

Influence of Agricultural Sewage Irrigation on Groundwater Environment in Suburban Irrigation Areas

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Abstract: How to make rational and effective use of urban sewage in areas where water resources are scarce is not only a problem of resource regeneration, but also a problem of protecting the environment and keeping the regional economy sustainable. Agricultural sewage irrigation is one of the common ways for the final disposal of sewage. Sewage irrigation can alleviate the shortage of water resources to a certain extent, which is beneficial to the protection of water resources, and can also bring nutrients to crops and increase the yield. However, long-term sewage irrigation will have an impact on groundwater quality, because the source of urban sewage is continuous, and the water demand of crops is seasonal. In the non growing period of crops, sewage is easy to enter the groundwater and cause water pollution. In view of the environmental problems caused by sewage reuse for farmland irrigation, the necessity of reasonable sewage irrigation is explained by analyzing the adverse effects of sewage irrigation on groundwater, farmland soil environment and human health. At the same time, in view of this problem, the research directions that should be strengthened in the future are put forward to provide a theoretical basis for the smooth progress of sewage reclamation.

1. Introduction

Water pollution is one of the main problems of water resources in China at present. In recent years, with the rapid population growth and industrial development, water resources have become increasingly tense, and the problem of agricultural water sources has become an important factor restricting agricultural development. Using urban sewage and industrial wastewater to irrigate suburban farmland is an important way to save and protect urban water resources. As an effective method to solve this problem, sewage irrigation has been widely used in China. Properly treated municipal sewage can not only be used as an ideal irrigation water source, but also provide nutrients beneficial to crop growth, such as nitrogen, phosphorus and potassium. At the same time, proper sewage treatment can not only achieve economic benefits, but also make use of the self-purification function of soil to reduce the pollution of urban sewage to the environment. For example, centralized treatment of sewage, various treatment methods should be adopted to reduce the harm to the environment and human health. Besides proper wastewater treatment strategies, a good management system is essential to ensure the safe operation of sewage. However, with the rapid development of China's economy, the discharge of industrial wastewater and domestic sewage has increased rapidly, which has led to the continuous decline of the quality of sewage, while the sewage treatment capacity can not develop synchronously and lags behind. At the same time, due to the high salinity and high organic content of waste water, and often accompanied by toxic and harmful substances such as heavy metals and pathogenic microorganisms, unreasonable methods for sewage irrigation are easy to cause the accumulation of toxic and harmful substances in the soil of irrigation area, and may cause pollution of groundwater environment. Therefore, how to reasonably and effectively use sewage irrigation is not only a problem of resource regeneration, but also a problem of environmental protection and regional economic and social sustainable development. To sum up, the impact of sewage irrigation on groundwater environment can not be ignored. Pollutants in sewage enter groundwater with irrigation, and the contents of ion N and Cl in groundwater in sewage irrigation area exceed the standard. Groundwater pollution caused by

sewage irrigation needs researchers' attention.

2. Impact of Agricultural Sewage Irrigation on Groundwater Environment

At present, the water quality of sewage irrigation is not up to standard, and the relevant management is not perfect, resulting in the pollution of soil and crops. The downward migration of pollutants in the soil causes the pollution of groundwater in sewage irrigation area. The pollution of groundwater in sewage irrigation can not be ignored.

2.1 Impact of Chemical Pollution on Groundwater

Because of its high salt content, sewage irrigation has an impact on farmland soil. Long-term sewage irrigation not only increases the concentration of nitrate and nitrogen in groundwater, but also increases the hardness of groundwater in sewage irrigation areas, thus affecting the regional groundwater environment. According to the research, the groundwater quality in sewage irrigation area is different from that in non-sewage irrigation area, and the groundwater quality in sewage irrigation area is deteriorating gradually. The ion content and salt content in sewage irrigation area and non-sewage irrigation area have increased greatly, but the groundwater quality in non-sewage irrigation area is better than that in sewage irrigation area. For example, nitrate nitrogen and nitrite nitrogen produced by nitration of high-concentration nitrogen-containing organic matter and ammonium ions in sewage will enter the ground, and with the continuous sewage irrigation, it will permeate into the lower layer layer by layer, resulting in groundwater pollution. Generally, the content of ammonia nitrogen in the sewage is high. After sewage irrigation, the ammonia nitrogen in the water will have an ion exchange reaction with the calcium and magnesium plasma on the surface of the soil colloid, resulting in the increase of soil nitrogen content and the hardness of groundwater. On the other hand, the ammonia nitrogen in the soil will have nitrification, and the final product, nitrate nitrogen ions, will aggravate the pollution of groundwater in a short time.

