A Review on several aspects of Bio Technology

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ABSTRACT: Biotechnology is a field of biology that is used to solve problems and create useful products. One of the most widely used techniques in genetic engineering is that it allows scientists to modify the DNA of organisms at will. Biotechnology is especially significant in the realm of medicine, since it allows the creation of therapeutic proteins and other medications. The synthetic insulin and growth hormones, as well as diagnostic tests for identifying various ailments, are examples of how biotechnology impacts the medical disciplines. Biotechnology is also useful for improving industrial processes, cleaning the environment, and developing new products. This paper discusses the numerous uses of biotechnology in several areas as well as in everyday life. Biotechnology is mostly utilised to improve human wellbeing via the development of technologies and products. Biotechnology appears to be making significant progress in the future. Biotechnologies will change illness detection in the future, especially for diseases caused by genetic factors. The new tests will detect changes in the DNA sequences of genes linked to illness risks and estimate the chance of a patient acquiring a disease. Newer medications will develop in the healthcare industry in the future, thanks to the development of newer drugs.

KEYWORDS: Animal, Bio technology, Green technology, Plant, Red biotechnology.

1. INTRODUCTION

Biotechnology is the use of biological processes, creatures, or systems to the creation of goods that aim to improve human life quality. Farmers were the first biotechnologists, who used cross pollination and crossbreeding to create better plant and animal species. Biotechnology has grown in sophistication, scope, and usefulness in recent years. Biotechnology also has the potential to create new industrial processes that use less energy and are made from renewable resources. It's crucial to remember that biotechnology isn't just about biology; it's an interdisciplinary field that encompasses both natural and engineering sciences. Like other advanced technologies, biotechnology has the potential to be abused. Some groups have attempted to establish legislation regulating or prohibiting specific procedures or programmes, such as human cloning and embryonic stem-cell research, in response to this concern. There is also worry that if parties with malicious intentions employ biotechnological techniques, the ultimate product may be biological warfare[1].

Scientific progress has relied on the creation of new instruments to enhance health care, agricultural output, and environmental protection over the years. Individuals, consumers, governments, and scientists must finally determine if the advantages of biotechnology outweigh the hazards of this new method.

The knowledge and use of genetic information of animal and plant species is referred to as modern or "new" biotechnology. Genetic engineering alters the function of genes within a species or transfers genes between species, resulting in Genetically Modified Organisms (GMOs).

By tampering with the genetic code of plant and animal species, including humans, modern biotechnology poses ethical concerns. As a result, it may be considered "abnormal" or even sacrilegious. Furthermore, GM food (and feed) items and plant species may be viewed with suspicion, either due to health risks emerging from direct ingestion or longer-term environmental harm resulting from their uncontrolled release in nature.

In agriculture, biotechnology applications focus on the genetic alteration of existing plant and animal species by the insertion of genetic material from one species into another, where ‘natural' cross-breeding does not work. Gene-modified (GM) crops, maize, soya, and other oilseeds have so far been the most commercially important uses.

1.1 Branches of biotechnology:

1.1.1 Plant biotechnology:

Plant biotechnology is described as the genetic manipulation of plants to introduce desired characteristics. Plant biotechnology has its origins in the period when people began gathering seeds from their favourite wild plants and growing them in managed fields. When the plants were harvested, it appears that the seeds of the most attractive plants were saved and transplanted the next growing season.

1.1.2 Biotechnology: Green, red and white:

- *Green Technology:* The first wave of green biotechnology occurred in the agriculture business, and it is frequently referred to as the first wave since it was the first use of biotechnology. Although genetically modified crops receive a lot of attention these days, humans have been genetically altering our crops unintentionally for thousands of years. We've developed crops that are suited to human requirements via decades of plant crossbreeding[2].
- *Red biotechnology second wave:* Biotechnology in the medical field is sometimes referred to as the second wave of biotechnology. Companies rushed to develop innovative vaccines, antibiotics, proteins, and hormones by genetic modification in the 1970s, spawning the discipline of biotechnology. As the pharmaceutical business seeks for novel treatments and cures, this industry has amalgamated with the conventional pharmaceutical industry; it is marked by extremely high R&D expenses.
- *Industrial biotechnology or White biotechnology third wave*: In industries such as chemicals, food and feed, detergents, paper and pulp, textiles, and bioenergy, enzymes and microorganisms are used to create biobased goods (such as biofuels or biogas). It does so by utilising renewable raw materials and is one of the most promising and creative ways to reducing greenhouse gas emissions currently available. In these and other industries, industrial biotechnology has been shown to make substantial contributions to reducing the effects of climate change. Biotechnology may enhance industry performance and product value in addition to environmental advantages, and as the technology grows and matures, white biotechnology will offer more and more feasible solutions for our environment. These creative ideas have additional environmental and economic benefits.

