas where alternative water supplies are lacking, wastewater is an advantageous resource because it is available all year round and is a low-cost option for farmers.

There are also potentially significant positive health effects from improved food supply and nutrition in arid and food-insecure areas. To date, a systematic global assessment of the positive health benefits of the use of wastewater in agriculture has not been conducted and positive health benefits versus health risks will vary widely depending on the setting. For example, subsistence-level farmers who can benefit t most in terms of improved food security and nutrition are also at the highest risk of negative health impacts, especially where untreated wastewater is used for irrigation.

Conversely, in settings where alternative water sources are limited, treatment quality is high, and farming practices and food processing are advanced, potential benefits are likely to significantly outweigh risks. In any context, efforts should be made to quantify positive health impacts on nutrition and food security and

Weigh them against the potential negative health impacts discussed in the next section.

There are, of course, still many instances where farmers either have no other option but to use marginal-quality water resources (such as in regions where reliable water supplies are lacking and discharge of municipal wastewater into the environment pollutes water bodies), or where farmers are unaware that they are directly using wastewater (such as when farmers are located downstream of large cities where wastewater is being dumped into open water).

Planned wastewater use for irrigation, however, is an increasingly important resource in recognition of its potential benefits, especially in urban and peri-urban agriculture. This is driving wastewater use in both developing and industrialized countries – especially in water-scarce areas where alternative supplies are lacking.

* 1. **CHAPTER FOUR**
  2. **CONCLUSION**

Millions of tonnes of valuable resources (e.g. water, nutrients and energy) are wasted every year in the form of wastewater. Recovering these resources for productive activities makes good economic sense and can increase cost recovery in (“productive”) sanitation systems, therefore increasing the project’s sustainability.

An early economic appraisal of reuse projects that includes an economic justification as well as a financial and cost recovery analysis will help to decide on the best strategy in the local context.

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**REFERENCES**

Enva (2020), *How is wastewater treated? A step by step process,* source: Enva site map and policies. Available from: <https://enva.com/case-studies/how-wastewater-treated>.

Legit (2020), *why is food security important in Nigeria? ,* source: Legit.com. Available from: <https://www.google.com/amp/s/www.legit.ng/amp/1163922-importance-food-security-nigeria.html>

Net news ledger (2018), *the top 3 reasons that waste management is important,* source: Netnewsledger. Available from: [www.netnewsledger.com/2018/03/06/top-3-reasons-wate-management-important/](http://www.netnewsledger.com/2018/03/06/top-3-reasons-wate-management-important/).

Science for changing world (2020), *waste water treatment water use,* source: Science for changing world (USGS), Available from: <https://www.usgs.gov/special-topic/water-science-school/science/wastewater-treatment-water-use?qt-science_center_objects=0#qt-science_center_objects>.