

# Waste turns to resource

Bioconversion may be the answer to waste management, says S.Ananthanarayanan.

Professor and Padma Shree Dr Sharad Kale, of Homi Bhabha National Institute, Head Technology Transfer Division, and Head, Pesticide Residue and Soil Sciences Division, BARC, at Mumbai, in a short interaction related to the uses of social media, brought out a whole fresh viewpoint of waste disposal. The occasion was a panel discussion on *Taking technology & benefits to the masses using Social Media*, organized at Mumbai as part of the international Social Media week, 23<sup>rd</sup> to 27<sup>th</sup> Sep 2013.

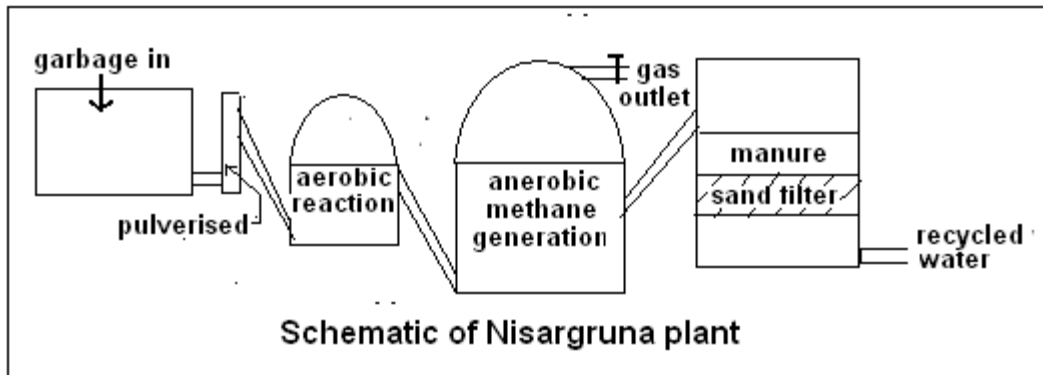


Dr Kale is a microbiologist who has specialized in pesticide residue and soil sciences at the Bhabha Atomic Research Centre, Mumbai. The centre has developed the two stage process, called *Nisargruna*, which is Sanskrit for ‘repaying nature’s debt’, which efficiently turns domestic waste into high quality manure and odor-free methane, which can be used as fuel.

Dr Kale is a well known science expositor and conservation crusader and had been invited to be on the panel to speak on how social media, which was connecting millions of people over the world through the Internet, could help the Government deliver its schemes and technology advances to more beneficiaries.

## **Nisargruna**

The Nisargruna arrangement is a next generation improvement of the traditional *Gobar Gas* plant. In the traditional plant, cattle waste, other organic waste, is confined in a digester. In the absence of oxygen, bacteria break down the organic matter into gas rich in methane and a slurry which is rich in nitrogen, phosphorus and potassium and valuable as compost. As it is a one stage, and anaerobic, or ‘sealed off from air’ fermentation process, it takes as long as 40 days for the waste to be digested. Nisargruna splits the process into two stages. The first stage is an aerobic, or ‘open to air’ phase in a first chamber, before the methane producing fermentation begins in the second chamber. The waste is pulverized before it is mixed with hot water and enters this first chamber, where it stays for 3-4 days. The structure of the chamber helps the aerobic phase effectively degrade the biomass into a homogenous and only slightly acidic liquid. This preparation enables more efficient fermentation by methane bacteria in the next, anaerobic phase, which now lasts only some 15 days.



The process consists, essentially, of the complex molecules in organic waste being broken down to simple components, which then react and recombine as methane gas and carbon dioxide, the remainder being left rich in nitrogen and other plant nutrients. Thus, in the first stages of anaerobic fermentation, the carbohydrates, fats and proteins are broken down into sugars, fatty acids and amino acids, respectively. In the next stage, the volatile fatty acids arising from the products of the first stage are reduced to acetic acid, carbon dioxide and hydrogen, in a process that is similar to the souring of milk. The next stage of fermentation is where the acetates and products of the earlier stages are converted into methane, with the hydrogen being used up, leaving largely methane and carbon dioxide gas.

In the two stage process, as in Nisargruna, there is control over the different bacteria that bring about the changes and the methane production is mainly in the second chamber. The bacteria that bring about the first changes, of complex molecules being broken down, reproduce and act faster, in the first chamber. The bacteria that act to form methane need more stable acid levels and temperature and they find optimum conditions in the second chamber

### Wet and garbage

Also on the panel was *Ms Jyoti Mhapsekar*, founder member and president of *Stree Mukti Sanghatna*, or the organization for the liberation of women. The Sanghatna has organized and trained, in microfinance, thousands of women waster pickers (rag pickers) in Mumbai to make use of and profit from waste. Ms Mhapsekar stressed the need for sensitizing citizens to segregating wet and dry waste, so that it could be readily disposed of.

Dr Kale came in to explain the need for segregation. It was important, he said, to view leftovers and discarded material not as 'waste', but as 'resource'. Once this distinction was made, the need to separate different resources, for use, becomes obvious.

Dr Kale brought home the concept of the value of waste and the efficiency of natural recycling with a captivating account of an ongoing experiment he had himself carried out, for the last fourteen years. He had in his flat in Mumbai, he said, a glass jar, in which he had placed soil and a plant and watered the plant till it had taken root and was growing. Dr Kale then sealed the jar, so that the bio-system in the jar became isolated. He placed the jar in a west facing window, so that the plant received sunlight every evening.



Dr Kale said the sunlight enabled photosynthesis and generation of oxygen, the water in the jar was recycled from the soil, the root, the leaves and back to the soil, the insect and other life forms in the soil thrived and when leaves withered, they enriched the soil. It was 14 years now and the ecosystem in the jar was thriving, all 'waste' recycled as 'resource'. Such 'ecosystems in a jar' are now commonplace and go under the name of 'terrariums'. "If recycling can work perfectly in a jar, why not on the earth?" Dr Kale asked.

The difference is that garbage in cities contains man-made materials, like used torch cells, toothpaste tubes or plastic bags. When different materials like this are mixed, one kind of waste poisons the other, to take away from its value as resource. The two components hence need to be separated. The Municipal authorities had a huge task to collect and dispose of hundreds of tonnes of garbage. They naturally balked at the suggestion that they also undertake 'segregation'. "Nor could they even attempt the task with such mountains of garbage. But every home only deals with 300 grams and each home can do the job for the municipality. The people and the authorities of the town of Matheran have successfully dealt with the problem," Dr Kale said. "Why not Mumbai, which is nothing but maybe fifty Matherans?"