2.2 Impact of Microbial Pollution on Groundwater

Urban domestic sewage and industrial wastewater discharged by some organic chemical enterprises contain a lot of organic substances, which may include “three-cause” toxic and harmful organic substances that are extremely harmful to the environment, including bacteria, viruses and parasites, among which the first two are the main ones. If the waste water is used for farmland irrigation without proper treatment, it will inevitably pollute the soil and groundwater environment in the irrigation area. Because the envelope of virus is much smaller than that of bacteria and protozoa, it is not easy to be filtered and purified when passing through porous soil, but it is more likely to migrate into deep soil and groundwater system with water. Therefore, the viral pollution of groundwater resources has aroused great concern of scientists all over the world. Some studies have found that some enteroviruses can migrate through unsaturated and saturated zones to deep soil, and then affect groundwater. At the same time, the impact of bacteria and viruses on groundwater is monitored in order to make a quantitative evaluation of the impact.

2.3 Influence of Heavy Metal Pollution on Groundwater

Heavy metal pollution in sewage irrigation area directly or indirectly affects human health. In general, heavy metals in sewage are mainly concentrated in the soil surface layer of sewage irrigation area within 0 ~ 20 cm. The adsorption of heavy metals in soil reduces their migration to groundwater. Studies have shown that heavy metals (especially Cd) in soil migrate downward with the extension of leaching time, thus posing a threat to groundwater. At the same time, studies have shown that the health hazards of arsenic in sewage irrigation areas are mainly chronic arsenic poisoning, which mainly shows abnormal changes of skin, hair, nails and nervous system, such as skin cancer and lung cancer.

3. Control Measures of Groundwater Pollution in Agricultural Sewage Irrigation

The pollution degree of sewage irrigation to soil and groundwater is determined by a variety of factors, including the type and content of pollutants in sewage irrigation, the intensity and mode of sewage irrigation, the type and nature of soil in the irrigation area, the main crops and vegetation in the irrigation area, the landform and water quality conditions, and the years of sewage irrigation. Using sewage instead of clean water to irrigate farmland not only saves water resources, but also solves the problem of water use in Polluted Irrigation Areas, agricultural water and agricultural water, and how to use sewage scientifically and reasonably. In order to alleviate and gradually solve the impact of sewage irrigation on Soil and water environment, and realize the sustainable and scientific utilization of agricultural production, this paper puts forward the following suggestions and countermeasures.

3.1 Strengthen Management and Environmental Awareness

People's governments at all levels should strengthen the treatment of municipal solid waste, set up urban sewage treatment facilities, make comprehensive planning for agricultural sewage irrigation areas in various regions, conduct seepage control in irrigation areas, and establish water quality monitoring points. At the same time, all industries, especially industrial and mining enterprises, should strengthen the standard discharge of wastewater, adopt advanced technical transformation, update old equipment, improve the recycling efficiency of water, and reduce the discharge of sewage, thus reducing the discharge of pollutants in sewage.

3.2 Strengthen the Monitoring of Sewage Irrigation Water Quality through Comprehensive Investigation

According to the irrigation conditions of crops with clean water and sewage, we should first inspect the sewage irrigation area, water source, water quality, irrigated crops and irrigation methods on the spot, and carry out scientific treatment according to the actual investigation results to ensure the ecological environment of the polluted irrigation area. At the same time, the discharge of urban sewage and industrial wastewater up to standard should be strictly controlled, and illegal sewage discharge and illegal sewage discharge are strictly prohibited. Strictly implement the relevant regulations of national, provincial and prefecture-level governments. The water quality in the irrigation area shall be monitored regularly. The sewage exceeding the water quality standard for farmland irrigation shall be restricted from irrigation. The environmental protection temporary measurement units at all levels shall check the sewage discharged from key factories and mines to the irrigation canal to restrict irrigation. The environmental protection temporary measurement departments at all levels shall check the water quality discharged from key factories and mines to the irrigation canal to eliminate pollution sources.