1.1.3 Animal biotechnology

Animal biotechnology is a branch of biotechnology in which molecular biology techniques are utilised to genetically alter (i.e. edit the genome of) animals for medicinal, agricultural, or industrial uses. Animal biotechnology has been utilised to create genetically engineered animals that can generate therapeutic proteins, develop faster, and are disease resistant.

1.1.4 Environmental biotechnology :

Environmental biotechnologists integrate biology and engineering to create and implement contaminated-site remediation techniques[3]. Microbes, fungus, and bacteria, for example, are capable of absorbing contaminants and breaking them down into harmless components over time. Environmental biotechnologists find, create, and employ suitable microorganisms for remediating a specific region and its contaminants. Contaminated soil can be remediated on site or transported away for treatment in containers. Plants may also be used to filter pollutants in soil, water, and air, convert plants to biofuels, and build more sustainable ways to prevent pollution[4].

1.1.5 Molecular biotechnology:

In its broadest meaning, molecular biotechnology is the study and modification of nucleic acids and proteins in the laboratory for applications in human and animal health, agriculture, and the environment. Many fields of science, including molecular biology, microbiology, biochemistry, immunology, genetics, and cell biology, have come together to form molecular biotechnology. It's a fascinating area that's fueled by the capacity to transfer genetic information across species in order to better understand essential biological processes or create a valuable product. The human genome project's completion has opened up a slew of new options for developing novel medications and treatments, as well as ways to enhance current ones. Molecular biotechnology is a fast-paced, ever-changing discipline. The significance and influence of molecular biotechnology may be felt all around the world[5].

1.1.6 Food chemistry:

Microbiology, biology, chemistry, engineering, and biotechnology are all areas of study in food science[6]. The application of science and engineering to the production, processing, distribution, preparation, assessment, and consumption of food is known as food science. The composition and characteristics of food components, as well as the chemical changes they experience during handling, processing, and storage, are all covered by food chemistry. To investigate and manipulate biological molecules as sources of human nourishment, a food chemist must have understanding of chemistry and biochemistry, as well as physiological chemistry, botany, zoology, and molecular biology. Food chemists examine the changes that

occur in biological systems that are dead or dying (post-harvested plants and post-mortem animal tissues) when they are exposed to various environmental circumstances.

1.1.7 Food microbiology:

Food microbiology is concerned with a wide range of current research on microorganisms that have both good and harmful impacts on food safety and quality, and hence constitute a public health problem. Food microbiology is the study of microorganisms found in food and those utilised in food production. This includes both contaminating microorganisms and those utilised in food production, such as those used to make yoghurt, cheese, beer, and wine[7].

1.1.8 Modern food biotechnology:

Modern food biotechnology allows scientists to enhance food characteristics and manufacturing techniques more quickly and precisely. Farmers have spent years crossbreeding plants or animals to get the precise advantageous qualities they want while avoiding the traits they don't want for millennia prior to the invention of this technique. Not only did the procedure take a long time and effort, but the end result was far from certain.

1.1.9 Food biotechnology:

Today, food biotechnology advances this legacy by combining plant science and genetics expertise. Scientists can transfer genes for desirable characteristics from one plant to another using contemporary biotechnology. This approach generates significant environmental and economic advantages for both the farmer and the customer.

