

Scope, Importance and Impacts of Biotechnology in Human Life: A Review

Rakesh Kumar Saket, Shikha Koshti and Sanjay Dohare

Department of Zoology and Biotechnology
Government Autonomous Girl's P.G. College of Excellence, Sagar (M.P.)

Abstract :

Biotechnology is the technology applied to biology, molecular biology, genetics, and many other subfields of biology. It is the application of scientific techniques to modify and improve plants, animals, and microorganisms to enhance their value. Biotechnology utilizes cellular and biomolecular processes to create technologies and products that help improve our lives and the nature. It is use of biological constituents to make products useful to the mankind. It has played an important role in the environment. Recent biotechnology develops breakthrough products and technologies to fight diseases, reduce our environmental harm, feed the hungry, use less and cleaner energy, and have safer, cleaner and more efficient industrial manufacturing processes. Biotechnology is now being used in numerous disciplines including bioremediation, energy production and food processing agriculture. The basic aim of this review paper is to through light on latest happenings in biotechnology and to aware the research scientists about its significance in every field of science. The paper also outlines the scope, importance, and impacts of biotechnology products. Biotechnology plays a very important role in human welfare.

Keywords : Biotechnology, bioremediation, microorganisms, agriculture, energy, biology.

Introduction :

Biotechnology is the application of scientific techniques to modify and improve plants, animals, and microorganisms to enhance their value. Biotechnology is the life science, which generally deals with the study of living organisms. It is an application of biology and different other techniques to change or to modify products for specific human use. Biotechnology is also known as biological technology. Biotechnology means any scientific application that uses biological systems, living organisms or derivatives thereof, to produce or alter products or processes for particular use [1]. Biotechnology consists of 'the controlled employment of biological agents, e.g. micro-organisms or cellular components, for favorable use [2]. 'Bio' refers to life and 'technology' refers to the application of information for practical use, i.e. the application of living organisms to create or improve

a product [3]. Biotechnology may be defined as 'the utilization of living organisms in systems or processes for the production of valuable products; it may involve algae, bacteria, fungi, yeast, cells of higher plants and animals or subsystems of any of these or isolated components from living matter'. Biotechnology can simply be defined as a technique that uses living organisms to make or modify and improve products [4, 5]. Biotechnology has affected everyday life through its different inventions [6]. BT crops have been introduced to overcome the use of pesticides. Modest yield and grains are the core objective in biotechnological crops [7]. Meat quantity and quality has been increased [8, 9]. Milk quality has been enhanced by the use of many biotechnology techniques [10].

Agricultural biotechnology may be defined as the use of living plant organisms, or parts to produce food and feed products such as insect-resistant corn, to develop processes like the manufacturing of biologics by tobacco, and to provide services such as, bioremediation of heavy metal contamination using genetically engineered poplars [11].

Importance of Biotechnology In Human Life :

Biotechnology plays a very important role in human welfare and has revolutionized mankind since its existence. It contributes much towards the human's welfare and their health needs.

Biotechnology in Agriculture :

The application of biotechnology in agriculture field helps in improving food quality, quantity, and processing. Agricultural biotechnology has been practiced for a long time, as people have sought to improve agriculturally important organisms by selection and breeding. An example of traditional agricultural biotechnology is the development of disease-resistant wheat varieties by cross-breeding different wheat types until the desired disease resistance was present in a resulting new variety [12]. Agricultural biotechnology include biological pest control, fermentation, and production of vaccines and biofertilizers as well as modern techniques like tissue culture, genetic engineering (GE) also called genetic modification, recombinant DNA technology (rDNA), crop and animal transformation as a result of transgenesis [13]. Many genomic techniques and molecular techniques have been identified to better understand the govern traits that have direct effect on plant physiological and economical values [14]. Biotechnology is producing great opportunities for the increase in global agricultural production and for protecting the environment through the reduced use of agro-chemicals like pesticides, fertilizers and rodenticides [15].

Biotechnology in human health and Medicine :

Biotechnology has played a significant role in improving human health by producing enriched nutrients food products such as Golden Rice, potato, maize, groundnuts, and

soybean etc. Biotechnology has offered modern medical devices for diagnostic and preventive purposes, which include diagnostic test kits, vaccines and radio-labeled biological therapeutics used for imaging and analysis. Human health is a major growing concern worldwide because of infectious diseases. Biotechnology has played a dynamic role in improving the challenges regarding to human health as it has flexibility to reduce global health differences by the provision of promising technologies [16]. Biotechnology is based on following diagnostic techniques; PCR, Monoclonal antibodies and microarrays. These are simple, quick, cost effective and have high sensitivity and specificity [17, 18]. Biotechnology has remarkable role to find out the problems regarding to human health and development in many developing countries [19]. Zinc is very essential to human health. Through biotechnology bio-availability of zinc has risen for the benefit of human health [20]. Application of modern biotechnology has reduced the level of certain allergens and anti-nutrients in food. For example, cyanide level in Cassava roots and levels of natural glycoalkaloid toxin in potatoes have been reduced by inserting invertase gene from yeast. Biotechnology has played a dynamic role in improving the challenges regarding to human health as it has flexibility to reduce global health differences by the provision of promising technologies [21, 22, and 16].

