AEROBIO

(NOVEL MICROBIAL CONSORTIA)

A SOLUTION TO HUMAN WASTE MANAGEMENT

(The R&D of the product has been certified by an Institution under aegis of Govt of India)

AEROBIO®

Mfd by :

ADVANTAGES OF AEROBIO

Aerobic Bacteria are very efficient in breaking down organic waste products including complex forms. The end product of Aerobic bacteria are CO2 and H20.

The result of Aerobic Treatment usually yields better effluent quality. The Aerobic pathway also releases a substantial amount of energy. A portion is used by the microorganisms for synthesis and growth of new micro-organism.

Developed by W.J. Decor
Research & development done under MOU Sign with Accredited Government institution.

THE PROPOSAL

OBJECTIVE

To implement AEROBIO the Aerobic Bacteria in the state for better waste management and reduce the spread of diseases and improve of life in the state.
Few areas of investment today have as much to offer the global shift towards sustainable development as sanitation and wastewater management. Gaps in access to decent, functioning sanitation are clear markers of inequality and disadvantage. Unsafe management of excreta and wastewater expose populations to disease, and degrade ecosystems and the services they provide.
This project shows how this radical change might take shape. To put the scale of the opportunity into perspective, globally we produce an estimated 9.5 million m3 of human excreta2 and 900 million m3 of municipal wastewater every day.
To realize these opportunities, massive investment in sanitation and wastewater management systems is needed; to address existing gaps in provision and make the transition to more sustainable systems. What form those investments and systems take has major implications for global sustainable development.
The AEROBIC technology has been researched and developed by W.J.Decor with the Research and Development and formulation undertaken by IISER, Kolkata, West Bengal and Institution under the Government of India.

METHOD

New technologies involving biological communities are increasingly used as part of innovative solutions to tackle issues such as dealing with sewage and human fecal contamination of the environment. Based on the existing knowledge, we have developed a new consortia of bacteria called AEROBIO that are capable of fast breakdown of human feces. With continuous and detailed research over months these bacteria have been made more efficient in using human feces as food for growth and in turn breakdown the component of human feces.
The bacteria has proven to be very useful to tackle environmental issues in particular those of public health concerns such as ground water contamination with human feces

SUMMARY

AEROBIO is very useful in breaking down organic waste product including complex forms. The end product of Aerobic Bacteria is Carbon Dioxide and Water. Which are safe components to be released to the environment.
The result of the Aerobic Bacteria yields better effluent quality. The Aerobic pathway also releases a substantial amount of energy. A portion is used by the micrорganism for synthesis and growth of new microorganism.

Key Features

- Improved sanitation and wastewater management can generate energy resources and mitigate GHG emissions.
- Recycling water resources results in less freshwater that must be abstracted from natural systems to meet human demand, contributing to environmental sustainability

THE SITUATION TODAY

The status of sanitation and wastewater management today differs widely around the world as do the challenges of making them more sustainable. Waterborne excreta management (with flush toilets and sewer networks connected to a centralized wastewater treatment plant) is the standard in many places, especially in urban areas and richer countries. However, large segments of the population in some regions lack a sewer network connection. For example, only around 10 per cent of the populations of some states in the country (including Maharashtra and Uttar Pradesh) are connected to a sewer system. Worldwide, about 2.7 billion people are thought to use some kind of onsite sanitation system (e.g. pit latrine, septic tank) requiring faecal sludge management. Users of on-site sanitation are expected to almost double by 2030.

Furthermore, in many states untreated wastewater and excreta pollute streets, agricultural land and freshwater bodies. However, when making any generalizations about the national situation, it is important to acknowledge that there is limited information available concerning wastewater management in the Northeast region. According to a national assessment, only 20 states have collected complete data on their wastewater management, including information on production, treatment and reuse, while the rest other states have collected no data at all. Based on the available data it has been estimated that on average 30 per cent of wastewater is released untreated in high income countries, rising to 62 and 72 per cent, respectively, in upper-middle and lower-middle income states, and 92 per cent in low-income communities and states. According to another analysis, nationally perhaps 90 per cent of wastewater that is released into the environment is untreated.

The development of sanitation and wastewater management is also following very different paths in different parts of the country. Many drivers shape sanitation development, not least patterns of urbanization, existing infrastructure and preconceptions about what constitutes "modern" sanitation. In many cases, current trends seem incompatible with sustainable development. For example, while centralized waterborne systems are widely associated with modernity and advancement, they are being built in areas facing growing competition for limited water resources. And taking India as a whole, only 15 per cent of the population have private connections to piped water networks, making waterborne excreta management far more difficult. As this project seeks to show, low-water and non waterborne systems are being recognized as often the most appropriate, sustainable solution, even in non metropolitan cities.

The sanitation and wastewater management sector has suffered from lack of political prioritization, further complicating already complex challenges. For instance, poor governance (e.g. weak regulation and enforcement, limited capacities of public authorities and service providers) and inadequate attention to operation and maintenance (O&M) have led to systems malfunctioning and falling out of use, particularly shared or public facilities. In addition, sanitation programmes have often failed to overcome cultural barriers to sustained behavior change (e.g. ending open defecation).

The difficulty of overcoming these challenges can be seen in the low coverage achieved and high failure rates for sanitation and wastewater management projects reported in many countries around the country. The case for investing in sustainable sanitation is growing stronger. It is already well established that appropriate sanitation and wastewater management can pay for itself many times over due to to reduced health care costs and associated increases in productivity.

SANITATION WASTEWATER MANAGEMENT

How do we bring about the transformational shift to sustainable sanitation and wastewater management? What does it look like in practice? We do have all the answers, with our AEROBIO aerobic bacteria solution that will help us sustain waste water management for all the days to come.

Technologies are developing fast. We have a much better understanding of the social and institutional factors that influence success. Our product have stood the test of time and are being successfully scaled up. Most importantly, there is a growing willingness to talk about sanitation and its role – among politicians, development practitioners and in public discourse.

Key sustainability dimensions in sanitation and wastewater management

OUR SOLUTION

Our Product Aims at resolving the issues that every state in the country aims at eliminating with human waste management at the source with the most efficient technology known in the present day.

Aerobio takes care of the following issues:

- Unsafe management of excreta and wastewater is widespread and creates significant health and environmental risks.
- Sustainable sanitation and wastewater management systems are those that minimize depletion of the resource base, protect and promote human health, minimize environmental degradation, are technically and institutionally appropriate, socially acceptable and economically viable in the long term
- A vision of resource-efficient, circular economies is unachievable without radical change in how we manage wastewater, excreta and other biomass waste.
- Sustainable sanitation and wastewater management will be central, even fundamental, to fulfilling the 2020 Agenda

RETHINKING WASTE WATER

Bold, innovative solutions to the challenges of sustainable development like AEROBIO will require for thinking about wastewater and other sanitation waste.

One reason for the slower progress in a emerging cities like ours, resource recovery from wastewater and sanitation waste streams may be a high degree of lock-in the shape of urban sewerage networks designed to mix and transport liquid waste flows, including waterborne excreta. These are expensive and difficult to upgrade or replace. As these systems age, however, the need for repair and replacement increases and it is here that innovations like handling the waste management at the source should be introduced. New urban and peri-urban developments have the chance to leapfrog over conventional sewerage and build source-separating systems optimized for cost-effective resource recovery from the beginning.

