Purification Mechanism of Microorganisms in Wastewater Treatment

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Abstract

In the current field of waste water treatment technology, biological treatment is one of the most widely used technologies. Aerobic biological treatment of activated sludge is the main process of waste water treatment. Explanation of research results on the degradation mechanism and environmental factors of microorganisms in aerobic biological treatment of waste water. The existence of microbial population in activated sludge is relatively stable. In the case of good waste water treatment effect. There is a fixed proportion relationship between the microbial population of activated sludge. Many microorganisms in nature have the ability to oxidize and decompose organic matter.Production practice shows that it is very effective to decompose organic matter in waste water by microbial oxidation. This method of using microorganisms to treat waste water is called biological treatment.

Keywords

Microorganism, Bio film process,Anaerobic treatment.

1. Common Microorganisms in Waste Water treatment

Protozoa belongs to Eukaryotic Protozoa.It's a single-celled microanimal. Consisting of protoplasm and one or more nuclei. Protozoa are the same as multicellular animals.It has physiological functions such as metabolism, exercise, reproduction, sensitivity to external stimuli and environmental adaptability. Individual protozoa are smaller. They all have cell membranes. Cell membranes are firm and elastic.Keep the protozoan body in shape.Protozoa generally have one or two nuclei.Having various shapes. They differentiate in their cells.Formed organelles that can support various physiological functions and life activities.

The nutritional patterns of protozoa are divided into: Plant nutrition.In sunshine, Photosynthesis of protozoa containing pigments. Formation of carbohydrates Animal nutrition.

To phagocytize bacteria, fungus, algae or Organic particulate microorganisms. Most protozoa are animal nutrition. feeding organs with stoma and organelles.saprophytic nutrition.Feeding on dead bodies or inanimate soluble organic matter.Parasitic nutrition,Use other organisms' bodies as living places, And get energy and nutrition.

2. Purification Mechanism of Microorganisms in Aerobic Treatment of Waste Water

Aerobic treatment of waste water is under aerobic conditions,By the action of aerobic microorganisms.In the process of processing,dissolved organic substances in waste water are absorbed by bacteria through cell walls and membranes, and solid and colloidal organic substances are first attached to bacteria in vitro. Decomposition of extracellular enzymes secreted by bacteria into soluble substances,then into cells. Bacteria through their own life activities,oxidize absorbed organic matter into simple inorganic matter, and get the energy needed for the growth of bacteria,converting another part of organic matter into nutrients needed by microorganisms to synthesize new cellular substances, with the gradual growth and reproduction of bacteria, more bacteria are produced. After other microorganisms ingest nutrition,in vivo, the same biochemical reactions occur with bacteria. Biological treatment process can be divided into two types according to the growth status of microorganisms: attachment growth type and suspension growth type. In aerobic treatment, the adherent growth type is represented by bio film process and the suspended growth type is represented by activated sludge process.

2.1. Purification Mechanism of Activated Sludge Process

The purification mechanism of activated sludge process includes the adsorption of organic matter by activated sludge,oxidative assimilation of adsorbed organic compounds, sedimentation and separation of activated sludge.

2.1.1. Adsorption of Organic Matter by Activated Sludge

In gas and liquid, solid solution isophase interface, the substance is concentrated by physical and chemical effects,this phenomenon is called adsorption. The adsorption of organic matter by activated sludge is the concentration of organic matter on the surface of activated sludge. Mixing and aeration of waste water and activated sludge, the organic matter in the waste water will be reduced,then removed. During the period when the waste water and activated sludge begin to contact, organic matter is removed in large quantities,initial adsorption. The organic matter adsorbed and removed is hydrolyzed and ingested by microorganisms, then oxidized and assimilated.In the early stage of adsorption, the aerobic amount of activated sludge is independent of the apparent organic removal, it is related to the amount of oxidation and assimilation.

2.1.2. Oxidation and Assimilation of Adsorbed Organic Matter

Organic matter adsorbed by activated sludge as a nutrient source, oxidation and assimilation,

use by microorganisms. Oxidation refers to the energy required by microorganisms to obtain synthetic cells and maintain their life activities.decompose the adsorbed organic matter.If there is little organic matter in the wastewater, the microorganisms in the activated sludge will oxidize the accumulated organic matter and self-cellular substances in the body to obtain the energy needed to sustain life. Called the endogenous breathing process.

2.1.3. Precipitation and Separation of Activated Sludge Flocs

The coagulation and sedimentation performance of the activated sludge is related to the pro liferative phase of the microorganisms in the activated sludge. The process of microbial proliferation can be divided into stagnation phase, logarithmic growth phase, decaying pro liferative phase and endogenous respiratory phase. In the logarithmic growth period, the ratio of organic matter to microorganisms is high, and the speed at which microorganisms go to organic matter is fast, but the coagulation and sedimentation performance of microorganisms is poor. With the increase of aeration time, it is getting smaller and smaller. When the microbial proliferation is close to the endogenous respiration period, the adsorption, coagulation and sedimentation performance of activated sludge are higher.

