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## Eco-sanitation as a means to treat wastewater from underground metro rail stations

Akarshika Chaudhary

[akarshikac@gmail.com](mailto:akarshikac@gmail.com)

Babu Banarasi Das National Institute of Technology and  
Management, Lucknow, Uttar Pradesh

Akanksha Maurya

[akanksha1217@gmail.com](mailto:akanksha1217@gmail.com)

Babu Banarasi Das National Institute of Technology and  
Management, Lucknow, Uttar Pradesh

Anant

[anant.dablu@gmail.com](mailto:anant.dablu@gmail.com)

Babu Banarasi Das National Institute of Technology and  
Management, Lucknow, Uttar Pradesh

Abraj Singh

[abrajsinghgr8@gmail.com](mailto:abrajsinghgr8@gmail.com)

Babu Banarasi Das National Institute of Technology and  
Management, Lucknow, Uttar Pradesh

### ABSTRACT

*A sanitation trouble exists for people throughout the globe: simple human waste collection and remedy is inaccessible to a whole lot of the world's populace; and the reputation-quo gray infrastructure system of sanitation is unsustainable and fallacious for extensive software. Ecological sanitation, or ecosan, refers to a range of sanitation technologies in which human excreta is recovered and retained on-web page, and in the end reused. The underlying aim is to shut (nearby) nutrient and water cycles with as less expenditure on fabric and strength as viable to contribute to a sustainable development. Human excreta are treated as a resource and are typically processed on-websites online and then treated off-site. The nutrients contained in excreta are then recycled via the use of them, example, in agriculture. EcoSan is a systemic approach and an mindset; unmarried technology are most effective method to an end and may variety from near-herbal wastewater treatment techniques to compost toilets, easy family installations to complicated, specifically decentralized structures. These technologies aren't ecological consistent with se however best on the subject of the found surroundings. They are picked from the complete range of available conventional, present day and conventional technical options, combining them to EcoSan structures. The paper affords an advent to EcoSan standards and Zero waste toilet device as a way to make certain powerful eco-sanitation.*

**Keywords**— Eco-sanitation, Zero-waste toilet system, Ecologically viable, Waste water treatment

### 1. INTRODUCTION

The previous decade has seen fast turn of events and dissemination of biological sanitation around the globe. Natural sanitation, or ecosan, alludes to an assortment of innovations that recuperate and reuse human waste for utilizes that exploit its supplement properties. Biological sanitation has gotten a lot of consideration in light of its capacity to give satisfactory sanitation to family units, give a supplement rich item, and ensure water assets. Objective 7 of the United Nations' Millennium Project is to "guarantee natural manageability" (United Nations, 2005). Target 10 of the Millennium Development Goals is to a large portion of the extent of the total populace without access to safe water and improved sanitation, and Target 9 means to "turn around the loss of natural assets." Ecological sanitation moves in the direction of accomplishing both of these objectives and subsequently could be a perfect part of incorporated water asset the board activities. Networks, be that as it may, regularly have negative relationship with human stool.

The EcoSan approach is asset disapproved and speaks to an all-encompassing idea towards biologically and monetarily stable sanitation. The hidden point is to close (neighborhood) supplement and water cycles with as less consumption on material and vitality as conceivable to add to a practical turn of events. Human excreta are treated as an asset and are normally handled nearby and afterward rewarded off-site. The supplements contained in excreta are then reused by utilizing them, e.g., in horticulture. EcoSan is a foundational approach and a disposition; single advances are just unfortunate obligation and may go from close normal wastewater treatment procedures to compost toilets, straightforward family unit establishments to complex, fundamentally decentralized frameworks. These innovations are not natural in essence but rather just comparable to the watched condition. They are picked from the entire scope of accessible ordinary, present day and customary specialized alternatives, joining them to EcoSan frameworks. The paper presents a prologue to EcoSan standards and ideas including re-use viewpoints (accessible supplements and happening dangers), and contextual analyses of EcoSan ideas in both industrialized and creating nations.