It is also important to realize that wastewater need not be seen as a fixed, unchangeable substance. Its nature and composition can be changed by restricting what is allowed to enter the wastewater stream, or by separating different streams at their source. Wastewater can be reduced in volume, and even be turned into a solid. It can be treated to remove the pathogens and pollutants that make it hazardous.

WATER SECURITY

Water consumption by human activities has grown twice as fast as the global population since 1900, from around 600 billion m3 to 4,500 billion m3 in 2010, and is expected to grow by more than 50 per cent again by 2050.

Sustainable development requires access to safe drinking water and hygiene facilities as well as protection of aquatic and terrestrial ecosystems. Water security is a growing problem for many arid and semi-arid areas, and those where demand from industry, energy generation, agriculture, freshwater supply and ecosystem replenishment outstrips availability. Sustainable sanitation and wastewater management systems can relieve these pressures in two ways: first, by reducing the input of freshwater into the system, particularly by using low-flush or dry toilets, and second by making the water fraction of wastewater available for safe reuse or environmental release.

Improved water use efficiency and reduction of water consumption can add up to significant water savings. This in turn reduces the energy and infrastructure requirements of the water and wastewater system, since it reduces the volume of wastewater that needs treatment and thus allows more efficient and specific treatment of different excreta and wastewater fractions. Water savings using dry or low-waste systems can vary between 6 m3/person and 25 m3/person annually, depending on waste separating techniques.

Water released from processing directly using AEROBIO can be used for irrigation or back to the ground safely with no contamination or even further processed for household usage to eradicate issues in many parts of the state during the dry season and maintain constant water supply for their daily use. It has been proven that water after processed using the AEROBIO product is safe enough and reduction of contamination in bore wells in very densely populated areas in the city which causes a number of diseases in the present time.

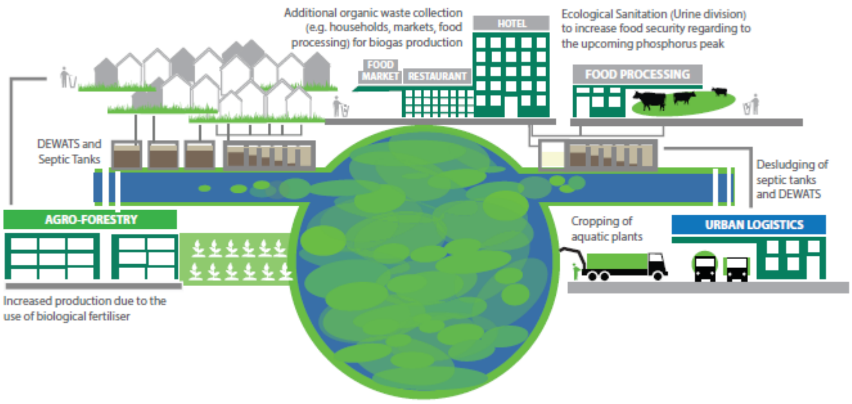
VALUE OF SUSTAINABLE SANITATION & WASTEWATER MANAGEMENT USING AEROBIO

More sustainable sanitation and wastewater management could yield vast economic (as well as social and environmental) benefits for societies. Many of these benefits come in the form of savings of costs linked to inadequate sanitation and wastewater management – most notably in health care, but also in terms of lost economic productivity, reduced ecosystem services and others. In India, for example, the estimated economic savings available through providing adequate sanitation to all (i.e. without taking into account benefits from wastewater/excreta management or resource recovery) have been estimated at US$54 billion annually.

Such economic benefits should be explored and factored into the financial planning of any program to build or upgrade sanitation and wastewater management systems. Figure 2.1 shows some estimates of the economic benefits that could become available from resource recovery. As the figure shows, improved management and recovery of waste resources could produce additional benefits in areas as diverse as natural water management, food security, renewable energy production and climate change mitigation.

ADVANTAGES OF AEROBIO IN SUSTAINABLE SANITATION AND WASTE WATER MANAGEMENT

- Complete removal of methane gas emission from human waste water.
- Complete Diluted pH, alkaline and neutral distilled water at the source safe to be released in the environment eradicating soil pollution.
- Bacteria in formulation belong to enterobacteriocese.
- Water processing does not require an STP or a Waste Management Plant but work at the source cess pool or bio toilet thereby reducing operational and maintenance cost.
- The result of Aerobic treatment yields better effluent quality results releasing a substantial amount of energy.
- AEROBIO is very efficient in breaking down organic waste product including complex forms and the end product is Carbon Dioxide and Water safe for the environment and ground water removing contamination of both.
- AEROBIO is totally harmless and an eco friendly bacteria consortia.
- Can be used in house-holds, institutes, biotoilets and STP for decontamination and breaking down of human feacal matter into non toxic clean water for reuse.



POTENTIAL ADDED VALUE OF RESOURCE RECOVERY IN THE CITY OF VIENTIANE

ECONOMICAL ADVANTAGE OF AEROBIO

The opportunity costs of additional access time, poor water quality and negative impacts on a states economy. To these we could add a range of other sustainable development issues that can be addressed through sustainable sanitation and wastewater management:

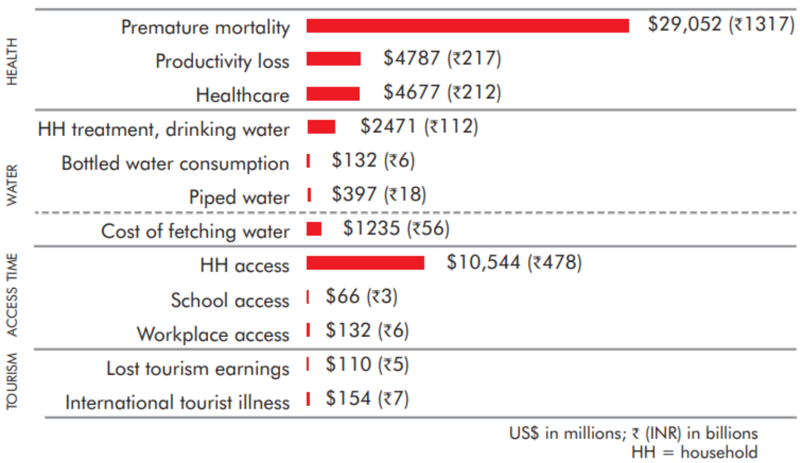
- Disaster resilience: sustainable sanitation systems using AEROBIO can contribute to keeping wastewater safely contained during floods and other disasters, reducing health risks, especially among the most vulnerable.
- Educational opportunities: diarrhea and other sickness spread by untreated wastewater can result in missed school, and reduce the cognitive ability of children due to under-nutrition. Lockable sanitation facilities, especially with provision for menstrual health management, at schools can remove important obstacles to education for adolescent girls. AEROBIO helps decontamination of waste water reducing such sanitation related illness.
- Personal safety: people, especially girls and women, risk violence and other types of harm when they have to walk a long way for open defecation or to access a sanitation facility. Thus having close access to a facility can improve personal safety.

