



Ecosanitation: Eco-friendly Sanitation

Dr. Uday Bhawalkar

Introduction

Ecosanitation is eco-friendly, that is, it follows laws of nature. It is an emerging concept that gives us sustainable remedy to sanitation challenges we face in our homes, farms, hospitals, institutions and industries. Odour, pathogens and pests are the challenges that appear due to loss of sanitation. Basically, ecosanitation avoids killing of pathogens or pests using mechanical, electrical, chemical or biological means. It also avoids odour suppression using fragrant molecules. Odour-pathogens-pests, after all, are signals telling us that sanitation has been spoiled.

All warning signals have to be unpleasant. Pleasant signals obviously, cannot warn us. Our cooking gas (LPG) has no smell, hence highly unpleasant mercaptans are added to LPG, only to create noticeable signals, should there be any leakage.

Principles of Ecosanitation

Ecosanitation involves proper balance of man and plants. Human wastes are plant food, while human food and other necessities, are sourced from plants. Similarly, human activities produce carbon dioxide that is vital food for the plants and plants produce oxygen that we need. Sanitation, thus, gets spoiled when we do not use plants in our surrounding and allow build-up of carbon dioxide and salts such as nitrates (and related nitrogenous compounds), heavy metals, sodium, sulphates, etc.

One family of 4-5 people, however needs a

minimum soil (garden) area of 5-20 m² (this area depends upon the soil quality). Many people do not have this much area in urban communities. Also many people say they do not have knowledge, time or interest necessary to nurture the plants. Hence they resort to 'clever' tricks of suppressing the unpleasant signals.

'Smart' Sanitation: This involves physical, chemical or biological techniques to fight with the signals, rather than tackling the root cause of sanitation challenge.

Low temperature slows down the biology and thus sanitation challenges get suppressed at low temperatures. Spoilage of food, garbage and sewage slow down at low temperatures. Mosquito breeding, too requires warm temperature, along with polluted water medium. Some smart people keep their garbage in cold room, so as to avoid sanitation problems.

Using high temperature to kill the spoilage microorganisms is another smart idea. Water, milk and beverages are sanitized by raising the temperature. High temperature may suppress the spoilage organisms that are warning mechanisms of nature. Spoilage can set in after the medium gets cooled, because spoilage needs nitrates and other salts. The culture of spoilage microorganisms is readily available in air.

Spoilage organisms also are very loyal to their duty of warning people about food, water or beverage





INDIAN PLUMBING TODAY

quality. They learn through mutation, how to cope up with low or high temperatures. This is how we get sporadic food poisoning cases reported in the media. Food poisoning basically is due to presence of nitrates and other harmful salts.

Another smart way to suppress spoilage organisms is to use toxic chemicals, including radiation. But the spoilage organisms soon learn how to survive the toxicity and then, man has to use higher level of toxicity. Whole ecology gets poisoned in this race and man gets increasing cancer incidence. Man breeds much slowly (population doubling time of man is about 20 years), while the spoilage organisms can double their population in 1 hour (microbes) to 1-4 weeks (insects, rodents, etc.). This is precisely the reason man takes more time to learn how to live with the toxic chemicals, while the spoilage organisms quickly learn how to digest the toxic chemicals.

Introduction of sterile males to reduce breeding of spoilage organisms is not "smart" at all. This is like reducing the number of fire-fighters, just because they rush through the traffic with lot of noise, break traffic rules and drench our property with water.

Finally, there is quite a "super-smart" way of suppressing the signals of pollution (odour-pathogens-pests). This is by destroying the food (energy) needed to sound the alarm. This amounts to removing the battery of a fire alarm.

Garbage can stink or breed nuisance-causing organisms. This happens only if garbage has harmful salts such as nitrates, heavy metals, sodium, etc. Real crisis due to garbage (and sewage) is due to these salts. But the warning signals are created only if organic molecules are present, to fuel the bio-processes that sound the alarms.

Treatment of garbage or sewage, thus should focus on these salts, not on organic food molecules. But we often find that people compost garbage (or treat sewage) so as to reduce the C/N ratio, making it more hazardous and with no signals possible because energy molecules are removed, without removing the actual problem (the salts).

Such hazardous compost can catch fire on its own. Auto-ignition is shown by hazardous materials, this is nature's way of telling us about the hazards and crude way of correcting it. Nature expects that

the wise man should convert the pollution into resources, using the plant kingdom.

Mistreated sewage, also may look clean to eyes, give no foul smell to nose (because all these signals need organic food molecules). But it is ideal food for breeding of pathogens or pests. That is why such mistreated sewage is let out only after chlorination, so that immediate blame does not come on the act of letting mistreated sewage into the environment.

Mistreated sewage also can breed malaria/dengue mosquitoes, while the raw sewage may hardly breed ordinary mosquitoes. Ideal sewage should not breed any mosquitoes or frogs and should breed fish. We can use this criterion to evaluate the quality of sewage.

Best criterion of successful treatment, thus is to ensure that the treatment of real problem (the salts) takes place and resource value of waste is fully tapped. Letting out any waste stream only indicates that the treatment is improper.