## 2. LITERATURE REVIEW

The modern conventional system of sewage disposal is both “flush-and-discharge or the drop and keep”. The “flush-and-discharge” gadget has helped to dispose off human excreta successfully inside the few areas wherein there is access to the flush lavatory. This gadget is water based totally and treats human excreta as waste and is disposed into the natural environment serving as the waste container. This version has no longer been able to clear up the sanitation needs for growing international locations. Also, due to its water dependence, big quantities of water is needed frequently for flushing to obtain successful functioning of this machine. This isn't always a suitable gadget for water-confused nations.

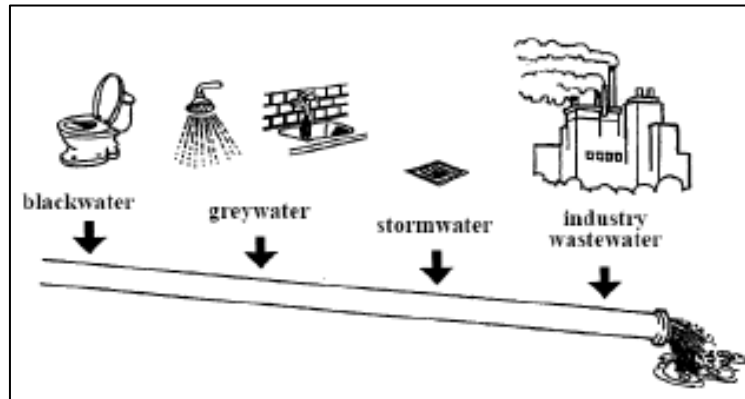


Fig. 1: Small Amounts of dangerous material pollute huge amounts of water, Source: Esrey et. al, 2001, p.10

The drop-and-save version is the traditional sanitation device for the terrible human beings in growing countries. This machine has weaknesses for example, it become a hassle in densely populated regions where there may be very restricted area. Areas with hard grounds, high water tables or flood prone areas do now not assist he system. Ground water in the areas with those systems are underneath the hazard of infection from pit latrines which renders it dangerous for ingesting. Also, the humid conditions inside the pit latrines make it a favorable breeding vicinity for a few sicknesses vectors which transmit ailment in people. They also purpose odor and entice flies if pit latrines are not properly built.

The models beneath the conventional system of human excreta disposal that is, the “flush-and discharge” and drop-and-keep” are inadequate to clear up the currents sanitation problems considering that of their disposal methods new issues are created. These fashions are also linear and permit nutrients in the excreta to head free and pollute valuable water sources.

The linearity of the present-day sanitation structures has made it not possible to recover the precious plant vitamins launched in human excreta. This requires the want for sanitation wishes to be rethought (Esrey et al., 2001, p. 12) to make it feasible for the recovery of these nutrients for his or her next use in food production. The era of excreta starts off evolved with food. If the two ends are delivered collectively, that is, Changing the nutrients within the excreta again to food for man via sanitization and reuse of the vitamins found inside the excreta, it'll assist the arena to a tremendous deal considering meals safety can be strengthen in addition to discount of environmental pollutants. This is what Ecosan approach is all approximately since it treats human excreta as a useful resource instead of a waste as in the present-day traditional sanitation machine.

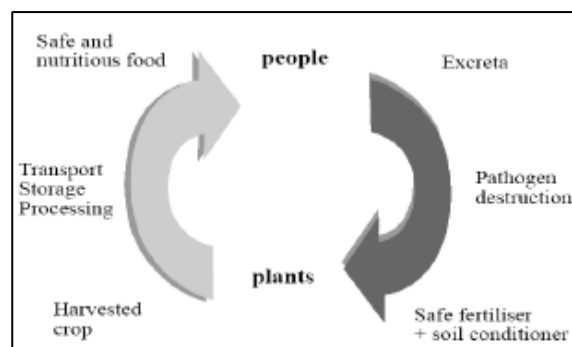


Fig. 2: The ecosystem loop, Source: Esrey et. al, 2001, p.10

In records, human excreta use in crop fertilization is not new. Thousands of years in advance, the Chinese have been composting human and animal excreta (Esrey, et al., 1998, p. 14). Japan within the twelfth century has introduced human and animal excreta recycle for agriculture (Matsui, 1997).

The concept of Ecological sanitation therefore is to go back nutrients found in human excreta back to the soil and to use them as fertilizer and soil conditioners for the improvement of the soil for the manufacturing of food. This way, the vitamins are saved in a closed cycle inside the environment. Cultural barrier is one of the most powerful elements hindering the acceptability of the Ecosan method.