In addition to the reductions in disease incidence offered by improved sanitation using AEROBIO, resource recovery and safe agricultural reuse can contribute a range of other health benefits, particularly in relation to nutrition (by safely boosting agricultural productivity). Especially in the case of smallholders, the livelihood improvements that agricultural reuse can bring to farmers can mean they can spend more on accessing health care or improving their quality of life in other ways

ENVIRONMENTAL PROTECTION AND HEALTHIER ECOSYSTEM SERVICES

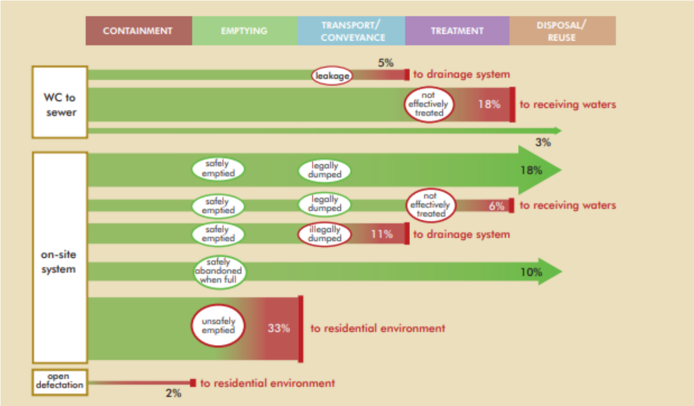
Preventing environmental damage has become an increasingly recognized and valued function of wastewater treatment, and a component in the sustainable development agenda. Systems that ensure wastewater is treated before any release into natural receiving waters reduce threats to ecosystems and the services they provide, including by improving the quality and safety (and thus usability) of freshwater, and reducing pollution and eutrophication in ecosystems that provide food.

If wastewater is recycled and water-saving techniques are used, less freshwater needs to be abstracted from natural systems to meet human demand, leaving more of it available for other uses, including preserving ecosystem services and ensuring environmental flows. In cities with combined wastewater and sewage systems, moreover, making surfaces in the built environment more permeable by leaving green spaces and ditches or using permeable paving. This can contribute to treatment of human waste water and replenishment of the water table. Alternatively, treated water with AEROBIO run-off can be used for irrigation, though it may require some treatment and may not be suitable for food crops.



Economic impacts of inadequate sanitation in India, by categories, 2019

FAECAL WASTE FLOWS IN NORTHEAST PRESENT STATUS



The red arrows indicate unsafe waste management and the green arrows safe management, at least from a human health point of view

ESTIMATED EXCRETION OF NUTRIENTS PER CAPITA IN DIFFERENT COUNTRIES

Country	Nitrogen (kg/capita/yr)			Phosphorus (kg/capita/yr)			Potassium (kg/capita/yr)		
	Urine	*Faeces*	Excreta	*Urine*	*Faeces*	Excreta	*Urine*	*Faeces*	Excreta
China	3.5	0.5	**4.0**	0.4	0.2	**0.6**	1.3	0.5	**1.8**
Haiti	1.9	0.3	**2.1**	0.2	0.1	**0.3**	0.9	0.3	**1.2**
India	2.3	0.3	**2.7**	0.3	0.1	**0.4**	1.1	0.4	**1.5**
South Africa	3.0	0.4	**3.4**	0.3	0.2	**0.5**	1.2	0.4	**1.6**
Uganda	2.2	0.3	**2.5**	0.3	0.1	**0.4**	1.0	0.4	**1.4**

RECYCLED WATER

In many places in the Northeast and the rest of the country reuse of water resources is an important strategy for managing water scarcity, especially when there are competing demands for limited water from human settlements or industrial activities. Many small-scale farmers in urban and peri-urban areas in water-scarce states already depend heavily on wastewater to irrigate crops – often as it is the only reliable source of irrigation water available. The World Health Organization (WHO) has estimated that 20 million hectares of arable land worldwide (approximately 7 per cent of total arable land) is irrigated using wastewater (WHO 2006). In 2006 there were over 3,300 water reclamation facilities worldwide, with varying degrees of treatment and for various applications.

In addition, the reuse of greywater (water from washing, showering etc.) is gaining increasing interest at household and community levels. Greywater makes up most of a typical domestic wastewater flow and can be safely used for toilet flushing, landscape irrigation and similar uses if it is kept separate from excreta and free of toxic substances.

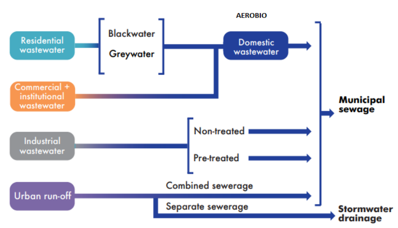
There are numerous examples of ways to reuse or recycle wastewater post processing using AEROBIO. Some common ways include:

- Agricultural and landscape irrigation,
- Industrial uses (e.g. recycled process water, cooling)
- Potable uses (e.g. mixing in municipal water supply)
- Non-potable uses (e.g. toilet flushing, dust control, car washing)
- Recharge of natural water bodies (e.g. groundwater)
- Replenishing lakes and wetlands.

For the management of water demand and potential scarcities it may be strategic to make an inventory of the main water supply flows, and then compare them with wastewater flows to see how the wastewater flows could be matched to demand – similar to the faecal waste flow. Here it makes sense to try to find wastewater streams and recovery options that best match the water quality requirements of each segment of demand, to avoid investment in unnecessary treatment. How to deliver separate streams of treated wastewater to the end-user is another relevant question – for example, to avoid the inefficient but widespread practice of using drinking water for irrigation.

By volume, water is the main component of any wastewater stream. A locality may produce a wide variety of wastewater types, depending on industrial and commercial activities, land use types, human settlements and urban structures. The volumes and content of the different streams can also vary widely.

The overall amount of wastewater generated within a locality can be very roughly estimated based on water supply data, which is usually readily available. Adjustments must be made for water that does not end up in wastewater, such as water used for irrigation; water incorporated into industrial products; or the portion of water drunk by people that does not end up in wastewater. Furthermore, if sewer networks are poorly maintained and leak, they can reduce the amount available for reuse, as well as contaminating groundwater and surface water with pathogens and pollutants.



Origin and flows of wastewater in an urban environment

TECHNICAL FUNCTIONALITY

DESIGNING THE SYSTEM

A common mistake in many attempts to improve sanitation and wastewater management is to start with a preferred technology that has "worked", even as part of a sustainable system, elsewhere. This approach has left many cities and communities with less-than-optimal systems that, for example, cannot be easily adapted to changes in population density; put heavy demands on scarce water resources; break down or malfunction frequently, especially during flooding and heavy rains; and in some cases are not even used. Furthermore, models for financing and service delivery, and institutional arrangements that work in one city may not necessarily work in another.

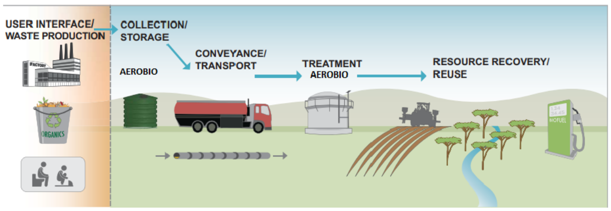
No sanitation user interface or treatment technology is sustainable in itself – there are only technologies that serve specific functions within a more or less sustainable system. AEROBIO is a technology that is self sustainable and requires minimal to negligible maintenance and works with breakdown of the feacal matter at the source of contamination and breaks down the bacteria so effectively that is well planned, designed and operated to suit the specific conditions in which it will operate.

