

## APPLICATIONS OF THE IMMOBILIZED ENZYMES

**Food industry Application:** In food industry, the purified enzymes are used but during the purification the enzymes will denature. Hence the immobilization technique makes the enzymes stable. The immobilized enzymes are used for the production of syrups. Immobilized beta-galactosidase used for lactose hydrolysis in whey for the production of baker's yeast. The enzyme is linked to porous silica matrix through covalent linkage. This method was used for the various purposes such as confectionaries and ice-creams.

**Biomedical Application:** Immobilized enzymes are used in medicine from 1990. Immobilized enzymes are used for diagnosis and treatment of diseases in the medical field. The inborn metabolic deficiency can be overcome by replacing the encapsulated enzymes. The enzyme encapsulation through the electroporation is a easiest way of immobilization in the biomedical field and it is a reversible process for which enzyme can be regenerated. The enzymes when combined with the biomaterials it provides biological and functional systems.

**Biochemical Analysis:** Immobilized enzymes can be used for the development of precise and specific analytical techniques for the estimation of several biochemical compounds. The principle of analytical assay primarily involves the action of the immobilized enzyme on the substrate.

**Biodiesel Production:** Biodiesel is produced through triglycerides (vegetable oil, animal fat) with esterification of alcohol (methanol, ethanol) in the presence of the catalyst. The production of catalyst is a drawback of high energy requirements, recovery of glycerol and side reaction which may affect the pollution. Hence the biological production of liquid fuel with lipases nowadays has a great consideration with a rapid improvement. Lipase catalyses the reaction with less energy requirements and mild conditions required. But the production of lipase is of high cost, hence the immobilization of lipase which results in repeated use and stability. In the biological production of biodiesel the methanol inactivates the the lipase, hence the immobilization method is an advantage for the biodiesel production.

**Textile Industry:** The enzymes derived from microbial origin are of great interest in textile industry. The enzymes such as cellulase, amylase, laccase, pectinase, cutinase etc and these are used for various textile applications such as scouring, biopolishing, desizing, denim finishing, treating wools etc. Among these enzymes cellulase has been widely used from the older period to till now. The textile industries now turned to enzyme process instead of using harsh chemical which affects the pollution and cause damage to the fabrics. The processing of fabrics with enzymes requires high temperatures and increased pH, the free enzymes does not able to withstand the extreme conditions. Hence, enzyme immobilization for this process able to withstand at extreme and able to maintains its activity for more than 5-6 cycles.

**Wastewater Treatment:** The enzymes used in the wastewater treatments are peroxidases, laccase, azo-reductases. These enzymes due to harsh conditions like extreme temperature, low or high pH and high ionic strength may lose its activity; to overcome this problem immobilized enzymes are used.

### Important immobilized enzymes and their Industrial applications

Immobilized enzyme	Applications
Aminoacylase	Production of L-amino acids from D, L-acyl amino acids

Glucose isomerase	Production of high fructose syrup from glucose (or starch)
Amylase	Production of glucose from starch
Invertase	Splitting of sucrose to glucose and fructose
B-Galactosidase	Splitting of lactose to glucose and galactose
Penicillin acylase	Commercial production of semi-synthetic penicillins
Aspartase	Production of aspartic acid from fumaric acid
Fumarase	Synthesis of malic acid from fumaric acid
Histidine ammonia lyase	Production of urocanic acid from histidine
Ribonuclease	Synthesis of nucleotides from RNA

Please refer to these links for additional information

[http://chesci.com/wp-content/uploads/2016/12/V1i3\\_4\\_CS17204211.pdf](http://chesci.com/wp-content/uploads/2016/12/V1i3_4_CS17204211.pdf)

[https://www.researchgate.net/publication/232083060\\_Application\\_of\\_immobilized\\_enzyme\\_technologies\\_for\\_the\\_textile\\_industry\\_A\\_review](https://www.researchgate.net/publication/232083060_Application_of_immobilized_enzyme_technologies_for_the_textile_industry_A_review)

<https://www.ncbi.nlm.nih.gov/pubmed/27770861>

**Write the answers of the following questions and mail the same latest by March 29, 2020. Do not type and send. It should be handwritten, clicked and converted into pdf.**

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### **Assignment**

- 1) What are the salient features of enzyme immobilization?**
- 2) Name the various methods for enzyme immobilization.**