Aerobic Wastewater Treatment Packages: An Environmental and Energy-Saving Option

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Abstract
The water management systems throughout the world employ and depend heavily on water supply management approach to cater the demand. This approach is unsustainable in the long run as water demand will eventually overtake water supply. It requires an effective approach like building water retaining structures; dams, canals etc., along with an effective management plan to sustain future needs. A more proper management of water is needed to sustain any adverse conflicts of water supply.

The objective of this work is the development of an aeration wastewater treatment package which includes a well-equipped system that enables a sustainable management in the field of wastewater treatment, low energy consumption, and last but not least low investment and operation costs. The treatment package works by Extended Aeration Method. Performance of these packages is based on the continuous aeration including injection of oxygen gas or air into the aeration chamber via tube aeration diffuser through very small apertures for providing the required oxygen for aerobic bacteria.

Keywords: wastewater treatment, Extended Aeration Method, aerobic bacteria.

Introduction

Water is essential for life and plays a vital role in the proper functioning of the earth's ecosystems. Water pollution has a serious impact on all living creatures, and can have undesired effects to human lives, their activities and also to their environment. Pollution in whole is caused by pollutants which is basically drawn into two types.

Type one pollutants are apparently acute and have short-term damages, while the other are latent, persistent, and carry long-term damages. The first type which includes air, sound pollution and…, are obviously clear and is one of the main concerns of scholars, experts, governmental and NGO bodies around the world as well as the whole community itself. The concern even runs into human daily lives and become part of people's demands and some may even use it as main their main issue for gaining election votes.

The second type of pollutants which are latent, persistent and actually carry long-term damages are recognized to be largely ignored by the international community. The threat is seen in the changing growth rate of human, animal and plant species together with human amenities, comfort, and health and property values. The unseen project done by these pollutants brings the world and the ecosystem to a catastrophe in a slow motion. As a consequence, people have been worriless about the danger it can cause to the future of their lives and therefore, exclude it from their country's development and health agenda budget. However, in some countries, the topic may be part of their political and economical budget agenda but in the end, no serious actions are taken to cure the critical on-going situation. These pollutants persist in the environment in the long term that even the particular sources of the pollution is blur and undefined and the line of affects and effects is also unknown. The examples of this second type of pollutants are industrial, municipal and agriculture wastewater.

According to FAO (Food and Agriculture Organization), the wastewater generated in developing countries is about 600 million cubic meters, which 95% of those without treatment enters the seas, oceans, rivers and underground waters Another recent report done by World Water Development shows that 2 million tons of human waste are disposed in watercourses, and in developing countries 70% of industrial, sanitary and agricultural waste are dumped untreated into water where they pollute the usable water supply (WWD, 2012). Hence, there is a need to adopt measures which can significantly reduce water pollution and at the same time, increase water quality. This also leads to an improvement of wastewater treatment and water efficiency which reduces the water loss. One highlighted valuable option that is known to be environmental and energy-saving is the usage of wastewater treatment packages. Another reason is that the cost difference between septic tank usages in water management varies from the cost of wastewater treatment usage for such purpose. The first, demands for the average of 160 dollar for every 1 cubic meter while the second, only requires an average of 6 dollars for the same amount of water usage.

In the near future, water shortage crisis will paralyze humans and at that time there would be no time for political struggles, expanding geographical borders and ideological challenges. That time is pretty close even closer than finishing fossil fuels. We want 85.5 percent of generated wastewater to return to life cycle and be reused,

while in Asian countries only 2.4% of the generated wastewater returns to life cycle and is being reused. This problem needs your guidance and supervision.
However our children will not be patient toward environmental pollution and it is our responsibility. This environment with all its beauty and divine bounty not only belongs to us, but also all animals and plants are parts of this nature.

1) Design of SHAR Wastewater Treatment Package

A new wastewater treatment package has been invented by Hady Hamidyan (CEO, SHAR WWTP Sdn. Bhd. Malaysia), holder of 8 international awards and 6 GOLD medal, using aeration wastewater treatment package which includes a well-equipped system that enables a sustainable management, low energy consumption, and last but not least low investment and operation costs.

The treatment package works by Extended Aeration Method with depth injection. Performance of these packages is based on the continuous aeration including injection of oxygen gas or air into the aeration chamber via tube aeration diffuser through very small apertures for providing the required oxygen for aerobic bacteria. It is also designed to be back sludge airlift pump-free.

The table below indicates the models of the packages with the details of the power, weight and volume:

1	Models		P1	P2	P3	P4	P5	P6
2	Capacity	$m^3/_d$	1	3	5	7	10	15
3	Power	kw	0/19	0/24	0/37	0/55	0/75	1.2
4	Weight	kg	37	58	90	160	280	340

Table 1: Models and Details of SHAR Packages

Picture 1: A Model 3 $m^3/_d$ SHAR Package

2) Development of SHAR Wastewater Treatment Packages

2.1: Project Site

SHAR WWTP Sdn. Bhd. has chosen Iran to be the site for longitude developmental project in four years time; 2011-2014. Primarily the site was selected and make available by the regional administration, considering its geographical and climatic features to the targeted project.

Iran is covered by a remarkable salt swamp and partly by areas of loose sand of surrounding mountains. The climate is one of great extremes due to its geographic location and varied topography. The average annual rainfall is 230 mm, while rate of evaporation exceed 2000mm annually. Approximately, 90% of the country is arid or semi-arid and located in the interior and far-south which is characterized by long, warm and dry spells, lasting sometimes over seven months. About 23% of the rain falls in spring, 4% in summer, 23% in autumn and 50% in winter as snow fall.