In between these two extremes are a range of possibilities with different functions taking place on-site, in decentralized or centralized facilities, depending on population densities, geophysical conditions and other factors. Fortunately, The AEROBIO technology is now available for you to choose. This product gives a broad overview of the different functions of the technology in a sanitation and wastewater system, and looks at how to identify and set up to fulfill those functions within a locally appropriate, sustainable system. In doing so it introduces some of the most common and most interesting aspect of the product using the Aerobic Technology.

TECHNICAL ELEMENTS OF THE SYSTEM

A sustainable sanitation or wastewater management system needs to include infrastructure or services to fulfill the following functions in a safe, efficient and appropriate manner:

- User interface: This is the point at which the waste stream (excreta, wastewater, and potentially other organic waste) is first taken out of the user's immediate environment; for example a toilet or floor drain. Here AEROBIO can be directly introduced to the toilets to start working at breaking down the bacteria of the feacal matter into safe decontaminated quality.
- Collection and storage: The collection and storage of waste streams can take place on-site or at a more central point; for example in jerry cans for urine, and holding or septic tanks for wastewater. AEROBIO processed contaminated water does not require on-site processing plants to further process the water for agricultural use or even released to the environment because of its safe pH level and no harmful bacteria in the water.
- Conveyance and transport: Depending on system configuration the waste stream may need to be conveyed between locations and technological functions, for example from the user interface to the collection point(s); from a collection point to treatment; and from treatment to reuse. Parts of the waste stream may be released into the environment after treatment or deposited in long-term storage (e.g. in the case of toxic content that needs to be isolated). The means of conveyance and transport can range from plastic containers to fixed pipe networks to trucks. There is very negligible cost that is required to transport the processed waste water post the AEROBIO process thereby cutting the logistic cost to more than half for transportation as compared to the current practice of moving the waste water to a processing plant for further decontamination process.
- Treatment: This is a set of processes designed to eliminate or remove unwanted or harmful components and render other components safe and practical for reuse (or release into the environment). Treatment can be passive (storage) or active, using mechanical, biological or chemical processes. In our case the AEROBIO product uses Aerobic Bacteria technology to break down the feacal matter in the contaminated water at the source further elimination methane gas emission in the first stage before further breaking the matter down to clean and a safe pH level water safe to be released directly to the ground or for the use in agriculture.
- Resource recovery and reuse: There are various methods for recovery and reuse or recycling the resources in waste streams, depending on demand and local conditions.



Technical functions in a sustainable sanitation and wastewater value chain using AEROBIO

OPERATIONAL FACTORS

Among the most important choices to make in designing a sanitation or wastewater management system are where collection, storage and treatment will take place, and with what degree of centralization; whether the system will be waterborne, low-water or dry; and what kinds of treatment and resource utilization to aim for.

AEROBIO the Aerobic technology allows you to start the processing process in just a few uncomplicated steps as seen in the video where you can add the solution directly to the toilet bowl and let the bacteria start breaking the feacal matter into simpler non toxic component removing the methane gas emission and making the contaminated water safe to dispose into the environment for further usage or safely added to the ground with a safe pH level.

On the other hand we can have both the collection and treatment services can be organized as centralized or decentralized, but also on-site or off-site or a combination of these. From a resource recovery perspective, there are both advantages and disadvantages to these different management schemes.

Centralized wastewater management is a common approach in large parts of the world. The often cited advantage of centralized management is economy of scale: the per capita investment and operational costs of a single large treatment plant are much lower than those for several small-scale plants, while the control of quality standards and plant operation procedures could also be more effective. Centralized systems can, however, be challenging from a resource management perspective due to the higher level of dilution and complexity of wastewater composition; source control of contaminants is more difficult in a larger system. With AEROBIO the cost of processing is close to negligible and need not require an investment of a centralized management since the process starts at the source level. With no requirement of an investment to set up shop for further processing, This Aerobic Bacteria technology is the most feasible one for upcoming cities or unplanned cities where sewage water and drain water results in huge human disease epidemic every year.

Each institute or household can be given the product to directly charge in their toilet for the anaerobic process of break down to start.

This technology works for all type of collection system:

- Centralized system, either combined sewerage (inc. rainwater) or separate sewerage (separate wastewater and rainwater sewers)
- Combined on-site and centralized system
- Semi-centralized system
- Decentralized on-site system (no sewerage) household based

CHALLENGES ASSOCIATED WITH SOURCE SEPARATED DOMESTIC WASTEWATER

Waste Stream:

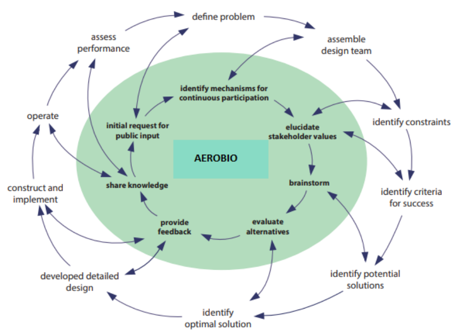
1. **Urine:** Heavy to transport mechanically; risk for precipitation and clogging when transported in pipes; ammonia evaporation and odour.
2. **Faecal matter:** Small volumes produced per person; transport and logistics may be difficult; high pathogen levels; odour.
3. **Black water (flush water, urine and faeces) or brown water (flush water and faeces, with no urine):** Amount of water affects transport (clogging) and energy production value; pathogens; odour.
4. **Greywater (water used in shower, bath, hand washing, dish washing, and laundry):** Treatment required to prevent regrowth of bacteria; generation of parallel products (sludge and foam); impact of salinity and chemicals on soils; source separation; pathogens; odour. Faecal sludge (sludge collected in on-site systems, containing excreta and possibly other waste)

All the above issues can be resolved at the source when you charge or use AEROBIO our Aerobic bacteria technology that will help you take care of all the waste streams in all its forms breaking down the pathogenic bacteria at the cess/biotoilets for safely releasing them to the environment.

The major challenge of resource recovery from more conventional, especially municipal, combined waterborne systems is the level of contamination. Sewerage systems commonly receive a mixture of wastewater from, for example, residential areas, hospitals, industries and storm water, with potential loads of heavy metals and other toxic substances. Hence, control the quality (and composition) of these streams as close to source as possible is important to facilitate treatment and enable safe resource recovery using AEROBIO that will immediately break down the bacterial composition of the contaminated water and eradicate methane gas emission resulting in a safer pH level quality water safe for the environment and human population around the area.

TREATMENT

A treatment system for wastewater or excreta and other organic waste using AEROBIO is designed according to the reuse (or disposal) options chosen. This relates not only to the physical form of the finished product (including its volume, water content etc.) but also the level of pathogen reduction.



THE SOLUTION

PROTECTING AND PROMOTING HUMAN HEALTH

A fundamental function of all sanitation and wastewater management systems is to prevent human contact with hazardous pathogens and chemicals, even when the main aim is resource recovery. Well-designed resource recovery systems not only protect health but also promote it by contributing to food and water security. AEROBIO helps breaks down all harmful pathogens and bacteria in the source or the STP helping it be safe for the processed water to be discharged into the open environment.

Open defecation and poor sanitation and wastewater management facilitate the spread of diseases caused by pathogenic bacteria, viruses, protozoa and parasites. They do this by exposing people to pathogens in untreated or inadequately treated excreta, either through direct contact or ingestion, or indirectly through contaminated water, food or soil. The negative outcomes can be multiplied during natural disasters such as floods and storms, which are expected to become more

frequent and extreme in some regions, due to climate change. Thus sanitation, combined with good hygiene practices, is fundamental to breaking the cycle of waterborne disease.

