

# STUDY OF ENZYMES FOR WASTEWATER PURIFICATION: A Review

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**Abstract:** - Due to contact of variety of chemicals, pharmaceutically active compounds and many other effluent with water causes wastewater. Many hazardous contaminants (dye and phenol contaminants) badly effect on human and ecosystem, due to their toxicity. The conventional wastewater treatment available but it gives low efficiency and stability, also high cost required for process. In recent years, enzymatic wastewater technologies are use for wastewater treatment. Various enzymes from various microbes have been reported to play important role in wastewater treatment. Enzymatic wastewater treatment is more economical effective and eco-friendly. Enzymes remove recalcitrant pollutants by precipitation and transform to other value added product. By using the Immobilization of enzymes increase the mechanical and thermal stability of enzymes. The use of the enzymes in the case of harmful reactions is extremely important for cleaner and greater technologies to save the planet.

**Keywords:** Enzymes, Microbes, Wastewater, Immobilization, Effluent.

## I. INTRODUCTION

The limited availability of fresh water is a global crisis due to wastewater. Various agricultural and chemical industries release variety of chemicals into environment. The result of that, it badly effect on human health and environment. Nowadays, due to increase the population and disposal of municipal sewage into water, also the disposal of large amount of industrial waste direct into water bodies without proper waste management system. Due to these reasons water pollution become a very big problem for whole world. Industrial chemicals, pharmaceutical active compounds, dye and phenolic components when mix into water bodies then it badly effect on aquatic life. Synthetic dyes are highly coloured so it responsible for photosynthetic effect. The photosynthetic effect happen on aquatic life due to light penetration and it affect on food chains. It has also side effect for human such as allergy, headache, and fever after exposer. For prevention these problems proper wastewater treatment is very important.

In the enzymatic wastewater treatment different enzymes to be use while treatment. Enzymes produced from the living cells. Many enzymes have the hydrolyzing, oxidizing or reducing characteristics. Microbial enzymes as a metabolic catalysts, resulting it use in many industrial applications. Enzymes are also use in wastewater treatment. Physio-chemical or biological processes are two methods of waste treatment processes. Enzymatic treatment falls in between two conventional processes. The main advantages of enzymatic

wastewater treatment are it can be operated at low and also at high concentration; it can be operate at high temperature and salinity. It operates over a wide range of PH and help for reduces sludge volume. It is easy process and simple for control the process.

In enzymatic wastewater treatment mainly two methods are used for improve the process. These two methods are Immobilization of enzyme method and Single enzyme nanoparticle method. Immobilization method is used for decrease the operating cost because by using this method the working capacity of enzymes increase as well as its reusability increases. Single enzyme nanoparticle is also play important role in the wastewater treatment. It increases the speed of the process. In variety of industries it is used for degradation of harmful recalcitrant compounds. By using these two methods wastewater treatment become easy, clean and green. So enzymatic wastewater treatment becomes more important in industries for controlling the water pollution and for healthy environment. In enzymatic wastewater treatment many enzymes use as a key parameter. So this paper give the clear idea of which enzymes are use in the enzymatic wastewater treatment and also give the all information of these type of wastewater treatment process.

### POLLUTANTS OF WASTEWATER

Many industries such as petroleum refinery, coal conversation, resins and plastics, textile, pulp and paper industries are mainly responsible for wastewater. In wastewater, aromatic compounds including aromatic amines and phenols are major pollutants. In bleaching operation dark brown coloured effluent produce which is highly toxic and mutagenic chlorinated product. This responsible for environmental hazard. The enzymes such as peroxidase and laccases are used in the treatment of bleaching effluents. Many heavy metals such as arsenic, copper, cadmium, lead are dangerous pollutants found in many industries and mining waste. Many food industries such as dairy industries, winery industries and meat processing industries are also responsible for the wastewater because of pollutants produce from the process occur in industry. Pesticide industries very important throughout the world today because it provides pesticides for the production and formulation of pesticides large number of waste produce. Leather processing industries are also responsible for produce huge source of waste.

- Major pollutants in wastewater given below in the table:

POLLUTANTS	EFFECTS
Pathogenic Organisms	They are generally found in wastewater and they can cause infectious disease.
Suspended Solids	It can form sludge deposits when unreacted wastewater is discharged into aquatic environment.
Biodegradable Organics	This pollutant can deplete the natural oxygen resources, if directly discharged into rivers, streams or lakes.

Heavy metals	This pollutant mostly removed from wastewater for reuse of the wastewater
Dissolved inorganic constituents	It mainly contains calcium, Sodium and Sulphate

## II. ENZYMES USED IN WASTEWATER TREATMENT

Many enzymes play important role in enzymatic wastewater treatment. The information of enzymes is given below as:

### 1. OXYGENASES:

These enzymes belong to oxidoreductase group of enzymes. It participates in oxidation of reduced substrates by transferring oxygen from molecular oxygen and utilizes FAD/NADPH as a co-substrate. These enzymes have a very important role in to increase the reactivity of organic compound or solubility in water. Oxygenases also mediate dehalogenation reactions of halogenated methanes and ethanes.

