BIOREMEDIATION.

Bioremediation is a process used to treat contaminated media, including water, soil and subsurface material, by altering environmental conditions to stimulate growth of microorganisms and degrade the target pollutants. In many cases, bioremediation is less expensive and more sustainable than other remediation alternatives. Biological treatment is a similar approach used to treat wastes including wastewater, industrial waste and solid waste.

Most bioremediation processes involve oxidation-reduction reactions where either an electron acceptor (commonly oxygen) is added to stimulate oxidation of a reduced pollutant (e.g, hydrocarbons) or an electron donor (commonly an organic substrate) is added to reduce oxidized pollutants (nitrate, perchlorate, oxidized metals, chlorinated solvents, explosives and propellants). In both are these approaches, additional nutrients, vitamins, minerals, and pH buffers may be added to optimize conditions for the microorganisms. In some cases, specialized microbial cultures are added (bioaugmentation) to further enhance biodegradation. Some examples of bioremediation related technologies are phytoremediation, mycoremediation, bioventing, bioleaching, landfarming, bioreactor, composting, bioaugmentation, rhizofiltration, and biostimulation.

Process	Reaction	Redox Potential (Eh in mV)
Aerobic	$O_2 + 4e^- + 4H^+ \rightarrow 2H_2O$	600 ~ 400
Anaerobic	–	–
Denitrification	$2NO_3^- + 10e^- + 12H^+ \rightarrow N_2 + 6H_2O$	500 ~ 200
manganese IV reduction	$MnO_2 + 2e^- + 4H^+ \rightarrow Mn^{2+} + 2H_2O$	400 ~ 200
Iron III reduction	$Fe(OH)_3 + e^- + 3H^+ \rightarrow Fe^{2+} + 3H_2O$	300 ~ 200
Sulfate reduction	$SO_4^{2-} + 8e^- + 10H^+ \rightarrow H_2S + 4H_2O$	0 ~ -150
fermentation	$2CH_2O \rightarrow CO_2 + CH_4$	-150 ~ -220

Reference: ①. N. Arumugam (2019). Biotechnology Saras publication.

②. Vanithagopal (2014). Biotechnology

Net source.

PRODUCTION OF XENOBIOTICS PRODUCTS

Xenobiotics are chemical compounds mostly produced by human activity, which enter into the environment at higher than background concentration. xenobiotic compounds were originally thought to be the result of action of industries. However it soon because apparent that nature also contributes to the formation of these compounds to a small extent.

The "xeno" in xenobiotic comes from Greek word xeros meaning foreigner and bio meaning life. So we can define xenobiotics as chemical substances that are foreign to the biological system. In other words, Xenobiotic is a compound found in human body which is not produced by it or expected to be present in it. They include man made or naturally occuring compounds, drugs and environmental agents. The classes of xenobiotics include: pesticides, polycylic aromatic hydrocarbons (PAHs), polychlorinated aromatics, solvents, hydrocarbons, and others like surfactans, silicons and plastics.

As mentioned earlier nature also contributes to the formation of xenobiotic compounds. Several examples can be enumerated. Petroleum hydrocarbons seep into the environment through natural processes. Some volatile terpenes (P-cymene) produced by plants have a remarkable resemblance in structure to simple aromatic petrolum hydrocarbons. A wide variety of halogenated compounds are produced as metabolites by plants, fungi, algae, bacteria and other organisms. presently 3500 of such compounds have been documented. Totally more than 200,000 xenobiotic compounds have been identified in our environment. Some of the important xenobiotic compounds and their sources are summarized.

Pesticides are the most important xenobiotic pollutants because of their widespread use in agriculture. In many developing countries, unregulated use of pesticides by farmers contributes not only to environmental pollution but also to health problems.

Reference: ①. N. Arumugam (2019). Biotechnology Saras publication.

②. Juliet Abisha (2016). Biotechnology.

Net source.

③ Bioleaching:

Bioleaching is the extraction of metals from their ores through the use of living organisms. This is much cleaner than the traditional heap leaching using cyanide. Bioleaching is one of several applications within biohydrometallurgy and several methods are used to recover copper, zinc, lead, arsenic, antimony, nickel, molybdenum, gold, silver, and cobalt.

