Research on Organic Removal of Food Processing Waste-Water Based on Watershed Water Protection

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Abstract. If the waste water from the production of candied fruit, as one of the non-staple foods, is not treated up to the standard and discharged directly into the surface watershed. It will inevitably cause the pollution of the watershed water and affect the safety of production and domestic water. The biodegradable index of candie waste-water is higher than 0.45 due to the large amount of sugar, which is easily biodegradable. Because of the high value of BOD₅, anaerobic fermentation method was adopted. The digestible sludge from the sewage treatment plant was taken and put into the plastic bucket with a ratio of 2:28 sludge waste water. The pollution index value of waste water was significantly reduced when the reaction was 60 h. The COD in the waste-water decreased by 1480.6 mg/L, and the COD removal rate reached 49.6%. The BOD₅ of waste-water decreased by 793.6 mg/L, and the BOD₅ removal rate reached 50.1%. The turbidity of waste-water decreased from 110.8NTU to 69.3 NTU, the turbidity decreased by 41.5 NTU, and the turbidity removal rate of waste-water reached 37.5%.

1. Introduction
In the production and living activities of urban residents, toxic and harmful substances are discharged into the water body, the amount of which exceeds the environmental capacity of the water, resulting in the decline of the urban water quality and the water pollution in the river basin. Urban industrial waste-water and domestic sewage are important sources of urban water pollution. Urban water pollution sources are divided into point pollution sources and non-point pollution sources. The former refers to the point where the discharge of waste-water is large and relatively concentrated, such as the effluent from an enterprise or sewage treatment plant. The latter is the pollutant produced by human activities carried by storm runoff. Urban domestic sewage can be effectively removed from the municipal sewage treatment plant, but the waste-water generated in the production, such as the candied waste-water produced in the production process of the factory, if not effectively treated, directly discharged into the river basin, will cause water pollution in the river basin, affecting the safety of production and domestic water.

About candied fruit, this is one of the non-staple food that the south likes, our country has always had "north has candied fruit, south has candied fruit" of view. However, according to the production process of candied fruit, the process of fruit selection, peeling, curing, desulfurization and dyeing all
produce a lot of pollution, especially the pollution of waste water. Candied waste-water is characterized by high organic matter content, especially high sugar content. The BOD₅/CODₐ value of waste-water is even higher than 0.45, which is a typical easily treated waste-water. Considering that the aerobic treatment of waste-water requires a large number of sites and bod BOD₅, anaerobic treatment can be used to treat waste-water. Anaerobic treatment is efficient in removing organic matter and occupies a small area, which is suitable for candied waste-water treatment with organic matter concentration.

2. Experiment part

2.1. Principles and structures of anaerobic biological treatment of waste-water
Anaerobic biological treatment technology is in the anaerobic state, the organic matter in sewage by anaerobic bacteria decomposition, metabolism, and digestion, make the organic matter in sewage content significantly reduced, and produce methane at the same time an efficient sewage treatment method. Anaerobic treatment, as an important form of biological treatment, is developing a series of new anaerobic treatment processes and structures, gradually overcome the shortcomings of traditional anaerobic treatment, and has made great progress in theory and practice. During anaerobic treatment, the organic matter in waste-water is finally converted into methane, carbon dioxide, water, hydrogen sulfide and ammonia by the combined action of a large number of microorganisms.

Anaerobic tank is a structure for anaerobic biological treatment of wastewater. In the absence of oxygen, waste-water is treated with large molecules decomposed into small molecules of organic matter, and then the organic matter in the water can be removed by good treatment of microorganisms. In experimental studies, anaerobic fermentation tanks were used as anaerobic reaction equipment, or sealed plastic drums were used for reaction, and small aerators were added for moderate stirring and reaction heat release.

2.2. Experimental water sample
The candied fruit production section from the food factory along the river basin. The properties of the original waste-water are shown in Table 1.

| COD(mg/L) | BOD(mg/L) | Turbidity(NTU) | pH  |
|---------|----------|----------------|-----|
| 3081.4  | 1789     | 110.8          | 5.42|

As can be seen from the above Table 1, the COD of candie waste-water is 3081.4 mg/L, and the COD is larger. BOD was 1789 mg/L, and the biodegradable index B/C value of waste-water was higher than 0.5. The turbidity of waste-water was 110.8 NTU, and the turbidity value was relatively high. The pH value was 5.42 and was strongly acidic.

2.3. Experimental technology
The above original waste-water is placed in a sealed cylinder, and a certain amount of digestive sludge is added, tightly covered and wrapped with plastic to prevent oxygen from entering and ensure anaerobic working conditions.