1.2 Benefits of biotechnology:

- *Protection of the environment*: Scientists have improved the disease resistance of several foods, such as papayas and potatoes. To protect themselves from dangerous insects or viruses, these crops require less chemical spraying, which is healthier for water and wildlife. Herbicides used to suppress weeds are shielded from other crops, allowing farmers to save soil by tilling the land less frequently.
- *Greater crop yields:* Farmers may employ biotechnology to help plants thrive by improving insect resistance and herbicide tolerance. This provides for a higher yield from these tougher plants.
- *Better tasting and fresher foods:* Biotechnology can create fresher and better tasting food, such as sweeter peppers and tomatoes that mature more slowly.
- *Grow more food on less land:* The world's population is expected to reach nine billion people by 2050. Farmers may grow more crops on their existing area by using biotechnology. Countries do not need to devote additional area to agriculture in this way. As a result, emerging countries stand to profit the most, as they will see the greatest population increase.
- *Keep food safe to eat:* Scientists can more precisely detect potentially harmful viruses and bacteria in food. As a result, the risk of food-borne disease will be reduced even further. Some kinds of fungus found in maize produce chemicals that are harmful to animals who consume it. In the United States, these chemicals are already controlled, and biotechnology offers another option to assist limit the level of these substances in maize.
- *New food varieties:* Biotechnology can help to expand crossbreeding improvements, resulting in novel food types such as seedless melons and tiny avocadoes. Farmers may also create food that has a superior flavour and nutritional profile.

1.3 Risks of biotech foods:

Food consumers are most concerned about two issues: first the possible introduction of food allergies and next is marker genes that might enhance human antibiotic resistance. The FDA keeps an eye on the possibility of food allergies in biotechnology goods. As part of the regulatory process, each item is assessed for its allergenic potential, and if a known allergy is moved to a food source not typically associated with that allergen, labelling is needed. There are currently no food items with this classification on the market in the United States. In fact, due of this issue, several items have been removed from the evaluation process. There is currently no scientific proof that genetically engineered foods cause increasing antibiotic resistance. (This is more likely to occur as a result of misuse of antibiotics prescribed by a doctor.) However, due to public outcry, crops without such antibiotic-resistant genes are now being created.

People are also worried about the environment and the emergence of "super" weeds or plants that are herbicide-resistant or insect-harming. As part of their endeavour to thoroughly examine the dangers connected with the use of biotechnology, scientists are gathering information on both of these concerns. Biotechnology's environmental effect, particularly its application in food production, is monitored by the Environmental Protection Agency (EPA).

1.3 Different techniques associated with food biotechnology

1.3.1 Old: Traditional crossbreeding, which refers to the random recombination of genes through sexual reproduction to produce a new organism with enhanced characteristics, is an older food biotechnology approach. Due to the unpredictability of gene transmission, crossbred plants, for example, may take multiple generations to attain a certain feature. Improved agricultural production, aesthetic characteristics, better tolerance to physical stress such as low temperatures, and increased disease and pest resistance are examples of such traits.

1.3.2 *New:* The combining of two fragments of DNA from distinct species to form a single piece of DNA is a modern food biotechnology method. Individual 'specific' genes are transferred from one creature to another to increase the nutritional content of a product, such as fortifying a fruit or vegetable. Modern methods are significantly more accurate and quicker. Rather than waiting for the random shuffling of genes across multiple generations, it is feasible to swiftly transfer a single gene of interest.

1.4 Food products have been or are being developed with biotechnology:

Corn varieties with a bacterial gene that kills insects and soybeans implanted with a gene that makes them resistant to weed herbicides like Roundup are two examples of food biotechnology products. Cotton, squash, and papaya are some of the other crops where biotechnology has been utilised to minimise pesticide usage, enhance profitability through increased production, and eventually lower consumer prices. Oils, such as canola, in which the quantities of nutritionally important fatty acids are raised, gluten-free wheat types, potatoes (protein), kiwi (resveratrol), and lettuce are examples of foods created using biotechnology to improve the levels of nutrients or to address a health problem (iron).