Biotechnology in Environment :

Biotechnology plays a major role in monitoring and controlling the environmental pollutions through the biological applications including bioremediation, biomonitoring, biotreatment and biodegradation of all the solid, liquid and gaseous wastes. Environmental biotechnology is science that's applied to review the natural atmosphere. Environmental biotechnology might additionally imply that one attempt to tackle process for industry and for its enhancements [23]. Microorganisms have enzymes to reduce or oxidize the heavy metal and municipal solid waste which helps in the biodegradation [24, 25]. Bioremediation is the use of microorganisms or microbial processes to detoxify and degrade environmental contaminants [26].

Biotechnology and Ecosystem modeling :

An ecosystem consists of producers, consumers, decomposers and detritivores and their physical environment, all interacting through energy flow and materials recycling. Biotechnology techniques like bioinformatics are useful in ecosystem modeling. Bioinformatics deals in gene database management, gene mapping, coding, sequence alignment etc [27, 16]. Genomic technologies point to their potential to radically improve the overall quality of human life and the environment [28].

Biotechnology in Food :

Genetic engineering provides powerful tools to enhance the modification of plants to the potential benefit of society. Crops have been engineered to decrease pesticide and herbicide usage, protect against stressors, enhance yields and extend shelf life. Beyond the environmental benefits of decreased pesticide and herbicide application, consumers stand to benefit by development of food crops with increased nutritional value, medicinal properties, and enhanced taste [29].

Conclusion :

The application of biotechnology to achieve a safe environment and agriculture are addressed will have a remarkable impact on the future of biotechnology. From all the facts that have been discussed above biotechnology is known to influence every aspect of human health. Biotechnology has offered modern medical devices for diagnostic and preventive purposes. Biotechnology has played a major role in producing nutrients enriched food. Biotechnology has evolved numerous strategies to biodegrade these pollutants by making use of microorganism. Biotechnology improves the overall quality of human life and the environment.

Acknowledgement :

The authors would like to express heartfelt thank to principal, Dr. B. D. Ahirwar and Dr. Sunita Singh, Head of the Zoology and Biotechnology, Government Autonomous Girl's Post Graduate College of Excellence, Sagar, (MP) India, for giving us encouragement and guidance in preparing the manuscript.

References :

1. Convention on Biological Diversity Handbook 3rd edn 1992 <https://www.cbd.int/doc/handbook/cbd-hb-01-en.pdf> (Accessed 29 Sep 2015).
2. Gupta R and Rajpal T 2012 Concise Notes in Biotechnology (Tata/McGraw-Hill Education) ch 1.
3. Samiksha S Biotechnology: meaning, technologies and applications in India www.yourarticlelibrary.com/biotechnology/biotechnology-meaning-technologies-and-applications-in-india8617-words/11249 (Accessed 1 July 2017).
4. Gibbs D F and Greenhalgh M E 1983 Biotechnology, Chemical Feedstocks, and Energy Utilization: Report Prepared for the Commission of the European Communities, Directorate General for Research and Development, as Part of the FAST Programme (Dover, NH: Pinter).
5. Olatunji O (2007) Biotechnology and Industries in Nigeria. Proc. 20th Annual Conf.,