Most people have been born into the prevailing sanitation systems. Ecosan is now a new idea to them given that they have got grown to just accept the cutting-edge machine. Human excreta are appeared in lots of regions as offensive and unpleasant. Many

human beings are faecophobic and commonly react with disgust once they hear about the usage of human excreta in agriculture (Rwabigene, 2002). It is a taboo in sure regions to deal with human faeces. Because of these motives, Ecosan is hard to employ in distinctly populated regions in view that it's miles hard for such cultural values to be followed strictly. This is due to the fact the population in such regions is made of human beings from numerous backgrounds. High population densities restriction the type of sanitation gadget in an area (EcoSanRes, 2002).

Many human beings have the perception that faecal be counted carries plenty of pathogens and consequently might also get infected after they manage them in agricultural sports. Due to this many people keep special reservations in opposition to the Ecosan method. This view is genuine, however then when the ideas of Ecosan are observed this is sanitizing the faeces before use in any form of agricultural sports the risk of contamination will be substantially decreased. Faeces needs to be handled well before use else it could pose health problems. Many human beings also have the notion that the ultimate sanitation solutions could be acquired from the water closet and centralised sewer systems. This notion widens the space between the wealthy and negative in society particularly inside the developing international locations. The Ecosan idea therefore need to be communicated to engineers, policy makers and stakeholders (Jenssen et. Al., 2004).

### **3. OBJECTIVE OF THE STUDY**

The objective of this study is to suggest an economically and ecologically viablehygienic waste water disposal system for Lucknow Metro Rail Corporation (LMRC) station with the aim to:

- Prevents the pollutants of surface and ground water,
- Reduce wastewater discharged to sewers thru recycling of gray water,
- Optimize the control of nutrients and water assets for agricultural purposes, by way of recovering nutrients from urine and faeces.

### **4. METHODOLOGY**

The EcoSan technique is recommended to be adopted as a resource minded and holistic idea closer to ecologically and economically sound sanitation. The underlying intention is to close (neighborhood) nutrient and water cycles with as less expenditure on fabric and electricity as possible to contribute to a sustainable improvement. Human excreta are dealt with as a resource and are typically processed on-site after which handled off-website. The vitamins contained in excreta are then recycled by using the use of them, example., in agriculture. Thus, Ecological Sanitation or Eco-sanitation provides a sustainable, closed-loop system, which closes the gap between sanitation and agriculture.

The proposed concept is based totally on the hygienic disposal of human waste, and specializes in the idea to retrieve and re-use vitamins like nitrogen, phosphorus and potassium, and to save money the usage of water. Eco-sanitation is:

- Based on the idea that urine, feces and water are sources in an ecological loop and, recycling of vitamins allows make certain meals security.
- Aims to sell the development, implementation and dissemination of socially and culturally appropriate and sustainable sanitation procedures.
- Hygienically secure and environmentally sound.

#### **4.1 Design of the Zero Waste Toilet System**

For the eco-sanitation challenge, a Zero waste rest room machine is proposed. The solid and liquid elements of human waste are separated at the entry point by way of the use of a 'separator'. The 'separator' diverges the liquid within the outward direction and is collected in a tank. Urine and liquid is further treated and reused as flushed water. Solid component (within the shape of slurry) is dropped into any other chamber referred to as retention tank. Fecal slurry is accrued and converted into manure via composting. Liquid is in addition dealt with and reused for flushing the toilets.

Zero Waste Toilet System is advantageous because of the following reason:

- It is easy to put in without a sewerage requirement.
- No electric electricity supply or motor pushed gadgets is needed to run this gadget.
- Hygienic conditions are maintained at the same stage as in conventional water borne structures.
- It may be without problems be operated and maintained by the community.
- It reduces the clean water demand for various sports like flushing and gardening.

