The characteristics of beer industrial wastewater and its influence on the environment

Ruqiong Qin
Guangxi Polytechnic of Construction, Nanning 530003, China
qinruqiong@163.com

Abstract. With the rapid development of beer industry, a large amount of beer wastewater is discharged, which poses a great threat to the environment. This paper analyzes the influence of beer industrial wastewater from its sources and characteristics. This paper provides a reference for research and development of new and efficient beer wastewater treatment.

1. Introduction
Since the 1980s, China's beer industry has been developing rapidly. In 1988, there were more than 800 state beer distilleries, and the annual output of beer was 6.63 million t, and ranked the third in the world [1]. By 1998, the brewery reached more than 1,000, with an annual output of 1.987 million t, making it the second largest beer producer in the world [2] with the improvement of people's living standards, China's beer consumption increases sharply, from 1996 to 2001, the national beer production respectively 16.3176 million t, 8.6653 million t, 9.8761 million t, 0.884 million t, 2.1, 2 and 2.3132 million t, 2.74 million t, the average annual growth rate of about 7%, by 2004 China's beer production of 2.4 million t, more than the United States, the first in the world [3].

But Chinese breweries tons of wine water consumption is bigger, according to the statistics, normally (10 ~ 30) t/t beer (because of the different wines differ for different enterprises) [4], close to the water consumption of the waste water emissions 90% [5]. In 2001 alone, 20 tons of water consumed per ton of wine was calculated, and the total waste water was about 41.1 billion tons, which is a huge amount of waste water in the beer industry. Beer wastewater contains a high concentration of organic matter, such as untreated directly discharged into natural water bodies, in the process of natural degradation of microbes in the water blooms, which consumes natural dissolved oxygen in water body, cause the water of oxygen, eventually lead to the water quality blackened smelly, serious environmental pollution.

2. The source of beer wastewater
Analysis of beer brewing process of beer production process easy, each working procedure has wastes (waste megan, cooling solidification protein, yeast mud, waste diatomite, waste of wheat bad, etc.), waste water (wash tank, wash bad water, soaking wheat water bottles, barrels and washing water, etc.). The main source of brewery waste water is the washing of wheat, water, germination and cooling spray, water, washing water and coagulation. The saccharification of the process of saccharification, the fermentation of the washing water fermentation process and the filtration and washing water; Wash bottle, sterilization, beer and cooling water and finished workshop washing water; The sewage
mainly comes from office building, canteen, dormitory and bathroom. Each finished product is 1t, producing about 1.7m3 of domestic sewage, including 0.85kg of COD pollutants or 0.5kg of BOD5 pollutants [6]. The emission of beer wastewater is mainly COD, BOD5, SS and PH4, and the water quality of wastewater discharged from each workshop is more volatile.

3. The water quality characteristics of beer wastewater

Breweries produce beer in large quantities, especially in the process of brewing and filling. As a result of the heavy use of fresh water, there is a large amount of waste water. Because the production process of beer is more, the consumption of t liquor and water quality is very different in different brewery. The management and technology level of the brewery is 8-12t per t, and the t wine consumption of our brewery is generally greater than that. The total water consumption of beer from scarification to filling is 10-20m3/t [7]. Brewing beer consumes a lot of water, except for a portion of the water to be transferred to the product, and most of the rest will be used as an industrial wastewater discharge environment.

As mentioned above, beer industrial wastewater has the following characteristics:

3.1. Cooling water

Cooling water, wheat juice and fermented cooling water, etc., are basically free of pollution and can be recycled.

3.2. Clean wastewater

Such as barley impregnated wastewater, the barley sprout cooling spray water, clean production of yeast wastewater, rinse water, bottle washing machine washing water, how the early disinfection liquid and Pasteur sterilization spray water and ground water flushing, etc., this kind of wastewater by different degrees of organic pollution.

3.3. Waste water

Such wastewater contains a large amount of suspended solid organic matter, such as wheat, cold and heat coagulant, wine and wine, residual yeast, liquor, liquor residue, and alkaline cleaning solution.

3.4. Filling wastewater

When filling the wine, the running of the machine is often a problem, and often the wine, the waste water is mixed with a large amount of wine. When the with hot water spray and spray, beer heating pressure rise caused by the bottle, bottle "Fried" phenomenon, there are a large number of scattered in spray water spilled beer, in order to use spray water circulation, prevent biological contamination and preservatives, so be replaced the spray water preservative ingredients.

3.5. Wash bottle wastewater

When cleaning the bottle, soak the bottle with alkaline detergents and then wash and finish with the pressure water. The water containing residual alkaline detergents, pulps, dyes, paste, residue liquor and mud sand etc. Alkaline detergents are replaced regularly, so waste alkaline detergents should be treated separately. Therefore, it can be considered that the discharge solution of the washing water is stored after treatment, which can be used to regulate the PH value of the waste water [6].

