ORIGINAL RESEARCH ARTICLE

Industrial Wastewater Treatment Technology and Prospect

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ABSTRACT

Based on the development history and background of industrial wastewater treatment at home and abroad, the urgency and importance of industrial wastewater treatment are highlighted. The current situation of industrial wastewater treatment in China is being introduced, the process and principle of industrial wastewater pretreatment and biochemical treatment are expounded. Lastly, the problems in industrial wastewater treatment are being pointed out, and the corresponding solutions are given.

KEYWORDS: sewage treatment technology; processing status; significance; prospect

Industrial development and innovation not only created countless jobs to alleviate the current stage of employment pressure, it also created a huge economic benefits to promote China's economic development. However, when the industrial development of environmental pollution is also growing, the problems created by industrial wastewater on water consumption and pollution are gradually being amplified. Water, is the source of life; is an important part of the human environment; is also one of the essential material for the survival of mankind and social development. But, water is non-renewable resources. With the rapid development of socio-economic, industrial production, industrial sewage and the growing variety of sewage, and lack of sewage treatment equipment, this has caused industrial production and serious environmental protection imbalance, improper sewage treatment or direct emissions. These have adverse effects on human living environment and the image of the city, and the pace of urban construction. Environment is the basis of human survival and development; therefore, industrial economic development and sewage treatment must complement each other. This paper analyzes the current situation of sewage treatment in China from the historical development of sewage treatment technology at home and abroad; discusses the sewage treatment model which is suitable for the development of China's national conditions; and realizes the healthy development of the industry while increasing environmental protection. The simultaneous improvement of environmental and social benefits has become the primary problem of China's industrial construction reform at this stage [1-2].

1. The development course and development background of industrial wastewater treatment

1.1. Development of foreign industrial wastewater treatment

The development of sewage treatment industry in foreign countries started earlier than our country. In 1914, United Kingdom had created an active sludge process applied to the sewage treatment process and had achieved a certain degree of effect. China, compared to the European countries, is lack of water resources per capita. In overall, the water condition in Western countries is relatively healthy, but the sewage caused by industrial pollution is a global problem, hence, the sewage treatment problem is an issue that all countries unable to get rid of.

In the beginning of 20th century, the European Union had highlighted that, industrial and agricultural sewage that flowed into lakes and seas has threaten the water organism, and thus affecting the quality of underground drinking water.

In 1975, the EU had imposed a law regulations on requirements on surface water, and requirement on drinking water in 1980, developing the standards of the groundwater, aquaculture water and other water quality. The effect of sewage varies in different countries and different location, hence, the requirement on sewage treatment and technology is also different. The facilities and regulations of sewage treatment are relatively simple in the countries that have richer

water resources. However, some developed countries treated water resources similar as crude oil, thus, the development in sewage treatment is more mature.

1.2. Development and Background of Industrial Wastewater Treatment in China

1920–1949 began to build sewage treatment plant. In 1923, the first urban sewage treatment plant in China was built in the northern part of Shanghai, followed by the western and eastern region of Shanghai after a few years. Prior to this, the industrial wastewater, urban sewage, and rainwater are directly drained into rivers, lakes or seas, rely solely on emissions to deal with sewage.

In 1950 to 1960, the job is focusing on straightening the old sewage pipeline in the old city of Shanghai, demolition of unreasonable sewage pipe and treatment of rivers and lakes pollution. After the completion of standardized New sewage pipes, began to invest in the construction of sewage treatment plant in Beijing, Shanghai and other places that has processing capacity of more than 100,000 tons of a sewage daily.

1961 ~ 1978 Sewage treatment applied on agricultural-used water. In 1957, the relevant departments has included the technical achievements into the national scientific research program. In the next few years held a multi-national technical exchange conference, and actively develop new technologies to promote the implementation. At this stage, China invested in the construction of a large number of bio-oxidation ponds. After the construction in many areas of China, the country's sewage treatment capacity has been raised to more than one million tons per day, the new sewage treatment pipeline has reached 19,600 km.