1.5 Safety concerns associated with food biotechnology:

The current definition of food biotechnology—also known as Genetically Modified Organism (GMO) or Genetically Engineered (GE), among other terms—is a food product produced by scientists in a laboratory by genetic alteration of a plant, animal, or microbe. Food biotechnology is a broad phrase that encompasses a wide range of techniques for developing new or enhanced food items by utilising live creatures such as plants, animals, microorganisms, or any component of these species. It comprises newer kinds of food biotechnology that allow for quicker and more accurate product development.

2. LITERATURE REVIEW

Michael C. Falk et al. discussed several concerns and benefits of food biotechnology in which they explained how the necessity for experimental data and good scientific judgement to determine the advantages and hazards to society has been underlined by recent advancements in agricultural biotechnology. To participate in this evaluation, nutrition scientists and other animal biologists must have a balanced grasp of the concerns. To date, the majority of crop plant changes have benefitted farmers. Crops have been modified to use less pesticides and herbicides, to be more resistant to stress, to increase yields, and to have a longer shelf life. Consumers will profit from the creation of food crops with higher nutritional content, medicinal qualities, improved flavour, and aesthetic appeal, in addition to the environmental benefits of less pesticide and herbicide application. There is still worry that these advantages come at a cost to the environment or put the customer at danger. The majority of Americans are unaware of the extent to which genetically modified foods have reached the market. Although consumer knowledge of biotechnology appears to have risen over the previous decade, the majority of consumers continue to be sceptical[8].

Moschini G discussed Biotechnology and the development of food markets in which author discussed how Over the last 12 years, biotechnology has had a significant influence on the agricultural and food industries due to the rapid and widespread acceptance of a few genetically modified (GM) crops. This has resulted in significant efficiency improvements, including increased yields and lower weed and pest management costs, as well as some environmental benefits. The projected development of crops with new agronomic

features, as well as output traits to improve the nutrition and health aspects of food items, might have even more far-reaching consequences. To fully realise such promises, it may be necessary to overcome the constraints imposed by stringent GM product regulations[9].

Kianoush Khosravi-Darani discussed Research Activities on Supercritical Fluid Science in Food Biotechnology in which he explained the current hot topic of supercritical fluids and its applications in food biotechnology. The essential concepts of the approach, as well as a discussion of the history, instrumentation, methodology, applications, issues encountered, and benefits over older, non-supercritical techniques, are included within each application, when possible. The majority of current commercial applications of supercritical extraction involve biologically produced materials; the technique may be particularly relevant to the extraction of biological compounds in cases where low-temperature processing, high mass-transfer rates, and negligible vapour pressure are required. Decaffeination of green coffee beans, the creation of hops extracts, the recovery of aromas and tastes from herbs and spices, the extraction and fractionation of edible oils, and the removal of pollutants are just a few of the food processing uses. New developments that integrate extraction with reaction or crystallisation processes may boost the appeal of supercritical fluids in the bioprocess industries even further. The deadly impact of high hydrostatic pressure CO2 on microorganisms, with no or only a minor heating procedure, has recently garnered a lot of attention in the quest to create and establish an unique and successful alternative to heating treatment[10].

3. CONCLUSION

Biotechnology is being used in a variety of sectors and businesses, including pharmaceuticals, food, agriculture, and medical. This industry encompasses both engineering and research. Genetic engineering has aided in the development of medicinal proteins as well as biological organisms. Biotechnology has made significant contributions to the industrial sector and molecular biology. Its scope has been broadened to include a wide range of biological disciplines. Bioengineering is a branch of biology that focuses on finding solutions to issues and developing useful products. The ability to change the DNA of organisms at will is one of the most commonly utilised techniques in genetic engineering. Bioengineering is particularly important in medicine since it enables for the development of therapeutic proteins and other medicines.

Biotechnology is utilised in a wide range of industries and sectors, including pharmaceuticals, agriculture, farming, and medicine. Engineering and research are also included in this business. Medicinal proteins and biological organisms have both benefited from genetic engineering. Biotechnology has had a tremendous impact on the industrial industry as well as microbiology. Its reach has been expanded to encompass a variety of biological fields. Bioscience is mostly used to produce technology and goods that promote human well-being. Biotechnology looks to be developing rapidly in the future. In the future, nanotechnology will revolutionise disease detection, particularly for diseases caused by genetic elements.

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