According to a recent estimate 842,000 people – the vast majority young children – die every year due to water-related diarrhea diseases, and a large share of these deaths can be directly attributed to inadequate sanitation. Faecal contamination has been implicated in major disease outbreaks such as cholera, typhoid and E. coli O157:H7, in both developed and developing countries, with dire social and economic costs.

In some communities that practice open defecation or with poor access to properly functioning sanitation, hygiene and wastewater management systems there is a range of constant health threats, including diarrhea disease and helminth infections. These infectious diseases are associated with chronic malnutrition, infant mortality, and lost work and school days.

In addition, persistent exposure can lead to undernutrition and cognitive impairment. It has been estimated that improved sanitation – with its focus on protecting the user household – can reduce rates of diarrhea disease by an estimated 35 per cent.

Most of the different types of waste that enter wastewater streams may contain pathogens along with chemicals hazardous to public health. Exposure to contaminants can occur at multiple points in sanitation and waste water systems – not only at the user interface. Example household environment) but also during transport, storage, treatment and resource reuse (if the resources have not been rendered safe through treatment). Health protection in sustainable sanitation and wastewater management thus needs to encompass the entire system:

HAZARDS IN WASTE STREAMS

Pathogens

The load of pathogens in different waste streams depends on the level of infection in the source population. Faeces, which contain the vast majority of the pathogens found in human excreta, may contain particularly high levels of the common pathogen Ascaris and the parasitic protozoa Cryptosporidium and Giardia, particularly in rural areas. The relative importance of these biological hazards in causing illness also depends on factors such as their persistence in the environment, minimum infective dose, ability to induce human immunity, and latency periods. For instance, helminths are of major concern in sanitation systems because their eggs are very persistent in the environment.

Chemical hazards

Chemicals such as heavy metals, pharmaceutical residues or their metabolic by-products, endocrine disruptors, and personal care products may also be present in different wastewater streams. High levels of pharmaceutical residues have been found in the influent and effluent of several wastewater treatment plants. The health risks associated with chemical contaminants from sanitation systems are insignificant, however, compared with those associated with pathogens (WHO 2006). Environmental hazards from chemical pollution

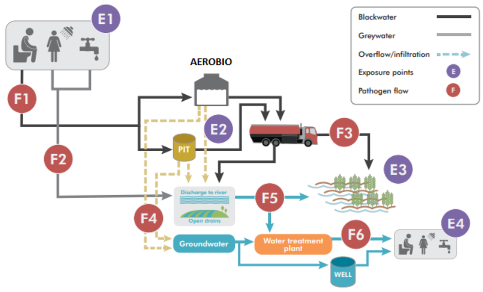
ON-SITE SANITATION AND WASTEWATER SYSTEMS

On-site sanitation systems can include both waterless and flush toilets, and may be combined with greywater-separating systems. Risks of exposure to pathogens in waterborne on-site sanitation systems are not significantly different from those in dry systems. Critical points of pathogen exposure risk are:

- User interface, such as a toilet;
- Storage and on-site treatment technologies, such as simple pits, ventilated pits, or septic tanks;
- Technologies to collect and convey sludge off site;
- Technologies for sludge treatment;
- Reuse/disposal.

The pathogen flow and main points of microbial pathogen exposure risk in a waterborne on-site sanitation system are shown below where you can see AEROBIO works at the source and the further processing plant is used to further process or does not need to be present before disposing the processed water into the environment. Infection risks may vary significantly at the different points. For instance, in the case of urine-diverting toilets, appropriate cleaning and management regimes are needed to reduce risk of disease transmission, such as from faeces that remain on the sides of the bowl. In addition, exposure to pathogens can occur during the emptying of septic tanks or pits, especially where done manually without any protective clothing. Study shows that workers emptying pit latrines were twice as likely to be infected with Hepatitis A virus as workers engaged in non-excreta-related activities.

TYPICAL PATHOGEN FLOWS AND EXPOSURE POINTS: WATERBORNE ON-SITE SANITATION AND GREYWATER CHAIN



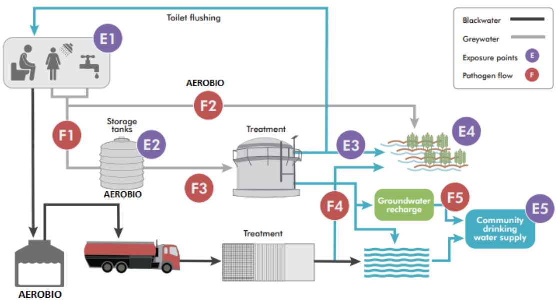
E1: Users and cleaners of toilet; E2: Ingestion of wastewater (workers); E3: Ingestion of sludge and consumption of crops (workers and consumers); E4: Consumption of contaminated surface and groundwater

CENTRALIZED SYSTEMS

Centralized wastewater systems are designed to collect and transport wastewater from households to a centralized point for treatment and disposal or resource recovery and reuse. Traditional centralized wastewater chains combine black- and greywater, with connection to large networks of sewers. They often also take in wastewater from industries and drainage. Depending on the intended application or recipient of the effluent, the choice of treatment technologies may range from a simple mechanical process to an advanced combination of mechanical, microbial and chemical treatment processes. The figure below shows a centralized wastewater treatment system configuration including exposure points for the transmission of microbial pathogens.

]The figure shows at phases where AEROBIO can be used and help in breaking down the feacal matter with no requirement to process further before releasing it to the environment. During wastewater transport, the surrounding community can be exposed to microbial pathogens, especially during flooding or the maintenance of pipe networks.

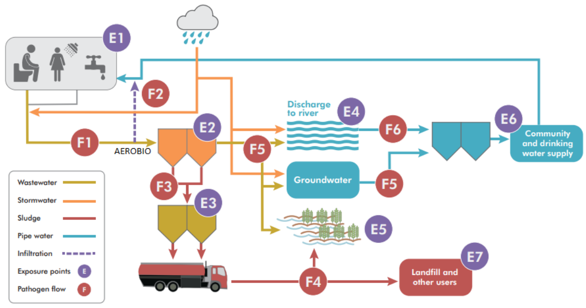
TYPICAL PATHOGEN FLOWS AND EXPOSURE POINTS: ON-SITE SANITATION SYSTEM WITH GREYWATER RECYCLING



E1: Users and cleaners of toilet; E2: Ingestion of raw greywater (workers); E3: Ingestion of treated greywater (workers); E4: Ingestion of greywater and consumption of crops (workers and consumers); E5: Consumption of greywater recharged water

The figure below shows the flow of pathogens in the environment and where AEROBIO can be charged and help breakdown of these pathogens right at the source to be released directly into the ecosystem for further processing based on their reusability or directly discharged for agricultural use or into natural environment.

