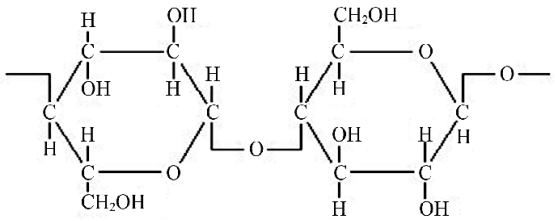
MODULE-02

Applications of Biomolecules

1. Explain what is Cellulose and mention the role of Cellulose in water filtration.

Cellulose is a polysaccharide that is a Carbohydrate. It is the most abundant organic compound found in nature. The chemical structure of the Cellulose molecule is shown in the figure below.



Cellulose

It is Insoluble in water and forms long fibrous strands that are highly resistant to chemical and biological degradation.

Because of its high tensile strength and biodegradability, cellulose is widely used in the production of paper, textiles, and other products.

Cellulose is effective in removing particles such as sand, silt, and sediment, as well as organic and inorganic contaminants.

Hence it is used in household water filtration systems to industrial-scale water treatment plants.

Role of Cellulose in Water Filtration: Cellulose Plays an important role in water filters. Some of the key functions of cellulose in water filtration is

Filtration: It is a fibrous material with a complex, porous structure. This structure allows water to pass through while trapping particles and impurities in the filter material.

Structural support: Cellulose provides structural support to water filters. Cellulose fibers can be combined with other materials like Perlite, which create a porous filter material. This porous filter maintains its shape and does not collapse under pressure.

Binding Agent: Cellulose can be used as a binder to hold other filter materials in place. For example, Cellulose can be combined with activated carbon to create filter material that holds activated Carbon in place and prevents it from leaching into filtered Water.

Biodegradability: Cellulose is a biodegradable material that breaks down naturally in the environment, and can be disposed of without causing harm to the environ

2. Describe the design and development of Cellulose-based Water filters

The design and development of a Cellulose base water filter involves the following steps.

1. Material Selection: Cellulose is a cost-effective material and is available from a variety of natural sources like wood pulp cotton, and other plant fibers. It has the desired properties of the filter.

2. Processing: Cellulose can be processed into a suitable form for use in water filters. It involves purification, drying, and milling to produce fine powder.

3. Filter design: Cellulose filters can be designed to trap different types of impurities. Such as sand, silt, and sediment, as well as organic and Inorganic contaminants.

4. Chemical Treatment: The cellulose filters may be treated with chemicals to enhance their filtration properties or to add anti-microbial properties.

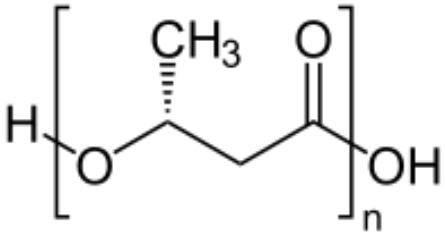
5. Testing: The Cellulose filter should be tested to ensure that it meets the required filtration standards and is effective at removing impurities from water.

6. Production: once the filter has been designed and tested, it can be produced at a scale of Commercial use.

7. Maintenance: These filters need to be replaced periodically to ensure effectiveness. The frequency of replacement depends on factors such as the level of impurities and the amount of use.

3. What is a PHA molecule and mention the applications of PHA Bioplastics.

PHA is a biodegradable and biocompatible Polymer obtained from renewable resources such as plant-based oils, Waste cooking oil, and agricultural waste. The chemical structure of the PHA molecule is shown below.



PHA Bioplastics have several advantages over traditional plastics.

These are biodegradable, which means they can be broken down by natural processes. They are non-toxic and do not release harmful chemicals when it break down, unlike traditional plastic

PHA can be used to make biodegradable packaging materials for food and beverages.

In agriculture, PHA can be used to make biodegradable mulch films.

In the medical industry, PHA bioplastics can be used to make sutures, implants, and drug

delivery systems.

PHA Bioplastics are compatible with human tissues and have low

toxicity, making them attractive options for medical applications

4. Mention the advantages of PHAs as Plastic materials.

1. Biodegradability: PHAs are biodegradable and can be broken down naturally by microorganisms in the environment. This makes them an environmentally friendly alternative to traditional plastic materials.

2. Versatility: PHAs can be produced in a variety of different forms, from flexible films to rigid structures. This makes them versatile materials that can be used for a range of different applications.

3. Renewable: PHAs are produced using renewable resources such as Plant oils, or waste streams from the food Industry. This makes them a sustainable alternative to traditional plastic materials

4. Non-Toxic: PHAs are nontoxic and Biocompatible, making them suitable for use in medical applications, such as sutures, drug delivery, and tissue Engineering.

6. Explain in brief nucleic acid. Discuss DNA Vaccine for rabies and RNA Vaccine for Covid-19.

Nucleic acids are biomolecules that are essential for life. They carry genetic information in all living organisms. There are two types of nucleic acids.

1. Deoxyribonucleic acid (DNA) 2.Ribonucleic acid (RNA)

DNA Vaccine for Rabies: To produce a DNA vaccine for rabies, Identify the genetic factor that codes for a protein on the surface of the rabies virus that is targeted by the immune system. This gene is then inserted into a plasmid, which is a small circular piece of DNA that can reproduce independently of the host DNA.

The Plasmid with the gene is then injected into the muscle tissue of the individual receiving the vaccine. The muscle cells take up the plasmid and begin producing the rabies protein. This triggers the immune response leading to the production of antibodies against the rabies virus.

RNA Vaccine for COVID-19: RNA Vaccines are the types of vaccine that work by using a small piece of genetic material.

The mRNA vaccines for Covid-19 such as Pfizer-BioNTech and Moderna contain a small piece of the virus's RNA when injected into the body it instructs cells in the body to produce a harmless piece of the virus called the Spike Protein. Once the spike protein is produced, the immune system recognizes it as a foreign body and stands as an immune response, producing antibodies that can recognize and neutralize the actual virus if the person is later exposed to it.