### 2. DIOXYGENASES:

These enzymes are use for oxidization of aromatic compounds and reflecting the applications of dioxygenases in environmental remediation. Dioxygenases found in the soil bacteria. It transform of aromatic precursors into aliphatic products.

### 3. MONOOXYGENASES

These enzymes act as a catalyst in oxidative reactions of substrates from alkanes to complex molecules as fatty acids. They require only molecular oxygen for their activity. In desulfurization, dehalogenation, denitrification, ammonification of various aromatic and aliphatic compounds are catalyzed by these enzymes.

### 4. LACCASES

These enzymes are produced by certain fungi, plants, insects and bacteria. These enzymes use for catalyze the oxidation of a wide range of reduced phenolic and aromatic substrates with molecular oxygen to water. Many enzymes of laccases group capable of aminophenols, polyphenol, lignin as well as some inorganic ions.

### 5. MICROBIAL LIPASES

These enzymes are very useful in various reasons such as hydrolysis, esterification and alcoholysis as well as aminolysis. It has many applications in food, chemical, detergent manufacturing and paper making industries.

### 6. CELLULASES

In the process of hydrolysis cellulose is use for reducing the sugars that can be fermented yeasts or bacteria to ethanol. In the paper industry and pulp industry it is widely use. It is use for removal of ink during recycling of papers.

### III. METHODS USED FOR ENZYMATIC WASTEWATER TREATMENT

#### 1. IMMOBILIZATION METHOD

In the Immobilization method enzymes increasing their reusability in treatment and minimizes the chances of loss of enzymes activity under the harsh condition. When immobilized enzymes are use in wastewater treatment it gives multiple advantages. Like it increase the stability of enzymes, reusability of enzymes while treatment, easy for handling. Most important advantage of this method is, it reduce running cost of treatment. Immobilized peroxidases enzymes gives easily decolorise solution of azo dyes. For the treatment the cells or tissues producing enzymes are directly introducing into the enzymes is the simplest method use for the purification of target effluent.

#### 2. SEN ( SINGLE ENZYME NANOPARTICLE)

Nanotechnology is also important method use for wastewater treatment. It is widely used for completely convert contaminants to harmless products such as carbon dioxide and water. For these conversation in wastewater treatment combination of enzyme technology and nanotechnology are used is called single enzyme nanoparticle. Many enzymes such as peroxidases, polyphenol, oxidases, dehalogenation, and hydrolases can be used for synthesis of SEN. In industry variety of recalcitrant compounds such as pesticides, phenols, dye can be degraded by this method. Similarly in wastewater treatment this enzymatic technology is used for wastewater purification.

### IV. ADVANTAGES AND FUTURE PERSPECTIVE

1] Enzymatic wastewater treatment gives many advantages over the physical or chemical method as they are regarded as clean and green. Many enzymes remove the certain recalcitrant pollutants by precipitation or transforming into other product. Enzymatic wastewater treatment gives the advantages like ease of operation and control, low energy consumption, low running cost of operation. The enzymes act as catalyst while treatment and selectivity degrade target pollutants without affecting the other components in the effluent. And most important advantage is it can operate under mild reaction conditions, especially temperature and ph. While the treatment enzyme is regenerate and available for next catalytic cycle. This treatment reduces their adverse impact on environment. Therefore making enzymatic wastewater treatment and ecologically sustainable technique.

2] Enzymes are widely used in industries for different purposes. Various industries use enzymes like amylases and cellulases in chemical treatment results in reduce waste chemical from treatment. In much industry enzymatic process are used by replacing use of chemicals. Immobilization of enzymes increases the mechanical and thermal stability of enzymes. In future trends the lesser quantities of chemicals, less water and les energy use and will get maximum performance. In these development enzymes technology can be used because it increases the efficiency with lesser energy consumption, lower cost and act as clean and green.

In future the developer and researchers can develop new chemicals and materials from cheaper resources which based on low carbon green growth.

## V. CONCLUSION

In conclusion, Immobilization of enzymes and SEN methods can be reliable and promoting tool for effective enzymatic wastewater treatment. In many industries such as dye, phenol and aromatic compounds it acts as clean and green as compared to other conventional method. Immobilized enzymes increase the catalytic efficiency of enzymes, operational stability as well as increase recovery and reusability of enzymes. These enzymes are widely used as a catalyst with wide range of applications in food, textile, leather and pharmaceutical industry. In wastewater treatment Enzymes produce waste less hazardous than the conventional techniques. And enzymes act on certain recalcitrant pollutants to remove them or convert into less harmful product. Therefore enzymes play vital role in wastewater treatment.

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