Hence, the new pollution guidelines are focusing on 'zero discharge.' These will reduce manipulation of laboratory results when treatment is improper.

Hospital Cleanliness

This is popular a phrase that tells us that our homes should be as clean as hospitals where no insects, rodents or lizards can be tolerated. This level is achievable using ecosanitation. But if it is achieved using any 'smart' techniques, it helps breeding of antibiotics-resistant microorganisms.

Compact BioSanitizer

Considering the above scenario, it was decided to develop BioSanitizer that is compact, easy-to-use and affordable (cost-effective).

Aim was to tackle the root cause, not just suppress the signals.

Collaboration was sought from Nature that has 4.6 billion years of evolutionary experience. Modern science that has created the suppression techniques is hardly 300 years old.

Learning from Nature

Following grammar rules were conceived and used to learn from Nature.





INDIAN PLUMBING TODAY

1. Nature is well designed and hence needs no 'improvements' aimed at correcting the 'faulty' design.
 2. Each organism has a role and is designed to play this role effectively. Population is decided by the task posed to the organism, at a given time.
 3. Organisms are of two types: resource builders (K-selected) and those who manage spillage of resources (R-selected). The former types are unseen, quiet or pleasant whereas the latter types cause various unpleasant alarms such as odour-pathogens-pests. The unpleasant nature of the latter organisms is only to warn us that resources are being wasted. They are, thus, the fire fighters of Nature.
 4. Even the unpleasant events such as earthquakes, cyclones, hurricanes, forest fires, epidemics and human madness (bad habits and crime) can be traced to large scale spillage of resources (pollution), in spite of and because of the current 6.7 billion population of Homo sapiens (man, the wise).
 5. Mild (First digit) pollution is converted into 'visible' indicators. A Second digit pollution sounds audible alarms, Third digit pollution is indicated to our skin, Fourth digit pollution warns us through creation of odour or through short-term illness and Fifth digit pollution causes sudden death. Nature thus, follows a 'digital' signaling system.
 6. Absence of pollution is indicated by creative mind and good culture wherein people care for the environment, nation, religion, family, friends and fellow human beings and other creatures in nature.
- Good quality water or sewage resists scaling, corrosion, biofouling and breeding of pathogens or pests (such as mosquitoes). These facts can also be used to evaluate quality of water or wastewater.
 - Wastewater is nothing but wasted water, hence aim should be to avoid waste through total recycling. BioSanitizer makes this practically possible, in cost-effective manner.
 - Green plants are the only way to utilise inorganic pollutants, no bacteria or membranes can do it. Green plants first produce electricity using the inorganic pollutants and then this electricity is able to split water into hydrogen and oxygen. Instead of releasing the hydrogen into the air, green plants combine hydrogen and CO₂, in the presence of warmth, to produce convenient storable energy, in the form of organic biomass.
 - Successful sewage treatment should increase the ratio organics/inorganics.
 - Sewage quality indicators are odour-pathogens-pests. These create unpleasant signals at low ratio of organics/ inorganics.
 - BioSanitizer has microplants that grow invisibly very fast and convert 'pollution into organic resources.' They work sustainably at steady load of pollution and work without any recurring expenses and do not produce any waste stream such as sludge or greenhouse gases.
 - Flow of 1 m³/day of water needs BioSanitizer investment of ₹ 10,000/-. Best place to put the BioSanitizer is at the start of water circuit so that we get water treatment, on-line sewage treatment, with finishing treatment in the septic

BioSanitizer Mechanisms

- Man is the last animal on the earth and hence, is still in the process of learning what to eat. Current human food-water-air is so polluted with inorganics that sewage is quite hazardous. It also remains hazardous after treatment because the so-called treatment increases the inorganic load. That is why people dispose off the (mis)treated sewage into neighbour's land. Zero discharge should be the criterion for safe and healing sewage.



BioSanitizer Ecochip



Case Study 1: Mumbai Deluge Disaster Management

The utility of the BioSanitizer technology was well demonstrated after the July 26, 2005 deluge in Mumbai, when it rained about 1,000 mm in a day.

Accumulated garbage heaps and dead carcasses of 16,000 animals created severe sanitation hazard in Mumbai. Combining BioSanitizer with a 100-ppm solution of calcium nitrate created special bio-spray. This was sprayed on stinking garbage heaps and animal carcasses. The results of ecosanitation achieved were dramatic, as seen by control of odour, pathogens and pests. This was a joint project of Green Cross Society of Mumbai, Bombay Municipal Corporation (BMC) and Indian Express Initiative. The operation was also extended in the jurisdiction of Vasai Municipal Council where dead buffaloes were dumped and their neglect could have created conditions suitable for plague. It was also found that polluted water ponds started generating ripples of oxygen production, within a few minutes of application of BioSanitizer granules into the pond. The healthy gases produced healthy growth of food crops in the region, mosquitoes were reduced and the pond water started going down. Nature allows higher percolation rate as soon as the water quality improves. The neighboring well that was heavily polluted soon started producing drinkable water.