1979–2000 During this period, China's sewage treatment had officially partnered with international standards into modernization, upgrading in the speed of development. In the early 1980s, two production-quality sewage treatment experiment bases were built in Tianjin and Beijing. Many development technicians jointly carried out large-scale exploration experiments and research on the sewage treatment technology and development routes of the two areas. The secondary biological treatment technology in the sewage treatment is being processed. After several years of continuous exploration, in 1984, Tianjin had built in China's largest sewage treatment plant, the new standard activated sludge biochemical process, in a period of operation

In the production, the local environmental improvement has achieved remarkable results, and the processing capacity is stable. China's sewage treatment had entered into large-scale enterprise.

2001-2015 The China in 21st century is the world of China, with the reform and opening up the pace of China's economic development into the speed stage, the development of sewage treatment industry is also a good momentum, with the country putting more and more attention to environmental governance and put forward sustainable development of strategic objectives, and constantly refine the requirements of sewage treatment, requesting almost every industrial park in the country has its own sewage treatment plant, urban sewage treatment plants had also entered the high standard version of large-scale investment and construction, the sewage treatment industry development was benefited by the introduction of environmental protection laws and regulations of the state continue to attach importance to environmental protection, environmental legislation [3].

Analysis of domestic and international development of sewage treatment history, combined with China's development status of the 18th report pointed out: the construction of ecological civilization, chemical enterprises towards green development, efficient development, transformation into low carbon development. By increasing the intensity and requirements of pollution control, and continuous learning from advanced technology of foreign sewage treatment while actively research and innovation, China has its own sewage treatment technology. The second half of 2015 began to decline in the effectiveness of local chemical enterprises, due to the strict policy of the national environmental requiring enterprises to increase environmental protection investment, overcapacity, sales decline, rising prices and many other reasons. The pace of industrial development has suffered by varying degrees of impact.

In the initial stage of transformation, the phenomenon of industrial development fluctuation is normal, we must adhere to the transformation, and constantly improve [4].

2. Research Status of Industrial Wastewater Treatment

2.1. Wastewater pretreatment process and principle

The process prior to biochemical treatment is called pretreatment. Biochemical system processing run smoothly, and the investment and operating costs are relatively small. However, it is impossible to manage wastewater only by biochemical treatment, because industrial effluent contains some of the active substances that destroy the ecosystem: microorganisms, fungi inhibit and destructive substances exist. So, in order to protect the health of the biochemical system operation, the materialization section of sewage must be carried out before a series of pretreatment, adjust the water quality of biodegradability, to ensure the healthy operation of biochemical treatment [5].

Pretreatment has two specific purposes: First, the waste water contained in this part of the biochemical pool of sludge active substances have an impact on organic matter or inorganic matter, to a certain degree of separation or removal or conversion into other harmless form, protection of sludge active material growth environment; the other is in the biochemical section before reducing the water color, salt and suspended particulate matter, adjust the COD load, to reduce the biochemical section of the operating pressure.

The impurities in the waste water can be divided into suspended matter, colloid and dissolved matter according to the size of the particles. Other large particles greater than 100 μm are generally precipitated naturally or separated from the water. Colloids and fine particles and suspended solids on the need for cohesion method, flocculation method, coagulation method to convert small particles into large particles, precipitation separation in the water.

Coagulation method and flocculation method in the waste water containing positive ions or groups of coagulants. The use of electrostatic induction principle is in the colloid by adding a large number of significant valence of ions or groups, a large number of positive ions between colloidal particles. It will form a lot colloidal particles condensed together to form a macromolecule group, easy to separate the water for the purpose of water purification. The most widely used coagulants are aluminum sulfate, ferrous sulfate, alum, ferric chloride and so on.

Flocculation method is the use of polymer coagulant in the formation of linear polymer in the sewage polymer. Polymer structure between the particles forms a relatively stable combination of the role of bridging in this molecular unit between the continuous formation of the frame. The role of the accumulation of bridge, condensed polymer material continues to grow, and finally to achieve the formation of large particles of flocculation coagulation together. Common flocculants are polyacrylamide (PAM), poly (PE) and so on.