### **5. RESULT AND DISCUSSION**

Eco-sanitation is a possible alternative to the traditional device. Some of the motives are listed underneath:

#### **5.1 Affordability**

Ecosan is affordable and can be used in both rural and urban settings and by using each the rich and the poor. Due to the variety of designs and strategies to be had for the gathering and treatment of the faeces and urine, you can locate an Ecosan facility that meets his requirement and one which he/she will be able to have enough money. In comparison with the Ecosan sanitation, the flush-and-discharge structures require large volumes of water for flushing and this makes it unaffordable in many communities. This makes the cutting-edge device expensive and relatively unaffordable.

#### **5.2 Disease Prevention**

As a result of touch with human faeces or faeces polluted materials in the environment, about6000 kids die each day from diarrhoeal sicknesses because of inadequate sanitation and hygiene(WEHAB, 2002) and around 1 billion people global, majority

of whom are children, get infested with intestinal worms and consequently go through nutritional deficiencies and retarded boom (WHO, 2003). Ecosan methodology seeks to remove all human faeces in a sanitary way from the surroundings through its recycling concept. Again, Ecosan removes a massive amount of black water from the surroundings, and this element is the main carrier of disorder inflicting organisms and polluter of water supplies (Jenssen et. Al., 2004).

### **5.3 Environmental Considerations**

Currently, the foremost cause of water pollution worldwide is the sewage discharges from centralized water-borne collection systems. Only 30% of all sewerage systems global have end-of-the pipe treatments (Matsui, 2002). The relaxation discovers their way into water our bodies. This is the scenario with the present-day sanitation system due to its water dependence. The nutrients found inside the urine and faeces as a result motive eutrophication within the water our bodies in which they may be discharged.

### **5.4 Nutrient Recovery and Recycling**

Large portions of urine and faeces are launched into the surroundings day by day. These include important crop vitamins together with Nitrogen and Phosphorus. This way those valuable nutrients are lost into the environment. With regards to Phosphorus that is non-renewable, the reuse of urine and faecal Phosphorus will assist to reduce the mining of this herbal useful resource and will also help to enhance agricultural production.

Urine is nutrient wealthy and faeces are excessive in organic matter. They incorporate all the vital vitamins required for vegetation and are very a good deal proper for use as fertilizers (EcoSanRes, 2005). Urine and faeces respectively contain 88% and 12% of the nitrogen; 67% and 33% of the phosphorus and 71% and 29% of the potassium carried in domestic wastewater. Faeces additionally incorporate in addition 46% of the organic carbon.

Most of the pathogens are determined inside the faeces. The recycle and reuse will promote poverty relief, lessen the price for fertilizer in crop manufacturing and then maximize profit. Malnutrition can also be reduced because of the elevated meals safety as a result of excessive crop yield from the fertilizers and soil conditioners produced from human excreta. It is estimated that Ecosan is able to recycle eighty-ninety% of the nitrogen, phosphorus and potassium in excreta and wastewater for agricultural manufacturing.

### **5.5 Energy Production**

It is feasible to provide biogas from human faeces. Through urine diversion as within the Ecosan method, human faeces may be accrued for the manufacturing of the gasoline. The bio-fuel could function an opportunity fuel to wood, oil, LPG and strength. Production of biogas from the human faeces will also lessen the chance of contamination from the pathogens which can be in the faeces. This may also result in the discount of odor and flies. The ensuing sludge from the biogas method may also be utilized in agriculture.

### **5.6 Water Protection/Conservation**

The Ecosan technique requires less or no water. This reduces the quantity of pollution that is triggered because of blackwater that outcomes from flushing of lavatories. The removal of the blackwater in the Ecosan method (Jenssen et. Al., 2004) facilitates to reduces the discharge of vitamins and disorder causing organisms into our water our bodies and therefore the supply of freshwater for human use.

Also, this method, that is, Dry sanitation, makes it viable for a reduction within the use of freshwater assets as in flushing of lavatories. This saves water from being overused.

## **6. CONCLUSION**

The findings propose that ecosan is a feasible sanitation option that fills a niche. Ecosan's comparative benefits seem to be large sufficient to outweigh negative cultural sentiments regarding the dealing with of human excrement to some person companies. The aim is a paradigm shift is the way Wastewater remedy is looked at:

- Shifting from water disposal to water recycle.
- Aiming from oxidation of organics to manufacturing of sludge for use as manure.
- Production of Biogas to Quality Manure (by using Vermicomposting and so forth.).

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