2.4. Detection method
Determination of COD: potassium dichromate method (GB11914-89);
Determination of BOD: BOD rapid measurement method;
Determination of turbidity: spectrophotometric method;
Determination of pH: glass electrode method (GB6920-86).
3. Experimental results and discussion

3.1. Experimental results

The sludge used in the experiment is taken from the digestible sludge in the pipes of the dehydration workshop of a sewage treatment plant. Remove the sludge 2 L, load it into the anaerobic digester, close the digestive reaction system, and place it for 24 hours so that facultative bacteria can consume the oxygen in the digester. Then add waste water 28 L, moderate stir evenly, add buffer to adjust the pH of waste water to 6.5, then add nutrient solution (glutamate + potassium dihydrogen phosphate), according to the ratio of COD: N: P=200:5:1 to prepare nutrient solution, place the set time period, make sewage and digestion sludge full contact, and then determine the waste water COD, pH and other water quality indicators. The results are shown in Table 2:

| Anaerobic time (h) | COD (mg/L) | COD removal (%) | BOD (mg/L) | BOD Removal (%) | Turbidity (NTU) | Turbidity Removal (%) | pH  |
|-------------------|------------|----------------|------------|----------------|----------------|-----------------------|-----|
| 0                 | 3081.4     | -              | 1589       | -              | 110.8          | -                     | 5.42|
| 8                 | 2450.6     | 22.8           | -          | -              | 100            | 11.2                  | 5.82|
| 16                | 2411.1     | 24.1           | -          | -              | 96.5           | 14.3                  | 5.83|
| 24                | 2275.1     | 28.3           | -          | -              | 83.9           | 25.5                  | 5.81|
| 32                | 2085.1     | 34.3           | -          | -              | 78.5           | 30.3                  | 5.82|
| 40                | 1932.5     | 39.1           | -          | -              | 76.4           | 32.1                  | 5.74|
| 48                | 1789.3     | 43.6           | -          | -              | 72.5           | 35.6                  | 5.70|
| 52                | 1620.6     | 49.0           | -          | -              | 71.9           | 36.1                  | 5.69|
| 60                | 1600.8     | 49.6           | 795.4      | 50.1           | 69.3           | 38.5                  | 5.68|

3.2. COD index and analysis

The COD index and analysis of waste-water are shown in Figure 1.

![Figure 1](image1.png)

It can be seen from Figure 1 that the COD of waste-water treated by anaerobic treatment changes greatly, the COD value decreases from the original 3081.4 mg/L to 1600.8 mg/L, and the COD removal rate of waste-water reaches 50% after 60 hours of anaerobic treatment.

3.3. BOD indicators and analysis

The BOD index of waste-water after 60 h anaerobic reaction is shown in Figure 2.

![Figure 2](image2.png)
Figure 2. Changes of anaerobic waste-water BOD

Figure 2 shows that the anaerobic treated waste-water BOD changes greatly, BOD value decreases from the original 1589.0 mg/L to 795.4 mg/L, and the waste-water BOD removal rate reaches 50.1% after 60 hours of anaerobic treatment.

3.4. Turbidity index and analysis

The turbidity index and analysis of waste-water are shown in Figure 3.

Figure 3. Turbidity changes of anaerobic waste-water treatment.

It can be seen from Figure 3 that the turbidity of anaerobic treated waste-water varies greatly, and the turbidity value decreases from the original 110.85 NTU to 69.3 NTU, and the turbidity removal rate of waste-water reaches 37.5% after 60 hours of anaerobic treatment.

3.5. PH index and analysis

The pH index and analysis of waste-water are shown in Figure 4.
Figure 4 shows that the pH value of anaerobic treated waste-water varies greatly from 5.42 to 5.68. After 60 hours of anaerobic treatment, the pH value of waste-water fluctuates, but it always shows acidity. The trend of increasing and then decreasing the pH of waste-water, because the organic degradation process produces small organic acids, which are further degraded over time.

4. Conclusion
According to the production process of candied fruit, a great deal of pollution, especially waste water, is produced in the process of fruit selection, peeling, curing, desulfurization and dyeing. The biodegradable index of waste-water is higher than 0.45 due to the large amount of sugar in the waste-water, which is easily biodegradable. At 60 h anaerobic reaction, the pollution index value of waste-water decreased obviously. The COD of waste-water decreased from 3081.4 mg/L to 1600.8 mg/L, and the COD removal rate reached 49.6%. The BOD₅ in the waste-water decreased from 1589 mg/L to 795.4 mg/L, and the BOD₅ removal rate reached 50.1%. The pH range of waste-water is relatively small. The turbidity of waste-water decreased from 110.8 NTU to 69.3 NTU, and the turbidity removal rate reached 37.5%.

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