Coagulation method is the combination of coagulation and flocculation method as suggested by the name. The coagulation method is often applied in the process of industrial wastewater pretreatment. The basic process is to add coagulant (alum, ferrous sulfate and other agents) to the sewage, to eliminate the electrostatic repulsion between the colloidal particles, and then add Flocculant (PAM, PE and other agents), making the water particle radius increases the formation of precipitation.

2.1.1After the removal of sewage impurities in the particles into the treatment

Iron and carbon microelectrolysis section iron and carbon treatment method, also known as iron carbon microelectrolysis or iron carbon electrolysis, uses Fe2+/Fe3+ redox reaction, iron carbon microelectrolysis to form numerous micro units Iron carbon original battery, the use of electrode reaction, resulting in active electronic swimming, and promote the reaction of organic matter in the sewage, so that the sewage toxic, unsaturated decomposition of the material into other forms of existence, reduce the COD and biological OOD BOD5 load, laying the foundation for the normal operation of the subsequent processing section.

Iron-carbon micro-electrolysis is an important means of industrial wastewater treatment, with iron carbon as a toxic, high concentration of COD industrial wastewater has a considerable effect. Iron carbon reaction principle is recognized: in acidic conditions, iron carbon filler added to the water, iron and carbon in between forms the original battery reaction, the formation of a large number of local micro-current reaction area, under the action of micro-current Promote the oxidation of inorganic matter in the sewage is reduced. In the actual sewage treatment of iron carbon micro-electrolysis treatment, the effect is good and recognized.

The shortcomings of Iron carbon method: iron carbon filler are expensive, under acidic conditions that were broken down, part of the reaction is not complete, iron and carbon will remain in the water, and increase the solid waste water, plug the instrument pipeline ; iron under acidic conditions in the sulfur-containing waste water to form a black iron sulfide darkened water color, a large number of iron ions absorbs into the water body to increase the salt content of water.

The reaction of Fenton wastewater flows into Fenton, adding hydrogen peroxide H2O2, H2O2 and Fe2+ formed by electrolysis forming strong oxidant Fenton reagent, can produce strong oxidizing ability of OH radicals under the catalytic action. The free radicals can make it easier to remove the macromolecular aromatic ring by biochemical removal, thereby degrading and removing. This has greatly improved the biodegradability of sewage, improve the B / C ratio.

In addition to the above process, wastewater pretreatment also includes membrane separation, flotation, filtration, disinfection ion exchange and adsorption and other physical and chemical treatment section, combined with the actual situation of the factory sewage selection of different processes require wastewater pretreatment.

2.2. Industrial wastewater biochemical treatment process and principle

At present, most of the industrial wastewater treatment is using bio-activated sludge method. The use of biological activated sludge process evolved a large number of treatment process, industrial park two sewage treatment plant commonly used treatment processes are: A/O dephosphorization process, A/O nitrogen removal process, AB process, A2/O dephosphorization Nitrogen process, UASB process, oxidation ditch series process. The assignments and combinations of processing facilities are different from the handling of different processing processes. With the continuous development and progress of sewage treatment has been formed: A/O process, UASB process, ion exchange resin, reverse osmosis water treatment technology, biofilm and other typical biochemical treatment process. The following will be more extensive application of these applications are introduced in depth.

A / O (A2 / O) Process A / O Abbreviation of Anoxic / Oxicology or Anerabic / Oxicology, is an important process for treatment of wastewater biodegradation. In the process of biological denitrification, because the denitrifying bacteria are anoxic bacteria, a large amount of carbon source is needed to maintain the metabolism and realize the denitrification process. After the aerobic nitrification reaction, the organic matter concentration (carbon source) Low, cannot provide sufficient denitrification of the demand, so the traditional biological dephosphorization section in the hypoxia unit before adding methanol to supplement the organic carbon source content. Before the aerobic work section is put into the aerobic section, the organic matter contained in the influent is used as the carbon source. This method is called the pre-denitrification process. After the mixture is refluxed, the nitrate and nitrite are introduced into the hypoxia reaction section.