3.3 Active Treatment, Purification and Diversion

The root of controlling the pollution in sewage irrigation areas lies in implementing environmental protection laws and strengthening the management and control of sewage. Relevant sewer units should properly treat all kinds of sewage to ensure that the sewage in irrigated farmland meets the water quality requirements of farmland. For example, before sewage irrigation, measures such as oxidation pond (oxidation ditch) treatment or sewage land treatment and ecological treatment should be adopted, so that the pollutants are much lower than untreated similar sewage. For example, the treatment process of “grid well + lift well + purification tank” is used to efficiently remove organic matter, suspended matter ammonia nitrogen and phosphorus in the water to meet the requirements of drainage water quality. The process flow diagram is shown in Figure 1.

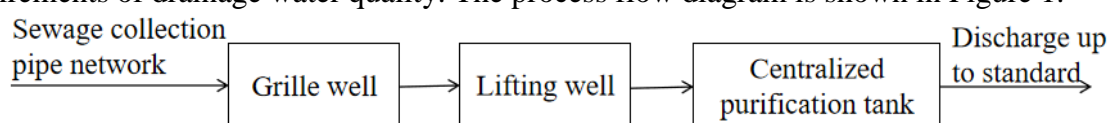


Fig.1 Sewage Purification Process Flow Chart

3.4 Strengthening Scientific Irrigation and Research of Sewage Irrigation

When implementing sewage irrigation, we should pay attention to rational utilization of wastewater, strengthen the management of sewage irrigation, and implement total amount control according to specific conditions, and distinguish various types of soil sewage irrigation, for example, sewage irrigation is prohibited at the sandy land leakage. For heavily polluted farmland, it is advisable to use printing method for cleaning and circulating irrigation; Sewage irrigation is mainly for field crops, so it is necessary to stop watering in time at flowering and fruit stage, and vegetables sensitive to sewage should be reduced or reduced as far as possible, so as not to affect the quality of agricultural products. Sewage irrigation is a cumulative environmental effect. The effect of pollution on soil has existed for a long time, which makes the mechanism of its migration, accumulation and transformation very complex. In addition, the absorption degree of effective components of sewage is different in different growth stages, which makes it difficult to standardize sewage irrigation. Therefore, it is necessary to strengthen the research on sewage treatment technology and carry out the impact of sewage treatment on crop physiological cycle, soil fertility, agricultural product quality and yield.

4. Conclusions

In recent years, the change of groundwater ion content by sewage irrigation and chemical fertilizer application shows an accelerating trend, which is related to the increase of sewage irrigation and chemical fertilizer application, thus accelerating the deterioration of groundwater quality. In areas where sewage is used for irrigation for a long time, the concentration of nitrate ions in groundwater is higher than that in areas where groundwater is used for irrigation only. But at the same time, it should be noted that how to use waste water reasonably and effectively for irrigation in areas where water resources are scarce is not only a problem of resource regeneration, but also a problem of environmental protection and sustainable development of regional economy and society. In the face of increasingly severe groundwater pollution and deteriorating groundwater environment, in order to realize the sustainable utilization of groundwater resources, it is necessary to actively explore new agricultural sewage technology and new sewage treatment and utilization technology, and realize the scientization of agricultural sewage irrigation, which plays an extremely important role in solving the contradiction between supply and demand of agricultural water, protecting the ecological environment, and ensuring the quality, quality and safety of agricultural products. Therefore, in view of the pollution of groundwater environment caused by human agricultural activities, it is necessary to carry out experimental research on groundwater pollution caused by various pollutants in sewage under sewage irrigation; Take effective measures to prevent and control pollution and protect the sustainable development and utilization of groundwater resources.

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