Several species of fungi can be used for bioleaching. Fungi can be grown on many different substrates, such as electronic scrap, catalytic converters, and fly ash from municipal waste incineration. Experiments have shown that two fungal strains (Aspergillus niger, penicillum simplicissimum) were able to mobilize Cu and Sn by 65%, and Al, Ni, Pb, and Zn by more than 95%. Aspergillus niger can produce some organic acids such as citric acid. This form of leaching does not rely on microbial oxidation of metal but rather uses microbial metabolism as source of acids that directly dissolve the metal.

Reference: ①. N. Arumugam (2019). Biotechnology Saras publication.

②. Sheamat (2015). Biotechnology Net source.

① Biomining:

Biomining is a technique of extracting metals from ores and other solid materials typically using prokaryotes, fungi or plants (phytoextraction also known as phytomining or biomining). These organisms secrete different organic compounds that chelate metals from the environment and bring it back to the cell where they are typically used to coordinate electrons. It was discovered in the mid 1900s that microorganisms use metals in the cell. Some microbes can use stable metals such as iron, copper, zinc, gold as well as unstable atoms such as uranium and thorium. Companies can now grow large chemostats of microbes that are leaching metals from their media, these vats of culture can then be transformed into many marketable metal compounds. Biomining is an environmentally friendly technique compared to typical mining. Mining releases many pollutants while the only chemicals released from biomining is any metabolites or gasses that the bacteria secrete. The same concept can be used for bioremediation models.

Reference: ①. N. Arumugam (2019). Biotechnology. Saras publication.

②. Raheela shabbir (2017). Biotechnology. Net source.

LAND FILL SITE FOR BIOFUEL PRODUCTION.

Growing biofuel crops on landfill sites will soon be a reality as Waste Recycling Group (WRG) looks to generate renewable energy from former rubbish dumps.

The company has begun planting a combination of Miscanthus grass and short rotation coppice (SRC) at 14 of its landfill sites across Lincolnshire, Nottinghamshire, Humberside and Yorkshire.

The grass and SRC have been introduced as biofuel crops over a total area of 100 hectares following a successful three-hectare feasibility project at the former Brighton landfill site, near Selby, East Riding of Yorkshire.

The project has attracted grant funding from Natural England and next year will see an additional 100 hectares planted at a mixture of operational and closed sites across the UK.

The plan is to sell the energy crops, once harvested, to Drax Power Station in Selby as a biomass fuel.

Miscanthus - or elephant grass - is a high-yielding energy crop that can grow up to 3cm tall and produces a crop every year without the need for annual replanting.

Its rapid growth, low mineral content and high biomass yield make it an ideal biofuel. It thrives in poorer quality soils and provides excellent habitat for various forms of wildlife.

Harvesting will begin after the third year of planting and is expected to generate between 8-12 tonnes per hectare. The grass has a 30-year lifecycle and will be harvested annually.

WRG is believed to be the first waste management business of its kind to undertake an energy crop initiative of this scale.

In addition to miscanthus, WRG also successfully harvested five hectares of SRC at its closed Burntstump landfill, near Arnold in Nottinghamshire, in 2011 which will be the first biomass crop the company has marketed to Drax.

WRG's senior restoration and energy crop manager, Mark pailing, said: "This is very exciting development for the company and builds on our track record of sustainable reclamation, recycling and regeneration".

WRG is also hoping to expand its use of short rotation coppicing for leachate treatment at selected landfill sites in next few years.

Reference: ①. N. Arumugam (2019). Biotechnology Saras publication.

② rohit barhe 29 (2013). Biotechnology Net source.

BIOTECHNOLOGIES IN AGRICULTURAL SECTOR.

Agricultural biotechnology, also known as agritech, is an area of agricultural science involving the use of scientific tools and techniques, including genetic engineering, molecular markers, molecular diagnostics, vaccines, and tissue culture, to modify living organisms: plants, animals, and microorganisms. Crop biotechnology is one aspect of agricultural biotechnology which has been greatly developed upon in recent times. Desired trait are exported from a particular species of crop to an entirely different species. These transgene crops possess desirable characteristics in terms of flavor, colour of flowers, growth rate, size of harvested products and resistance to diseases and pests.

Farmers have manipulated plants and animals through selective breeding for decades of thousands of years in order to create desired traits. In the 20th century, a surge in technology resulted in an increase in agricultural biotechnology through the selection of traits like the increased yield, pest resistance, drought resistance and herbicide resistance. The first food product produced through biotechnology was sold in 1990, and by 2003, 7 million farmers were utilizing biotech crops. More than 85% of these farmers were located in developing countries.