AB process AB sewage treatment process is a new two-stage biological treatment process, that is, the abbreviation of adsorption biodegradation. AB process is a treatment method from combination of high load method and two active sludge method. A, B two sections of strict division, so that different characteristics of the fungi separately cultured complement each other short of the role. Therefore, the AB process has a higher removal rate of BOD5, COD, SS, TP and ammonia than conventional activated sludge processes. But the AB process cannot achieve the effect of deep dephosphorization, because the removal of nitrogen removal is limited, there are still a lot of nutrients in the sewage, easy to lead to the eutrophication of water [6].

Principle: AB method of sewage in the removal of pollutants in the main role is reflected in the A section of the adsorption flocculation effect. Sewage direct flow through the pipeline and A docking, suspended solids in the wastewater and bacteria mixed together to form a relatively stable structure of the copolymer, while the A section provides a wealth of microorganisms. Increase the growth rate of microbial population in the A section, shorten the microbial metabolic cycle, and decompose a large amount of viscous material. This part of the viscous material and the suspended matter in the wastewater, large particles and free bacteria and other substances mutualize the formation of adsorption condensation, resulting in floc groups, and finally flow through the screen or precipitation separation in the water outside. The B section is similar to the conventional activated sludge process.

UASB process UASB is, known as the upflow anaerobic sludge bed in Chinese, the process includes the anaerobic activated sludge and anaerobic filtration method of double-sided characteristics. Created in 1971 Henan Agricultural University, researchers use the density of different substances under the action of gravity under the nature of the difference to create a three-phase separator for the rise of anaerobic sludge bed to create and upgrade to create favorable conditions. UASB process structure is simple, operation and maintenance and operation is low, suitable for different types of industrial wastewater treatment requirements. After a long period of development and innovation, it is now with mature technical support, has been widely used.

Principle: UASB composition is divided into sludge reaction zone, gas-liquid three-phase separation and gas chamber.

At the bottom of the reaction tower contains a large number of anaerobic activated sludge. As this part of the sludge cohesion and suspension caused by the bottom of the anaerobic tower in the formation of a good silt suspension layer, sludge in the suspended state of microorganisms, bacteria, fungi metabolism become active. When the waste water from the bottom of the anaerobic tower after the organic matter will be active decomposition of the sludge composition of the metabolic convert to biogas and produce bubbles, the bubble in the role of water pressure continue to merge, floating, driving a part of the sludge floating into the upper part of the anaerobic tower in a three-phase separator. The bubble burst biogas is collected from the surface into the biogas processor to derive the UASB reactor. The mixture from other part of the floating sludge into the three-phase separator area, the area of the solid-liquid mixture in the three-phase separator by adding the agent through the flocculation and condensation to form large particles of the group, the density of the bottom continue to participate in the active sludge of the biochemical reaction, the metabolites of the sludge

active substance will be separated from the effluent from the effluent through the slag to collect the sludge bed, which is collected from the outside of the tank and then through the muddy machine into solid waste collection [7].

3. Problems and development prospects

China's sewage treatment industry development started late, but with rapid development, has now made gratifying achievements This is a common fact, but because of the rapid development of China's industrial, industrial production of waste water is also increasing year by year. Although the current scale of construction of sewage treatment plants is basically able to meet the industrial sewage treatment, there is a great distance between the depth of purification and recycling. Sewage treatment is a worldwide problem. The sewage treatment capacity in developed countries is still able to reach 70% to 80%, but China's sewage treatment capacity can only reach 50% to 60% [8], the rest still rely on direct emissions.