TYPICAL PATHOGEN FLOWS AND EXPOSURE POINTS: CENTRALIZED WASTEWATER TREATMENT SYSTEM



E1: Users and cleaners of toilet; E2 and 3: Exposure to wastewater/sludge (workers); E4: Recreational use, e.g. swimming (users); E5: Exposure to wastewater/sludge and consumption of irrigated/fertilized crops (workers, community and consumers); E6: Direct or indirect consumption of potable water E7: Exposure at landfill site (workers and community)

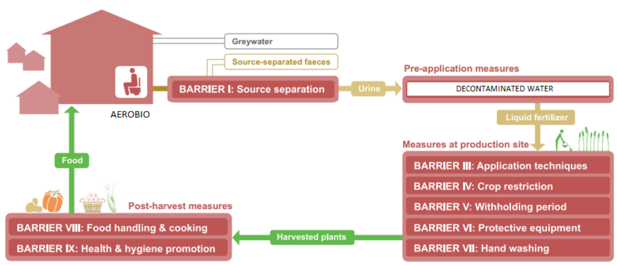
HEALTH RISK MANAGEMENT

Over the years several risk management approaches have been implemented to optimize sanitation systems to reduce or eliminate pathogens in wastewater; and restrict human exposure (contact, inhalation or ingestion) to pathogens in the sanitation system chain.

The most widely used health risk management approach in sanitation systems is multi-barrier risk management. More recently the sanitation safety planning (SSP) approach has been developed by the WHO to facilitate the implementation of risk management strategies by stakeholders in the sanitation sector. These risk management approaches are briefly described below with reference to specific case studies.

The figure below shows the multi barrier approach and how AEROBIO can be introduced to the source directly to help simplify the who process for breaking down.

A MULTI-BARRIER APPROACH TO AGRICULTURAL REUSE OF URINE USING AEROBIO



In a multi-barrier approach, the technical treatment steps are carefully monitored and controlled to ensure consistent water quality standards and compliance with local or national guidelines. The approach has been successfully implemented in potable water reuse schemes in States like Nagaland using AEROBIO.

KEY MESSAGES DERIVED FROM USING AEROBIO FOR PROMOTING AND PROTECTING HEALTH

Recovery and reuse of resources in wastewater and excreta can greatly improve human health and well-being through improved food security and nutrition, and reduced burdens of water-related disease.

- Removing of high risks associated with the reuse of untreated or improperly treated wastewater and excreta with AEROBIO.
- Recognizing potential risks associated with resource recovery and reuse requires an integrated perspective based on an understanding of local exposure pathways.
- Mitigating risks to human health in sanitation and wastewater management, particularly in resource recovery and reuse, can be achieved through both technical treatment and non-technical (e.g. behavioural) measures in combination.

ENVIRONMENTAL SUSTAINABILITY AND PROTECTION

Inadequate management of wastewater has significant implications for environmental sustainability. When large volumes of wastewater are discharged untreated into rivers, lakes and oceans containing nutrients, toxic substances and organic matter, they can severely compromise the integrity of ecosystems. In addition to the harm to aquatic life, degraded ecosystems have less capacity to provide a number of important services that humans rely on such as coastal protection, water purification and food provision.

While there is growing interest in ensuring wastewater treatment can mitigate using AEROBIO environmental risks, this is a relatively recent development and still found mainly in higher income countries. Environmental protection efforts in the context of sanitation and wastewater management were originally focused largely on monitoring. Increasingly, however, the focus has shifted to end-of-pipe measures to minimize harm from wastewater, which are generally technology-based, and preventive measures, including behavioral, regulatory and technology-based steps and systems based approaches such as integrated water resources management. As the viability of various forms of recovery and reuse usually depends on waste streams having a predictable quality and composition, it can provide an added incentive (and financing) for both preventive and end-of-pipe measures that help to reduce environmental damage.

INSTITUTIONAL AND SOCIAL ASPECTS OF SUSTAINABILITY

Even the best-designed technical system for sanitation and wastewater management cannot be truly sustainable unless all of the responsibilities for service delivery and system management are clearly assigned, and the stakeholders are aware of their responsibilities and both able and willing to fulfill them.

This is an even bigger issue for sanitation and wastewater management systems aiming for resource recovery, as they involve an even greater diversity of actors than conventional systems, and many of these actors have no prior experience of the sector. The additional complexity of linking in new sectors and stakeholders, while also raising the bar in terms of service quality, requires something beyond conventional institutional arrangements and governance.

The AEROBIO Aerobic Technology shows the special institutional and social challenges and how it can help resolve issues for a system designed for safe and efficient resource management, including recovery and reuse. It highlights management roles and responsibility and provides examples of proven solutions – both formal and informal – for reuse-enabling institutions.

The governance system for conventional wastewater management is already complicated, involving several sectors with different focus areas; for example, water discharge is regulated by one department, health and safety by another. AEROBIO takes care of all these issues and in addition of resource recovery can introduce additional components and actors into this system. For example, agricultural reuse directly affects the farmers as well as the consumers and traders of products produced using recovered resources. It is thus particularly important to understand interactions between major components of the governance system.

The division into public private spheres is a useful starting point for discussing the institutional and social aspects of sanitation and wastewater systems.

THE PRIVATE USER SPHERE

The private user sphere for sanitation systems includes the parts of the service chain with which individual users have direct contact, generally covering the user interface, collection, and transportation away from the immediate household environment. The main functions within the private user sphere are waste containment and other functions to protect health and provide convenience. AEROBIO induced in this sphere helps breakdown complex bacteria and reduces operational cost overheads and chances of diseases.

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THE PUBLIC SPHERE

Management of waste streams outside the household compound – mainly conveyance/transportation to a treatment facility, treatment and disposal – are regarded as being in the public sphere. Functionality in the public sphere is often the responsibility of the local government, though it may contract or partner with private service providers. Poor functionality in this sphere can impact public goods and the population at large, for example through degradation of the environment and ecosystem services, or high risks to public health – particularly in urban settings.

AEROBIO can eradicate this sphere if an STP or a proper sewage system is already not in place and this is a common scenario in most of our growing cities due to poor urban planning and can help process the contaminated water at the source thereby allowing municipal corporations and state governments along with central governments to reduce cost that are implied in all the overheads while planning a proper drainage system or sewage system,

In already existing STP plants AEROBIO has been proven to work equally well and better than the existing anaerobic bacteria technology and have shown results of superior quality where complete elimination of methane gas emission is removed and there are no sludge in the throughput of the processed waste water.

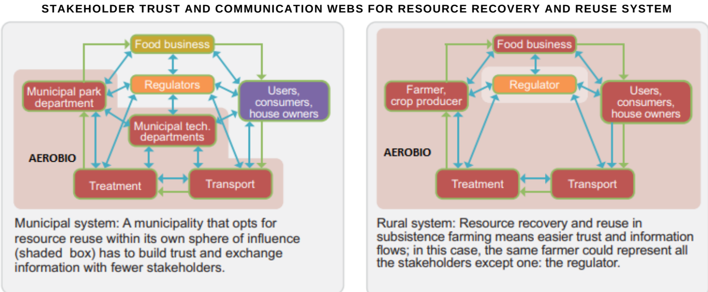
Resource recovery and reuse may also fall within the public sphere, for example in the case of water recycling and reuse, and excreta-based energy generation, fed into public grids. This is also the case where resources are used to restore ecosystem services within the public domain.

THE PRIVATE RE-USER SPHERE

Finally, depending on the nature of resource recovery, the treated products from the public sphere may also move into the private re-user sphere of the service delivery chain. This is the case when, for example, recovered nutrients, organic matter and water are applied on private agricultural land. Products linked to resource reuse, such as foods, fuel or treated water, also return to the user private sphere when they are purchased (and consumed) by individuals. The acquisition of the recovered resource products often takes place in the public sphere; for example, distribution of recovered water that households purchase.

Processed private re-user sphere water after processed using AEROBIO can be directly used for agricultural purposes or in gardens. There is no further processing that needs to be completed before the water is discharged into the ground water as well.