This deluge flooded the Mithi River that originates from the Vihar-Powai lake region, passes along the Mumbai airport and meets the sea at Mahim. But the flooding of Mumbai had no negative impact on health of 10 million population of Mumbai city. This was because of the BioSanitizer that was used in the Powai lake and the lake water was overflowing into the Mithi river. In fact, people rendered voluntary help to the community and the city could recover within a few days. Similar deluge that took place because of hurricane

Katrina in New Orleans (USA), within a few weeks, needed much longer recovery period. People there also exhibited unsocial behavior by looting the shops, instead of helping each other. This shows how healthy water and human chemistry can produce good citizens. Modern research, in fact, has shown a link between human chemistry and crime.

Case Study 2: Toxic Oil Spill Disaster Management

The 2010 Mumbai oil spill occurred after the Panama-flagged MV MSC Chitra and MV Khalijia three collided near Mumbai on Saturday, 7 August, 2010, at around 9:50 A.M. local time. The US Club, which is barely a kilometer from the location of the prong's reef where MSC Chitra ran aground, had received its share of oil spill as the oil stained rocks and mangroves became testimony to the disaster.

In 2008, the Indian Navy employed the BioSanitizer Ecotechnology for the treatment of sewage for maintaining its green top of the golf course spread over 47 acres and hundreds of trees.

About one million litres per day of sewage was sourced from the adjoining Naval Officers' Residential Area and was treated using BioSanitizer Ecochips.

During the monsoons the water from the treated sewage storage tanks was not used for watering and was diverted into the sea.

Seen from the US Golf Club, the shoreline with stained rocks appeared remarkably healthy as the greenish tinge on the surface of the rocks indicated revival of moss.

Presence of crustaceans among the rock crevices and schools of fish dancing in shallow waters of the shore indicated more signs of life. The bigger mangrove trees, as expected, were seen holding their heads high despite the slick clinging to their feet.



INDIAN PLUMBING TODAY

Surprisingly the smaller mangrove plants, which were completely drenched in the oil spill, were also showing signs of revival as new green leaves started sprouting from its top branches.

One need not be surprised by the observations. Damage to marine ecology from toxic pollution such as oil spill could be noticed by the impact it has on delicate species such as pomfrets and crustaceans such as crabs. There were no reports on large scale deaths of pomfrets and crabs.

Biosanitizer action in the treated sewage which was going into the sea was aiding the sea to revive from the oil spill.

Morning walkers of the club first noticed the difference, as they were initially aghast at the site of spill drenching the rocks and mangroves. However, to their amazement, they noticed that in a matter of weeks, the spill was disintegrating and marine life was reviving along the shoreline.

Oil in its purest form such as ghee is not toxic, and it is the inorganic components in the oil that make it toxic. Use of bacteria in tackling oil spill is not advisable as it devours only organic component of oil and the inorganic part of the oil continues to pollute the seawater. Pests are nature's pollution indicators and its cleaners.

Club members including naval officers who were associated with the initiative to bio-sanitize the sewage in 2008, were not surprised by the developments on the shoreline as they had seen for themselves what technology could do.

"Use of untreated sewage water was causing stench, infestation of pests in the grass and mosquitoes in the air. There were also a large number of crows that would fly away with the ball. Moreover, the labourers who were watering the grass and trees were refusing to use sewage water as it caused skin problems", said a retired naval officer. He added that trees and grass on the greens would die prematurely. The committee managing the club then decided to set up a sewage treatment plant.

"All these problems were resolved after BioSanitizer Ecochips were placed in the sewage tank and bio-sanitized sewage was used for irrigating the lawns. The results could be seen from the first month itself as the presence of mosquitoes and red ants reduced drastically. The stench in the air came down to five meters from the spraying point from the previous 50 meters. Moreover, the stench dissipated very quickly leaving freshness in the air. The grass had green sheen and trees became healthy," he said.




Mangroves at INS Kunjali site in Colaba showing new shoots

tank, without use of machinery, electricity, manpower and without producing any sludge or greenhouse gases.

- If pure water has value of ₹ 3 /liter, BioSanitizer produces water of ₹ 300 /liter value. Value of 1 m³ of water, thus, is ₹ 3,00,000. This value-addition is achieved each day, with an investment of ₹ 10,000/-.

Conclusion

Pollution creates sanitation challenges. But Nature wants us to see pollution as wasted raw materials, to be used to grow plants that convert pollution

into four F's such as food, fuel, fibre, organic fertilizer, also herbs and industrial raw materials, along with critical services such as cooling, oxygen production and reduction of air pollutants. BioSanitizer Ecochips are modern chips that help us harness invisible plants that grow without any human help and occupy no space. More case studies are given at www.wastetohealth.com. 



Dr. Uday Bhawalkar is a Chemical Engineer turned Ecologist from IIT Bombay. He discovered (the reaction) and invented the compact form of BioSanitizer Ecochips that 'convert pollution into resources'. He can be contacted at ecobhawalkar@gmail.com