ROLE OF BIOTECHNOLOGY IN MEDICINE SECTOR.

Throughout the years, Biotechnology has touched all aspects of health and agriculture. Biotechnology is an important field that is applied to these sectors with the aim of improving the different targeted genes and customized medicines. There are numerous methods applied to biotechnology such as gene treatment, recombinant DNA technology. A more targeted approach is called polymerase establishment revenge which uses genetics along with DNA particles to make a projected illness and put in replace them with healthy genes in the physical body in place of the harmed cells.

In this article we will discuss how biotechnology revolutionized the traditional medicine and help save and improve the quality of life for people suffering from various illness. In addition we will provide a brief overview of the common medical biotechnology field that was vastly improved using innovations by medical biotechnology.

Biotechnology is commonly used to improve medicines due to the advantages and pieces of knowledge it provides such as understanding the genetic composition of the human species, foundational structure of hereditary diseases manipulation and repairing of damaged genes to cure diseases,

ROLE OF BIOTECHNOLOGY IN INDUSTRY SECTOR

Industrial biotechnology includes modern application of biotechnology for sustainable processing and production of chemical products, materials and fuels. Biotechnological processing uses enzymes and microorganisms to produce products that are useful to a broad range of industrial sectors, including chemical and pharamaceutical, human and animal nutrition, pulp and paper, textiles, energy, materials and polymers, using renewable raw materials.

Use of biotechnology to substitute existing processes makes many of these industries more efficient and environmently friendly, contributing to industrial sustainability in various ways. This paradigm change involves various areas, ranging from the most known ones, such as pharamaceutical and agricultural, to production of materials such as biopolymers and also bioplastics.

Industrial biotechnology can produce the same results as the petrochemical industry, but using biological catalysts instead. Application of the state of the art of a vast range of scientific disciplines to industrial biotechnology, namely biochemistry, microbiology, genomics, proteomics, bioinformatics, systems biology and process engineering is the foundation for leveraging the rapid, specialized and competitive growth of the sector, based on biocatalysts that enable high productivity, performance and stability.

With the adoption of Industrial processes based on biotechnology, metabolic engineering has become an increasingly important subject. The goal of metabolic engineering is to maximize the production of compounds that are of Industrial interest in microorganisms that act within this context as cell factories through their genetic manipulation.

Reference: ①. N. Arumugam (2019). Biotechnology. Saras publication.

②. Deepak Bagantri (2016). Biotechnology.

Net source.

③ GMO's

A (Genetically modified organism) GMO is any organism whose genetic materials has been altered using genetic engineering techniques. The exact definition of genetically modified organism and what constitutes genetic engineering varies, with the most common being an organism altered in a way that "does not occur naturally by mating and natural recombination." A wide variety of organisms have been genetically modified (GM), from animals to plants and microorganisms. Genes have been transferred within the same species, across species (creating transgenic organisms) and even across kingdoms. New genes can be introduced, or endogenous genes can be enhanced, altered or knocked out.

Creating a genetically modified organism is a multi-step process. Genetic engineers must isolate the gene they wish to insert into the host organism and combine it with other genetic elements, including a promoter and terminator region and often a selectable marker.

Reference: ① N. Arumugam (2019). Biotechnology. Saras publication.
② tanvi suhani (2013). Biotechnology Net source.

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IPR (Intellectual property Rights).

Intellectual property is the product of the human intellect including creativity concepts, inventions, industrial models, trademarks, songs, literature, symbols, names, brands etc. Intellectual property Rights do not differ from other property rights. They allow their owner to completely benefit from his/her product which was initially an idea that developed and crystallized. They also entitle him/her to prevent others from using, dealing or tampering with his/her product without prior permission from him/her. He/she can in fact legally sue them and force them to stop and compensate for any damages.

industrial property, which includes: inventions (patents), trademarks, industrial designs and models and geographic indication of source.

Copyright, which includes: literary and artistic works, namely novels, poems, plays, films, musicals, cartoons, paintings, photographs, statues and architectural designs.

Related Rights is a term in copyright law used to include the rights of performers in their performances, the rights of producers of phonograms in their recordings. and the rights of broadcasting organizations in the

Reference: ①. N. Arumugam (2019). Biotechnology Saras publication.
②. Datrikamadhu (2015). Biotechnology Net source.