STAKEHOLDER TRUST AND COMMUNICATION WEBS FOR RESOURCE RECOVERY AND REUSE SYSTEM



Municipal system: A municipality that opts for resource reuse within its own sphere of influence (shaded box) has to build trust and exchange information with fewer stakeholders.

Rural system: Resource recovery and reuse in subsistence farming means easier trust and information flows; in this case, the same farmer could represent all the stakeholders except one: the regulator.

Green arrows = material flows; blue arrows = trust and information flows

MATCH SERVICE-DELIVERY TO CONTEXT

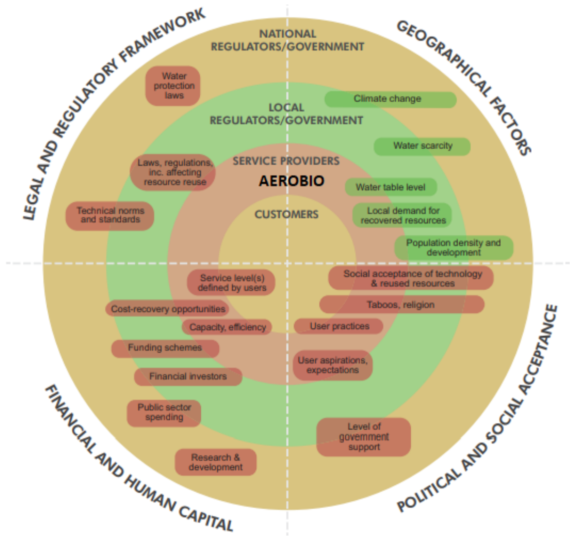
There is a widely acknowledged need to adapt governance and service delivery systems to local needs and conditions. AEROBIO is a One size-fits-all policies and technology and large national or regional roll-outs of wastewater technologies, regulations and approaches have been shown to be largely ineffective, and probably not the best way to achieve improved services and resource recovery.

Too often, however, the local government body responsible for sanitation and wastewater focuses on infrastructure expansion rather than service delivery; sets tariffs according to political agendas rather than realistic levels for financial sustainability; and under prioritizes O&M, all of which often lead to substandard service delivery as well as low accountability. AEROBIO is a technology that does not require an infrastructure but a charge based process where the product can be directly used in cess pools and bio toilets for direct breakdown of the contaminated water.

Management responsibility can reside with:

1. A public utility,
2. Private operator(s),
3. Community-based organization(s),
4. Combinations of the above.

The AEROBIO technology is such a product that does not require any such management or very negligible management of the process and can be left to work independently to breakdown the contaminated water thereby reducing cost in operational and maintenance aspect of it. As shown in the figure below, AEROBIO sits at the center of factor of the ecosystem in the water and sanitation management system.



ECONOMICS AND FINANCING

Inadequate sanitation and wastewater management places a heavy burden on national economies. While attempts to quantify the costs of inadequate wastewater management at global and regional estimates are rare, it has been estimated that water supply and sanitation together cost an estimated 1.5 per cent of global GDP, while regions such as India experience much higher economic losses: estimated at 2.9 per cent and 4.3 per cent of their GDP, respectively. The sanitation gap across the world correlates with low GDP and consumer poverty, underlining the fact that the gap is strongly connected to broader issues of development and inequality.

WHAT MIGHT IT COST TO PROVIDE THE WORLD WITH FUNCTIONING UNIVERSAL SANITATION COVERAGE?

A product technology of AEROBIO comes with very minimal cost for the product to help remove the cumbersome waste management system and it has been proven that it reduces cost by more than 50% of the current cost of operation and maintenance once implemented.

FINANCING SUSTAINABLE SANITATION AND WASTEWATER MANAGEMENT

The two main types of expenditures to consider in sanitation and wastewater provision are capital expenditures – in particular one-off investments in "hardware" items such as infrastructure, technologies, and equipment along with real estate – and recurring costs for operating and maintaining the system. There may be a range of other costs related to the factors such as regulatory reform and enforcement, quality testing of effluent, creating demand, and related aspects of development. It is essential to anticipate the costs (and benefits) along the entire system and value chain, and over the whole life cycle of the system. AEROBIO cuts down on cost for equipment and real estate because it works at the existing source of the waste (cess and toilets). Operational cost is minimal compared to the existing operational cost and maintenance runs hand in hand.

For system sustainability, financing must be both predictable and reliable over the long term. This is not only in order to access credit and service debts, but also to ensure the system operates efficiently for as long as possible.

Sustainable sanitation and wastewater management provide benefits for the user and for the surrounding community and society, and also often serve as part of a development strategy. However, while sanitation and wastewater management usually pay for themselves many times over, especially when there is resource recovery, many of the economic benefits are non-monetized. There will almost always remain a gap between the costs of installing and operating a system and the revenue that can be collected along the value chain. Consequently, the users or governments may be reluctant to make the investments needed to achieve the development outcome.

AEROBIO is cost at a minimum used as a 2:3000 liters of a septic tank charged once a year and from the following year just 1 liters. With a 100% assurance of complete decontamination and scientifically proven to be safe enough to directly discharged into the environment for agricultural use by the communities. Eradicating disease caused by the current process of partial decontamination of the waste water at the source.

CAPITAL EXPENDITURE

The capital investment that needs to be made for AEROBIO is only on the cost of the product and there is no additional cost on operation and maintenance other than the periodic charge that is required (once a year) for the sludge to break down.

Urban sanitation generally requires utility based systems. Installing (or upgrading) sewer networks and wastewater treatment plants requires major investments, usually by government or public-private partnerships and financed by bonds or equity. This is a process that is not required in our Technology.

This eradicates or removes the scale of the investment in these cases, and the length of time it takes to recover costs, it is important to plan for future developments in the area served so that, for example, infrastructure can be easily extended to serve new communities, and treatment plants have enough capacity to cope with growing user populations.

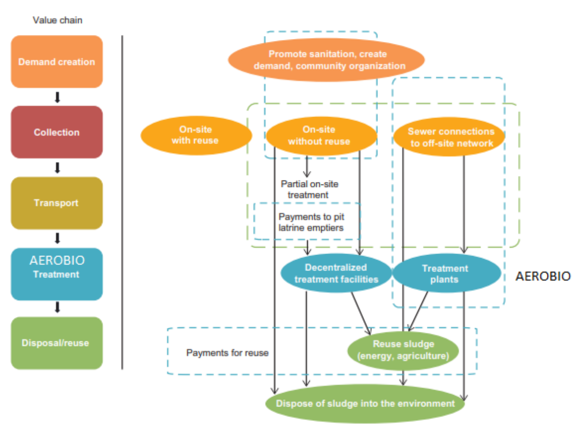
OPERATION AND MAINTENANCE

Failure to factor in O&M costs and only consider the initial capital investments is a common pitfall that results in systems functioning inefficiently or breaking down entirely over time. In the public sphere, O&M is usually carried out by private contractors. They may be employed or contracted by the government or utility (for example, to maintain a treatment plant or sewerage or drainage network), or directly by the user or community (for example, in the case of onsite systems, faecal sludge emptying services, community toilets or decentralized systems).

But with AEROBIO the operational costing is a bare minimum in the transfer of processed water to an open source is the only cost that will be implied in places where the outlet for the cess pool from households and institutions are not available.