- Biotech. Soc. of Nig. (BSN), 14th - 17th Nov, 2007 at Ebonyi State University, Abakaliki, Nigeria, pp. 36-38.
- Bar?s.C.C., K?rbaslar F.G. (2015) A Study of Certain Biology and Biotechnology Concepts in Secondary School and High School Course Books in Terms of Scientific Competency Procedia - Social and Behavioral Sciences, 174: 420-426.
- James, Clive. (2012) Global Status of Commercialized Biotech/GM Crops: 2012. ISAAA Brief No. 44. ISAAA: Ithaca, NY.
- Caroli, A.M., Chessa, S., Erhardt, G.J. (2009) Milk protein genetic variation in cattle: impact on animal breeding and human nutrition. J. Dairy Sci. 92, 5335- 5352.
- Marletta, D., Criscione, A., Bordonaro, S., Guastella, A.M., D'Urso, G. (2007) Casein polymorphism in goat's milk. Lait 87, 491-504.
- Martin, P., Szymanowska, M., Zwierzchowski, L., Leroux, C. (2002) The impact of genetic polymorphisms on the protein composition of ruminants milks. Reprod. Nutr. Dev. 42, 433-459.
- Bizily, S., Rugh, C. L. & Meagher, R. B. (2000) Phytodetoxification of hazardous organomercurials by genetically engineered plants. Nat. Biotechnol. 18: 213-217.
- Ania Wieczorek (2003) Use of Biotechnology in Agriculture- Benefits and Risks. College of Tropical Agriculture and Human Resources (CTAHR). BIO-3.
- Ene-Obong EE (2003). Current Issues in Agricultural Biotechnology. Quarterly Public Lecture of the Nigerian Academy of Science, p. 83.
- Rosamond L, Naylor a, Walter P. Falcon, Robert M. Goodman, Molly M. Jahn, Theresa Sengooba, Tefera, H., Rebecca J. (2004) Nelson Biotechnology in the developing world: a case for increased investments in orphan crops 5 Food Policy 29, 15-44.
- Soetan, K.O. (2011) The role of biotechnology towards attainment of a sustainable and safe global agriculture and environment -A review. Biotechnology and Molecular Biology Review Vol. 6(5), pp. 109-117, May 2011.
- Afzal H, Zahid K, Ali Q, Sarwar K, Shakoor S, et al. (2016) Role of Biotechnology in Improving Human Health. J Mol Biomark Diagn 8: 309. doi: 10.4172/2155-9929.1000309.
- Khan MT, Afzal S, Rehman AU, Zeb T (2015) Interleukin 10 (IL-10) promoter-1082 A> G polymorphism and risk of cancer: Meta-analysis. Advancements in Life Sciences 2: 67-73.
- Li X, Quigg RJ, Zhou J, Gu W, Rao PN, et al. (2008) Clinical utility of microarrays: current status, existing challenges and future outlook. Curr genomics 9: 466- 474

19. Singer PA, Daar AS (2001) Harnessing genomics and biotechnology to improve global health equity. *Science* 294: 87-89.
20. Anika Lehmann, Stavros D. Veresoglou, Eva F. Leifheit, Matthias C. Rillig (2014) Arbuscularmycorrhizal influence on zinc nutrition in crop plants - A metaanalysis. *Soil Biology and Biochemistry*, Volume 69, Pages 123-131.
21. Ahmed S, Nasir AI, Yaqub H, Waseem M, Tabassum B, et al. (2013) Molecular detection, phylogenetic analysis and designing of siRNA against Potato Virus X. *Adv Life Sc.*
22. Ali A, Iqbal M, Ali Q, Razzaq A, Nasir IA (2016) Gene profiling for invertase Activity: Assessment of potato varieties for resistance towards cold induced sweetening. *Adv Life Sci* 3: 63-70.
23. Abdul Hannan, Muhammad Qasim, Atif Bashir, Ejaz-ul-Hasan, Qurban Ali and Hafiz Saad Bin Mustafa (2015) Biotechnology: A tool for the improvement of human life. *Nature and Science* 2015;13(7).
24. Ivanov V, Hung YT (2010) Applications of environmental biotechnology. *Envi Biotechnol.*
25. Murphy, A. and Perrella, J. (1993) A Further Look at Biotechnology, Princeton, NJ, USA: The Woodrow Wilson National Fellowship Foundation. Woodrow Wilson Foundation Biology Institute.
26. Okpokwasili GC (2007). Biotechnology and Clean Environment. Proc. of the 20th Annl. Conf. of the Biotechnology Society of Nigeria (BSN), 14th - 17th, November, 2007 at the Ebonyi State University, Abakaliki, Nigeria.
27. Abd-Elsalam K.A (2003). Bioinformatic tools and guideline for PCR primer design. *African J. Biotechnol.*, 2 (5): 91-95, Available online at www.academicjournals.org/AJB.
28. Steven Weldon & David Laycock (2009) Public opinion and biotechnological innovation, *Policy and Society*, 28:4, 315-325, DOI: 10.1016/j.polsoc.2009.09.005.
29. Michael C. Falk, Bruce M. Chassy, Susan K. Harlander, Thomas J. Hoban, IV, Martina N. McGloughlin and Amin R. Akhlaghi (2002) Food Biotechnology: Benefits and Concerns. *J. Nutr.* 132: 1384-1390.