4. The effect of beer production wastewater on the environment

4.1. List of environmental waste water

The environmental impact factors of the waste water in beer production system mainly include COD and SS. COD and SS are mainly related to the emissions from brewing and packaging phases. The environmental emission of beer wastewater is shown in table [8].
Table 1. List of environmental emissions from beer wastewater kg/KL.

| The subsystem | emissions | emissions |
|---------------|-----------|-----------|
| brewing       | COD       | 22.08     |
|               | SS        | 7.36      |
| packaging     | COD       | 6.35      |
|               | SS        | 2.16      |

4.2. Environmental impact

![Figure 1. The environmental impact of beer production.](image)

As can be seen from the chart, the potential impact of China's beer industry on the environment is: eutrophication, dust and soot, global warming, acidification and solid waste. Among them, the largest environmental impact of beer production is eutrophication, which accounts for 30% of the total environmental impact due to the large amount of wastewater containing organic pollutants.

4.3. The impact of eutrophication

Beer wastewater is an important factor for eutrophication of water body. The eutrophication of water can lead to the stability and diversity of aquatic life, and destroy the ecological balance of the lake.

The main dangers are:

4.3.1. Reduce the transparency of the water body. In the eutrophic water body, there is a large number of algae which are the dominant species of cyanobacteria and green algae. These algae float on the surface of the lake, forming a layer of "green scum", which makes the water quality cloudy, and the transparency of the water is significantly reduced, and the water's sensory properties are greatly reduced.

4.3.2. The dissolved oxygen in the water body. After the emergence of eutrophication, the water will be blocked by the natural replenishment of oxygen, and the algae floating on the water will prevent the sunlight from penetrating into the water and reduce the release of oxygen by photosynthesis. At the same time, the respiration of the algae and the decomposition of the body of aquatic organisms will also consume dissolved oxygen, which will reduce the dissolved oxygen in water and the water will be changed from saturated oxygen to unsaturated or hypoxic state. When the dissolved oxygen in water is less than 5 mg/L, the water will lose its drinking value. When dissolved oxygen is less than 4 mg/L, it will affect the survival of fish in the water. When the oxygen is less than 1 mg/L, the fish in the water
will suffocate and die. Water body in the anaerobic state, after the anaerobic microorganisms in the water will become the dominant species, produce and release of NH3, CH4, reducing gases such as H2S and mercaptan, completely deteriorated water quality and water structure destruction, bring incalculable impact the ecological environment.

4.3.3. Release toxic substances into water bodies. Another influence on the eutrophication of water quality is some algae can secrete, releasing toxic substances, toxic substances into the water, if be cattle drink into the body, can cause gastrointestinal inflammation beast;People who drink also can have digestive tract inflammation, harmful human health.

4.3.4. Make the smell of water and surrounding air smell bad. Eutrophication of water bodies, make water algae blooms, aquatic ecological balance is destroyed, a large number of aquatic animals and plants death, death of aquatic organisms under the effect of microbial decomposition, oxygen consumption, or under the condition of anaerobic decomposition, produce hydrogen sulfide gas, there are some algae can send out a smell odour. Unpleasant smell spreading the air around the lake, a direct impact, disturb the normal life of people, give a person with uncomfortable feeling, at the same time, the stench and makes water taste bad, greatly reduces the quality of water quality.

4.3.5. Influence water quality and increase water production cost. As urban water supply water eutrophication occurs, due to the crazy breed algae, a large number of floating algae in water body, will cause the system of water plants some equipment such as grille, filter, such as congestion, caused by coagulation and precipitation. At the same time, it will increase the consumption of coagulant and disinfectant and increase the water cost. Some of the algae themselves, such as cyanobacteria, release chemicals that are toxic to fish and humans, creating disease-causing microbes that harm people's health. Eutrophic water body due to a lack of oxygen to produce toxic or harmful gases such as hydrogen sulfide, methane, and ammonia, and the algae produce some poisonous substances, in the process of water system, increased the difficulty of water treatment technology. It affects the water discharge rate of the water plant and increases the cost of water making [9].

4.4. Effects of acidification
Researchers at Princeton university have found that low pH lowers the ability of phytoplankton to absorb iron (an important nutrient for plant growth and photochemistry). Studies have shown that ocean acidification is likely to be unicellular micro values have a significant impact, and these plants are often located in the bottom of the food chain, and become a major source of food for fish, and ultimately affect the development of the fishing industry [10].

5. Conclusion
Chinese beer industry has developed rapidly, the first in the world for several years, but the production technology is still relatively backward, energy utilization level of resources with the international advanced level there is a certain gap, COD, SS and other organic pollutants emissions in great quantities, to the regional and even global environment has brought the noticeable negative effect. Beer production wastewater discharge environment caused by eutrophication is the largest, and between the various environmental impact QianZhi are on the rise in recent years, the total environmental impact QianZhi has increased year by year, the environmental impact of risk increase in beer industry, its development situation nots allow to ignore.

To realize the sustainable development of beer industry, to "reduction, harmless, reuse, recycling" for the principle, with low consumption, low emission and high efficiency as the basic characteristics of the road of circular economy, energy and resource use the most efficient, cost minimization, clean production, scientific management model of a virtuous cycle.
In terms of its effluent, it is necessary to establish effective waste water treatment facilities and to conduct strict testing of water quality to ensure that it meets relevant standards.

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