Because the services are so important for health and environmental protection, even service providers employed by the users need to be regulated, and measures put in place to ensure that service providers can and do keep operating. Subsidies and state provided services might help to do this and to ensure that users do not get unregulated, unqualified service providers. However, this needs to be balanced against the interests of long-term financial sustainability and building the strength of this economic sector.

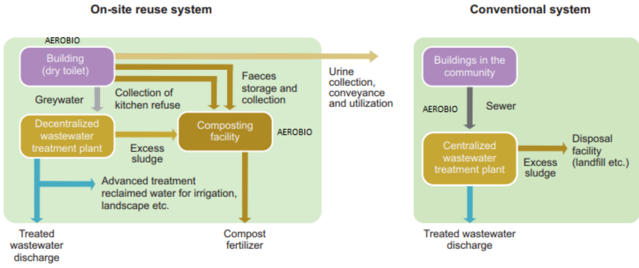
POTENTIAL WAYS OF PACKAGING OUTPUT-BASED AID SUPPORT ALONG THE VALUE CHAIN USING AEROBIO



SANITATION AND WASTEWATER MANAGEMENT IN A DEVELOPMENT CONTEXT

In many States in the country, wastewater management and sanitation form part of a larger development need, along with community and household improvements such as better housing, drainage, energy services, land-use reform/zoning, healthcare, food security, employment, literacy, community governance, tax systems and others. However, often water and sanitation investments are not well integrated with other development priorities, which can cause project inefficiency and even failure. Financing sanitation and wastewater management without integrating it with these other development areas can be counterproductive.

COMPARTMENTS INCLUDED IN THE COST-BENEFIT ANALYSIS COMPARING ON-SITE REUSE SANITATION SYSTEM WITH A CONVENTIONAL SYSTEM FOR THE AEROBIO PRODUCT



COST BENEFITS USING AEROBIO IN WATER WASTE MANAGEMENT

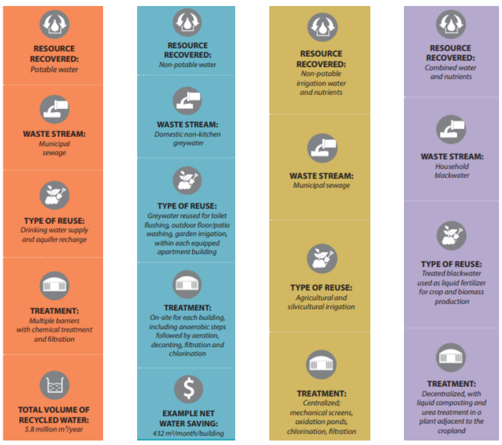
The direct and indirect benefits that can be obtained from sustainable sanitation and wastewater management systems are many times greater than the investments required.

- Safe AEROBIO services are affordable to consumer demand and can be stabilized and supply capacity for both capital and O&M can be increased within a context of broader development.
- Innovative financing mechanisms can be considered to address the significant financing gap for sustainable sanitation and wastewater systems using AEROBIO.
- Resource recovery and reuse will change the economics of sanitation and wastewater investment, providing both monetized returns and broader societal and environmental benefits with indirect economic value.

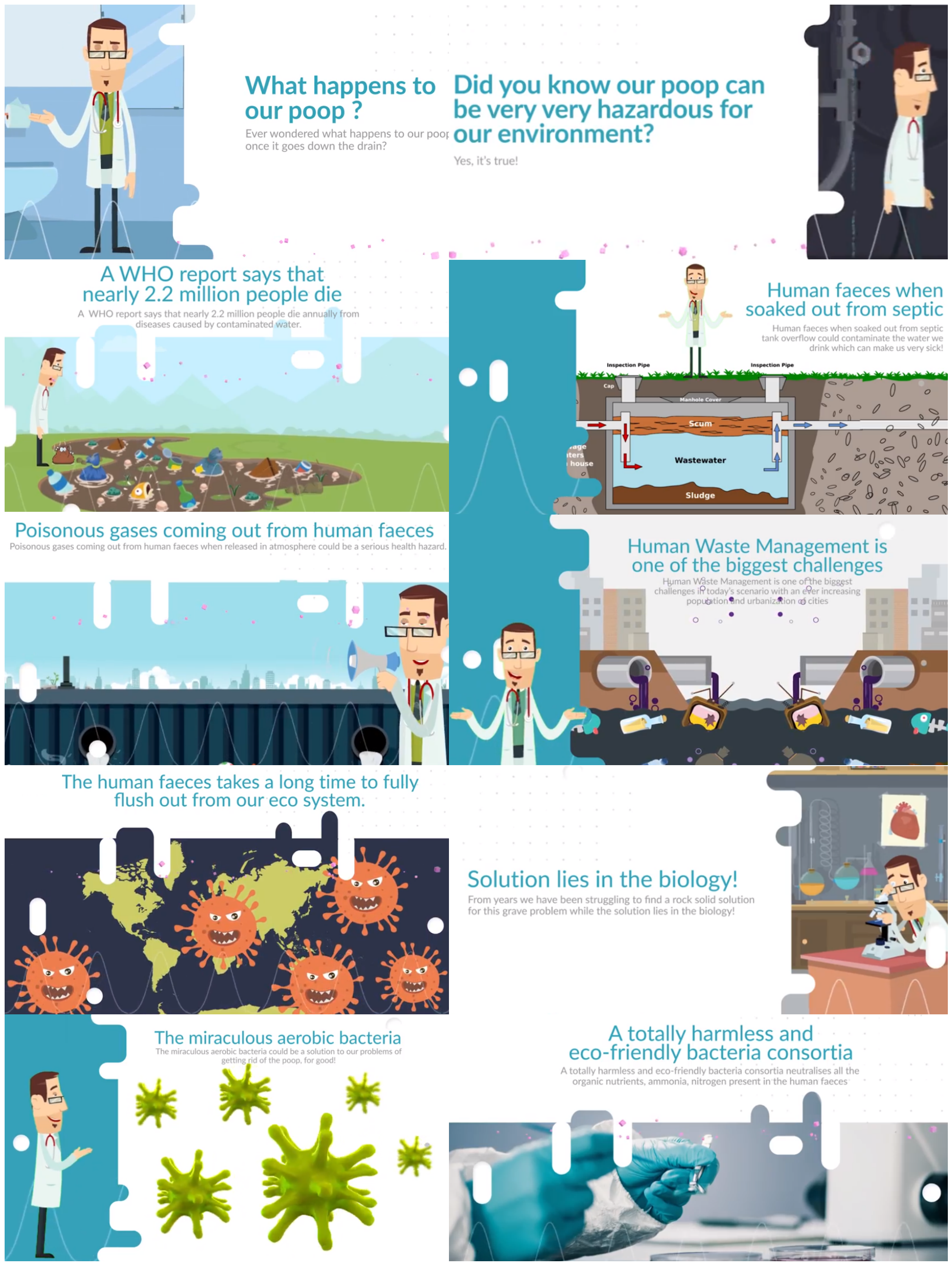
SHOWCASING TECHNICAL SYSTEMS FOR SAFE RESOURCE RECOVERY

This section presents some successful resource reuse and recovery solutions that are being implemented in various parts of the world. The descriptions focus on technologies, but also try to set out key issues and lessons in relation to other aspects of sustainability.

SUCCESSFUL PROGRAMS TO IMPLEMENT



AEROBIO - THE TECHNOLOGY EXPLAINED



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