

SUPER BUGS

Over the past decade, numerous studies have shown that these facilities leak waste containing antibiotic residue and drug-resistant bacteria into the environment. This pollution, experts warn, fuels the spread of so-called superbugs, micro-organisms that are resistant to antibiotics.

Polluted water bodies like lakes and rivers can be treated with genetically engineered microorganisms (GEMs)

A contaminated site, of either terrestrial or aquatic ecosystems, that is polluted with toxic chemicals is deadly for the environment. The textile, leather, fertilizer and other industries are continuously releasing toxic pollutants into our land and rivers, disturbing the normal balance of both the ecosystems which is alarming for a clean and healthy environment. Although there are various ways to clean up the environment such as recycling the wastes, incineration or disposing the wastes and pollutants into landfill sites, the best and most eco-friendly way to clean up the pollutants is using the microorganisms, the process known as bioremediation. Genetically engineered microbes (GEMs) or the so called superbugs could be a very promising option to perform this job.

Nature performs its own way of cleaning the environment by biodegradation of the toxic chemicals by its inhabitant microorganisms to maintain a perfect balance. This process is known as intrinsic bioremediation or bioremediation. But in this modern and industrialized society, the rate of pollution, probably, has gone far beyond what the natural biodegradation can deal with. Moreover, the generation of recalcitrant molecules, chemicals which are hard to degrade, and xenobiotics, unnatural chemical substances in the environment, has made it quite difficult for the natural microorganisms to cope with those pollutants. However, microorganisms also evolve to gain the capability of degrading certain chemicals. Here comes the opportunity for the biotechnologists to apply a simple trick and what they do is combine several characteristics, capable of degrading different chemicals, from different bacteria into a single one simply by transferring the plasmids responsible for those different characteristics making the new bacterium a superbug. Plasmids are extra chromosomal genetic elements of bacteria

containing certain genetic traits that can hop to other bacteria and gain the capability of reproducing independently into the new ones and share the traits with them.

SUPER BUG

'Superbug' is a constructed bacterium, *Pseudomonas putida* that can degrade hydrocarbons found in petroleum wastes. It is a multi plasmid strain developed by using genetic engineering technique.



Pseudomonas putida

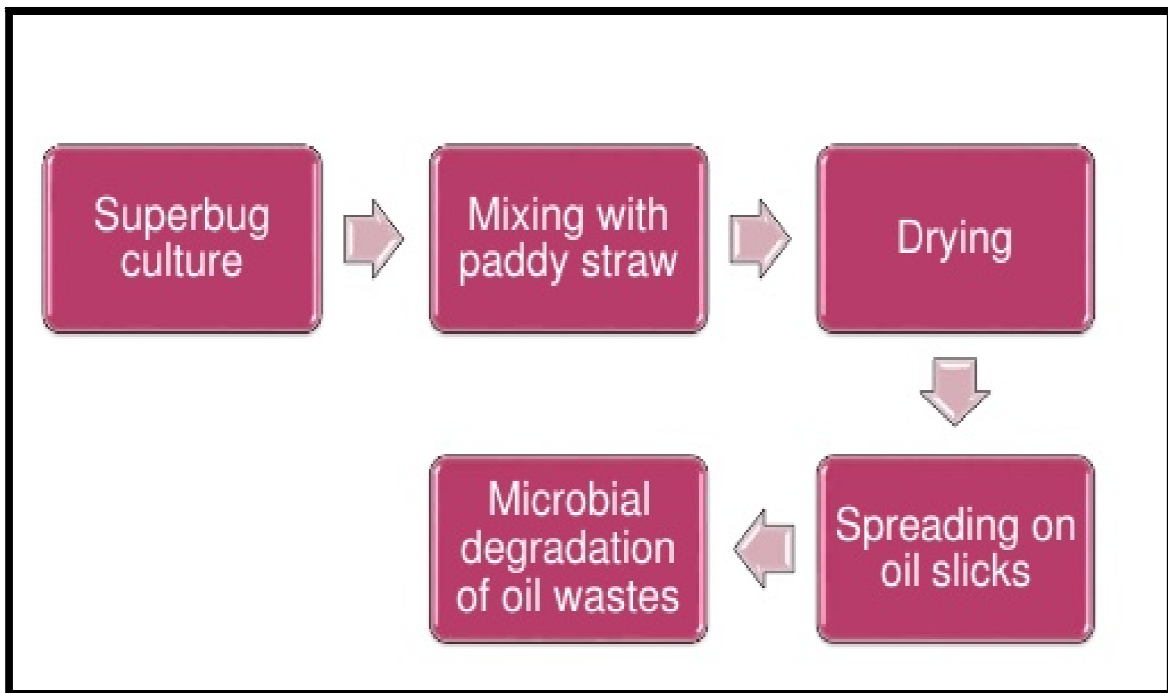
Super bug was developed by Anand Chakrabarty in 1979. It is used to treat oil spills as a measure to control oil pollution. Petroleum products contain cycloalkenes(octane), naphthenes, xylene, toluene and aromatic hydrocarbons. Since these compounds are not easily biodegradable, oil wastes become a major pollutant on the soil and water. Chakrabarty et al. took attempts to degrade oil wastes using micro organisms. They developed superbug to control oil pollution.

APPLICATION OF SUPERBUG

A patent was given to Chakrabarty regarding the construction and use of Superbug. The American Government, in 1990, allowed using the superbug to clean up oil spills in the water of Texas State. The mass culture of superbug is sprinkled over paddy straw and the straw is dried in shade. The bacteria inoculated straw can be stored for more than an year until we are in need. To treat oil spill, the straw is spread over the

oil slicks and is left as such for a week or more. During this time, the straw soak up the oil and the bacteria living on it break the oil into non-polluting materials. As a result, the oil wastes become harmless to other organisms living on soil or water polluted with petroleum oil.

Superbug culture mixing with paddy straw Drying Spreading on oil slicks
Microbial degradation of oil wastes.



Flow chart showing stages in the use of Superbug in the treatment of oil wastes.