3.1. Construction and operation of sewage treatment plants

To meet the needs of industrial development, in recent years the country has developed more than 500 new standardized sewage treatment plant, but sewage treatment capacity is still unable to meet the current stage of sewage production. The investment scale of sewage treatment plant is also different for each regional economic development. Moreover, sewage treatment Industry is mostly public institutions, not for profitable purposes in the industry, the main role is reflected in the public welfare and environmental protection, so the construction and operation of sewage treatment depends on the state and local government support and macro-control. By the impact of local economic development, the government's taxation will fluctuate. If the construction and operation of the sewage treatment plant are not improved, the effluent will have an immeasurable hazard to the local living environment [9].

3.2. Upgrading of sewage treatment equipment

The existing sewage treatment plant installation and operation of most of the equipment are older and traditional, many operating equipment are imported from foreign countries. In the delivery process, the equipment is aged, which caused huge cost in processing efficiency, equipment damage and other economic costs. Also, affected by the impact of intellectual property, the introduction of new equipment becomes expensive. Facing China's increasing sewage wastewater, independent development of the technology will be imminent. This is an opportunity, but at the same time this is a serious challenge. The domestic sewage treatment technology development has been tested, training professional and technical personnel to develop China's own sewage treatment technology has become the primary problem. In the continuous absorption of foreign peer experience at the same time, independent innovation and development of independent intellectual property rights of sewage treatment equipment to meet the pressure of additional sewage treatment.

Equipment transformation: the traditional sewage treatment equipment in recent years in China put into use to achieve considerable result and experience, through the actual commissioning operation. However, with the shortage of water resources in China, the deterioration of the environment, and the law promulgated in the state, sewage treatment requirements become more stringent and meticulous. New technology development and introduction will gradually replace the traditional equipment. Membrane technology, ultrafiltration, electric adsorption desalination technology, chitosan derivative technology, biochemical bed, electrocatalytic oxidation, mvr and other parts with energy saving, green, recycling, efficient modern technological innovation is the goal of our future reform [10 -11].

3.3. Sewage deodorant

In the sewage treatment process, the sewage with strong volatility will produce different types of odor during the materialization and biochemical system in the process. The temperature changes spread the odor around. For example, during the aerobic and anaerobic section, to ensure that the activated sludge metabolic temperature is generally above 20 ℃ or even higher, coupled with the Roots blower, directly affect the harmful gases of the Brownian movement [12] leading to the surrounding residential area. The air environment of work area has been severely damaged.

3.4. Sludge treatment

Sludge is mainly present in the biochemical system, the other process section of the bottom of the pool will also have a higher concentration of sludge, the traditional treatment is the first part of the sludge collected in the sludge pool, plus flocculant Pharmacy treatment into the mud press after bagging. The traditional mud machine is mainly plate and frame type mud machine, its operation is less difficult, less automation, sludge moisture removal to be improved. It will gradually be replaced by a cascade of sludge filter press [13], because it has a more efficient water removal effect, easy to operate, time-saving and efficient only the price is more expensive.

There are two main ways to treat sludge: incineration and deep burial. In essence, did not achieve harmless, the development of new technologies focused on the loach method of cultivation of sludge, plant absorption and other natural harmless direction, although the distance from the actual industry is still far away, but we have to be green with harmless efforts.

3.5. Sewage recycling

Energy conservation and environmental protection is the theme of sustainable development in our country. If the use of water treatment technology on industrial waste water for recycling purposes will save a considerable amount of water consumption, bring economic benefits while saving water resources in China. Recycling of sewage in foreign countries has achieved remarkable results, more and more enterprises applied the sewage after being treated on other industry. With the development of sewage treatment technology, the feasibility of secondary energy of industrial wastewater is getting higher and higher. The development of water treatment technology to promote the production efficiency, sewage recycling is increasingly valued by enterprises, conforming to national policy that the people's development is the fundamental of industrial development.