2.2: Method of Project

The development approach consist of three phase which is collection of data, analyze of data, implementation of invention.

Phase One

Collection of baseline data such as soil and wastewater data, metrological and hydrogeological data. Scientific information that was gathered on the biophysical and socio-economic conditions which came from concerned such as Minister of Energy (MOE), Water Affairs Department (WAD), Water Resources Management Company (WRMC), Provincial Water Authorities (PWA) Irrigation and Drainage Operation and Maintenance Companies (O&M), Water and Wastewater Engineering Companies (WWEC) and National Water and Wastewater Engineering Company (NWWEC) were also collected.

Phase Two

Analyze data using both qualitative and quantitative techniques.

Phase Three

Implementation of designed models namely SHAR packages, according to geographical location as well as being based on available standards and legal requirements.

3) Results of Project: Impact to the Environment and Energy-Saving

During operation phase, access to urban water supply has increased from 75% to 99%. Yet, a number of challenges remain in rural areas.

Out of 3,547.8 MCM sewage was produced and only 328.2MCM was used for mainly irrigation while it is estimated over 90% of the country's wastewater is treated by wastewater treatment by both dams and packages.

The package is known to have necessary adaption measures that deal with climate variability and is built upon existing land and water management practices, thus creates resilience to climate change and able to enhance water security and directly contribute to the development itself.

The feedbacks were mostly positive. Below is the list of feedbacks gained through interviews and surveys:

- Portable and light.
- Easy maintenance.
- Stainless and anti-corrosion.
- Low power consumption.
- Without the back sludge airlift, dislodging works become easier and saving (no dislodging trucks needed).
- Least required space for installation.
- No need of permanent operator due to its automatic application.
- Able to evacuate in surface water, agriculture lands and lawns.

Demands for installation of the package has increased throughout the years from 5 to 63 to 180 and 233 packages in the last year, respectively.

In whole, the percentage of population served by drinking water systems and wastewater treatment is, 75% and 45%, respectively. The figures is estimated to dramatically improve in the becoming years as the result of these installments.

Row	Parameter	Unit	Range	Method
1	Temperature	O C	29	St. M. 2550
2	EC	µs/cm	1910	St. M. 2510
3	pH	-	7.8	St. M. pH Value-B
4	DO	mg/l	0.4	O-G-4500 .St. M
5	COD	mg/l	709	St. M. 5220-D
6	BOD5	mg/l	346	St. M. 5210-B
7	NO3	mg/l	51	St. M. 4500-NO3
8	PO4	mg/l	9.5	St. M. 4500-P
9	TDS	mg/l	1240	St. M. 2540-C
10	TSS	mg/l	242	St. M. 2540-D
11	Focal coliforms	No./100cc	>1100	MPN/100ml
12	Total Coliforms	No./100cc	>1100	MPN/100ml

Table 2: Result of Inlet Analysis from SHAR Package,
Hotel Restaurant Nour City

Row	Parameter	Unit	Range	Method
1	Temperature	O C	25	St. M. 2550
2	EC	µs/cm	591	St. M. 2510
3	pH	-	7.2	St. M. pH Value-B
4	DO	mg/l	2.7	O-G-4500 .St. M
5	COD	mg/l	62	St. M. 5220-D
6	BOD5	mg/l	31	St. M. 5210-B
7	NO3	mg/l	18	St. M. 4500-NO3
8	PO4	mg/l	2.9	St. M. 4500-P
9	TDS	mg/l	102	St. M. 2540-C
10	TSS	mg/l	45	St. M. 2540-D
11	Focal coliforms	No./100cc	0	MPN/100ml
12	Total Coliforms	No./100cc	1	MPN/100ml

Analysis Correspond To the Requested Test ☑

Typing Results Correspond To the Analysis Results ☑

Table 2: Result of Outlet Analysis from SHAR Package,
Hotel Restaurant Nour City

4) Conclusion and Recommendations

Nowadays, the wastewater treatment in developing countries are commonly using septic tanks rather than wastewater packages. People are not aware that septic tanks only treats 30% of the sludge and wastewater. Furthermore, high additional cost is also undertaken for the building and maintenance of absorber wells which in actual gives negative impacts to the environment silently. The inefficient ways of treatment leads the unwell-digested water to pollute the underground water as well as seas, oceans and the ecology system.

The management of water is not merely a technical issue. It requires a mix of measures including changes in policies, prices and other incentives, as well as infrastructure and physical installations. The current situation is that only 2.4% of the disputed wastewater is reused in human activities as well as to not create damage to the environment. The truth is that we can actually recycle 90% of them to be recycled back to the environment.

As the subsequence of the longitude developmental research, we have come out with some suggestions and recommendations for future applications, those are;
- A framework and educational model is needed to build up the environmental education and ecological culture in the global community; starting from early age to adolescents.
- An effective and proper wastewater management along with prevention of water-related pollution is needed. However, the management control of other waste disposal; air, agricultural fertilizers and pesticides, soil, sound, radioactive wave etc. should also be included.
- Measures to be adopted which addresses on recycling for productive purposes and reusing the waste that has been significantly improved in quality and structure.
- Efforts to be made for encouraging industries, constructers and all concerned bodies to implement centralized system and management treatment.
- A global investment should be made on new innovative inventions that benefits the sustainability of the environment and the development.
- A development of international agenda or framework should be built in preserving the environment which refers to global action and cooperation as well as having rules and legislations to be followed properly by every country.
- A treaty organization should be signed by countries all over the world to defend and preserve the sustainability of the environment.
- Established international conservation organization: environmental NATO called: **ETO** (Environmental Treaty Organization)

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