2.1.4. Activated Sludge Microbial Community and Its Role

Activated sludge refers to a mixture of microorganisms composed mainly of bacteria and micro-animals, colloidal substances, suspended substances, etc., and has fluff-like particles that strongly adsorb and decompose organic matter and have good sedimentation properties. In the early stage of activated sludge formation, bacteria are mostly in a free state. As the activated sludge matures, the bacteria micelles secrete extracellular polymer proteins, nucleic acids, and multigrain to form fine fibrous intercellular substances. Then form a fungus floc by entanglement with each other. Subsequently, filamentous bacteria, molds, protozoa, etc. are intertwined to form activated sludge fluff-like particles, a process called bi-oflocculation. Therefore, the fungus mass is the structural and functional center of the act-ivated sludge. Due to its large surface area and viscosity, the activated sludge has the ability to adsorb and decompose organic matter, and the bacteria are embedded in the floc to avoid protozoa. The formation of flocs provides a place for the growth and growth of microorganisms to attach and inhabit, which facilitates the bottom-up and development of water-treated microorganisms. More importantly, flocculation makes the activated sludge have good sedimentation performance, which is beneficial to the separation of mud and water in the secondary settling tank.

Filamentous bacteria in activated sludge, such as jersey bacteria, thiophene bacteria, and thiobacteria, which are attached to sludge or interlaced with bacterial gums to form a skeleton of activated sludge. But if the sewage contains a lot of carbohydrates, when the concentration of hypoxia and organic matter is too high or low, it will cause the filamentous bacteria to multiply and cause the sludge structure to be extremely loose. The sludge will float due to the increase of buoyancy, resulting in sludge swelling and reducing the treatment effect.

Protozoa in activated sludge and their effects

Protozoa in activated sludge is second only to bacteria in quantity and species, and the common dominant species is cilia. They are mainly agglomerated on the surface of the sludge.

Its role in some protozoa (such as amoeba) can swallow organic particles in water and directly purify sewage. Certain protozoa (such as ciliates) secrete substances that promote bio flocculation. Ingestion of free bacteria helps to improve the quality of the effluent. It can be used as a finger organism for sewage purification.

2.2. Purification Mechanism of Biofilm Method

Biological membrane treatment of sewage,is a sewage biological treatment technology along with the activated sludge method. The essence of this treatment is to make microorganisms such as bacteria and fungi and micro-animals such as protozoa and metazoans attached to the filter or some carriers for growth and breeding. Forming a membranous biological sludge biofilm thereon. The sewage is in contact with the biofilm, and the organic pollutants in the sewage are used as nutrients, which are taken up by microorganisms on the biofilm, the sewage is purified, and the microorganisms themselves are proliferated and proliferated.

The ecological succession of microorganisms on biofilms is mainly restricted by dissolved oxygen and nutrients. From the membrane surface to the membrane, the microorganisms appear in the order of oxidation, facultativeness and anaerobicity from the upper layer to the lower layer of the filter, and the concentration of organic matter is gradually reduced. The dominant species is a strain of bacteria, filamentous bacteria, flagellates, swimming ciliates

Sequence of ciliates and rotifers. Therefore, by observing the succession of microbial species in each segment. It is possible to judge changes in waste water concentration or changes in sludge load.

3. Purification Mechanism of Microorganisms in Anaerobic Treatment of Waste Water

During the anaerobic treatment of waste water, the organic matter in the waste water is combined with a large number of microorganisms, which are finally converted into methane, carbon dioxide, water, hydrogen sulfide and ammonia. In this process, the metabolic processes of different microorganisms interact and restrict each other to form a complex ecosystem. Anaerobic degradation of organic matter is divided into three stages.

Hydrolysis fermentation stage. The macromolecular insoluble complex organic matter is hydrolyzed into small molecule-dissolved higher fatty acids under the action of bacterial extracellular enzymes, and then the microbes that infiltrate into the cells are mainly facultative bacteria and obligate bacteria.

Acetate production stage.At this stage, the product of the previous stage is further converted into simple fatty acids, hydrogen, carbonic acid and new cellular materials. The microorganisms involved in this process are mainly facultative bacteria and obligate anaerobic bacteria.

Methanogenic stage. At this stage, acetic acid, hydrogen, carbonic acid, formic acid, and methanol are converted into methane, carbon dioxide, and new cellular materials. The microbe involved is the absolute anaerobic methanogen.

Methanogens have the following characteristics: The value is less adaptable, the best pH is 6.8-7.2.The adaptability to temperature is weak. When the methanogen is domesticated at a certain temperature, the temperature increase and decrease may destroy the methane digestion. Methanogens have a long generation cycle, usually one generation a day. Methane bacteria are highly specific. Each methanogen can only metabolize specific waste. All methane bacteria can oxidize hydrogen in a molecular state and use carbon dioxide as an electron acceptor.

4. Conclusion

The microorganisms that play a leading role in the biological treatment of wastewater are bacteria and fungi, and all organic substances in nature can be degraded by microorganisms, thereby entering the circulation of matter in the Earth's biosphere. There is also the possibility of degradation by microorganisms for synthetic polymer chemicals.

The final products of various pollutants through microbial mineralization include carbohydrates, water, ammonia, nitrates, phosphates, carbonates, metal oxides and the like. At the same time, microorganisms can convert natural and synthetic substances into basic compounds. It includes dozens of substances such as amino acids, purines, purines, and various substrates in the basal metabolic cycle. This synthesizes the components necessary for the cells and the energy required to maintain the life of the cells. All of these biochemical reactions must involve specific bacteria, and these biochemical reactions are catalyzed by the presence of specific enzymes in the microorganisms.

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