3.6. Application after sewage treatment

The demand for industrial production for water in each section is different. In ensuring the safety of production requirements, we can use the sewage treatment technology to dissolve the waste water from workshop to form new water for workshop use. The sewage stunt clear water (including circulating cooling water, boiler water, overflow water, auxiliary water and cleaning water, etc.) in the workshop, rainwater collected on ground, water from living area and other less polluting wastewater, can be widely used in brick factories, cement plants, mines, construction and other factories after the initial treatment. This can reduce the amount of water used in production [14], so that the problem of water shortage has been alleviated.

Industrial wastewater contains a large amount of salt, unreacted raw materials and valuable intermediates. Using recycling equipment to extract the valuable components of sewage can turn waste into treasure. On one hand to save the cost of raw materials required for production, on the other hand to reduce the sewage concentration. In the chemical plant production process generated waste acid waste alkali can be applied to the sewage and the adjustment, saving sewage treatment costs to create the second value [15-16].

3.7. Watered and stealing row

Industrial Park, a large sewage, are generally located far away from the urban areas and developed areas in the remote wasteland, suburbs and other places. The phenomenon of peculiar sewage is widespread but difficult to apply punishment. With the increase in the demand for special new indicators related to sewage treatment, the sewage and the cost of sewage treatment are increasing by the increase in water, steam and electricity [17-19]. The increasing cost of industrial production and reduction in sales of enterprise products have a certain degree of impact on China's industrial development. More and more listed enterprises, peer competition, the international economic situation caused by the sluggish development of enterprises are unable to survive.

Some areas implemented 'one enterprise and one management' mode of management, that is, a business collect and treat their own sewage through a pipeline, and collect it to central standardized sewage treatment plant for centralized treatment. Sewage treatment plant to receive corporate sewage in the relevant indicators in Table 1, Table 2 [20].

BOD5 and COD indicators are the biological requirements and chemical oxygen demand that are used to identify the complete decomposition of organic matter in wastewater to form water and carbon dioxide. The higher the content of unsaturated organic matter and inorganic matter in wastewater, the higher the experimental value of BOD5 and COD [21].

BOD5 / C indicator is an important indicator of biodegradability of sewage, usually BOD / COD> 0. 45 biochemical effect is the best. Sewage to organic pollution, BOD / COD = 0. 58, the best biochemical effect.

The BOD5 / T index is an important indicator of the requirement of biological denitrification because the denitrification hydrogen donor in the biological denitrification system is mainly derived from the substrate in the wastewater. The larger the ratio, the more obvious the effect of nitrogen elimination.

BOD5 / TP indicator is an important indicator of the use of biological phosphorus removal requirements, usually we require the value must be greater than 20, the greater the ratio of phosphorus removal effect [7, 22-23].

Most of the plant floor raw water concentration (COD concentration) sum up to ten thousand of value, to deal with the above table to achieve the 500 mg/L. The following requirements are more difficult, need to invest a considerable amount of money. Economic interests driven by the combination of the concept of environmental protection caused by

the direct discharge of corporate sewage to the outside world polluted water environment; another means is to use tap water dilution treatment methods to enable enterprises to meet the requirements of sewage, these two illegal means can save for the enterprise. A large amount of sewage treatment costs, but the negative impact is very bad.

Environmental legislation on the responsibility of environmental protection is strict. In the future development, environmental recycling can never be placed after the money. The education of people's awareness towards environmental recycling should be placed in the first place, to abandon the thought of economic development at the expense of the environment, to maintain this fragile nature of the environment. Environmental Protection Bureau to encourage the masses to report enterprises who emit illegally; to increase the requirements of enterprise sewage treatment; to investigate and punish enterprises who use illegal means; and investigate the responsibility of the responsible person. Everyone has to participate in the historical mission of environmental protection to create a green home.

4. Conclusions

Environmental protection and industrial development can be harmonious. In the continuous development and improvement of sewage treatment technology, enterprise can achieve the sewage discharge standards. However, there is still some distance to hundred percent harmless in the realization of industrial sewage. With the speed of China's sewage treatment process in the forefront of the world, I believe in the next few years or ten years of sewage treatment will achieve new results.

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