# The Effects of Different Concentrations of Microplastics Based on The Feeding Ability Rate of Oysters

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**Abstract:** In order to explore the relationship between the feeding ability of oysters and microplastics, the changes in the feeding rate of oysters under different concentrations of microplastics can be studied in the laboratory. The results show that the four concentrations set in the experiment are above 5 mg It has a significant effect on the water filtration green and food intake rate of oysters, and the absorption rate and food intake rate decrease with the increase of microplastics concentration; when the concentration is 5mg \ L, the indicator is in a normal state. According to the research results, when the concentration is 5mg \ L, the feeding ability of oysters is ideal, which is suitable for the transformation and circulation of oysters in vivo.

## Water Filtration Rate

Microplastics generally refer to films and particles with a shape and size of less than 5mm [1], and they are also new types of pollutants that are of concern to everyone [2]. Such pollution in the ocean will seriously affect the growth and development of the marine life and the environment. In recent years, a large amount of pollutants and microplastics in marine organisms have been ingested, and a large number of reports have been broadcast. According to existing research instructions, research on toxicology and microplastics in the ocean has become a hot topic. topic.

The oysters selected for the test are long oysters, commonly known as "white oysters" [3-4] in the south. They have been cultivated in China for more than 700 years. They are mainly concentrated in coastal areas such as Guangdong and Fujian. For coastal cities, the value of shellfish has great economic value. There are relatively few reports on the effects of different concentrations of microplastics on the feeding ability of oysters. This study measured the feeding rate of long oysters, which can prove the feeding ability of oysters. This study provides a theoretical basis for future related research as well as relative data references.

## 1. Method and Materials

### 1.1 Test Materials

#### 1.1.1 Long Oyster

Long oysters are directly harvested in the sangouwan marine aquaculture area, and they are selected in a healthy and uniform shape (Table 1). It was kept in the laboratory for 11 days, the water temperature was 24 ° C, the salinity was 6.5, and the pH was 7.3. The seawater to be tested came from the Yellow Sea Bay, and the test was performed under the condition of sedimentation to remove impurities. During the formal test, the water needs to be changed about 1 \ 3 every day.

**Table 1** Biological references of long oysters

| Group | Body length（cm） | Ww（g） | Fatness（%） |
|---|---|---|---|
| 1 | 8.23±0.21 | 84.36±6.23 | 1.04±0.02 |
| | 8.45±0.31 | 83.69±5.21 | 1.01±0.03 |
| | 8.16±0.25 | 85.13±5.33 | 1.03±0.04 |

| | | | |
|---|---|---|---|
| | 8.21±0.17 | 83.78±4.21 | 1.02±0.01 |
| 2 | 8.26±0.26 | 84.03±4.65 | 1.03±0.03 |
| | 8.17±0.02 | 83.97±4.22 | 1.02±0.01 |
| | 8.36±0.34 | 83.23±3.69 | 1.03±0.02 |
| 3 | 8.42±0.29 | 83.95±3.21 | 1.01±0.01 |
| | 8.36±0.18 | 82.94±4.11 | 1.04±0.04 |
| | 8.25±0.13 | 83.11±2.69 | 1.02±0.03 |
| 4 | 8.18±0.29 | 85.99±3.15 | 1.04±0.02 |
| | 8.09±0.22 | 84.87±4.22 | 1.01±0.01 |

### 1.1.2 Microplastics

Microplastic powder was purchased from Haosai Technology Co., Ltd. See the following table for concentration settings:

**Table 2** Microplastic concentration settings

| No | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| concentration （mg\L） | 0 | 5 | 10 | 15 |
| Particle size （μm） | 149 | 149 | 149 | 149 |

### 1.2 Experimental Methods

The test was set with 4 concentrations of microplastics, and each long oyster tested was set to repeat 3 times; the long oysters were placed in the test water tank one day before the formal test; after stabilization, the long oysters were put into the test separately In different concentrations of test equipment, the water temperature was maintained at 24 ° C., the salinity was 6.5, and the pH was 7.3 for 5 days.

**Feeding test:** The water filtration rate and feeding rate of long oysters were measured by using a flow tank measurement method. Before and after the test, the water flow rate of the water tank should be adjusted, so that the speed of the water flow rate is controlled at 1.3-1.4L \ min. After 3 hours, the self-capacity sea current meter (AEM-USB) is used to determine the flow rate of each water tank Take 450ml each of the water inlet and the water outlet, and use a microscope to measure the concentration of microplastic particles in the water. Before the microplastic experiment, it was stained with Nile Red stain. 900ml of water samples in the water tank should be taken for refrigerating, and the feces of long oysters should be collected within 24 hours after the end of the experiment, in order to calculate the organic matter content (POM) and total particle content (TPM).

### 1.3 Calculation and Data Analysis

$$\text{Water filtration rate (FR)} = v\,(C1-C2) \setminus C1W$$

$$\text{Feeding rate (IR)} = FR\ C1$$

In the formula, v is the water flow rate (L \ h); C1 and C2 are the particle concentration (cell \ L) of the water inlet and outlet respectively; W is the dry weight (g) of the long oyster.

The data were analyzed by SPSS17.0 software.

## 2. Results Analysis

### 2.1 Effect of Different Concentrations of Microplastics on the Water Filtration Rate of Oysters

The effect of different concentrations of microplastics on the water filtration rate of oysters is shown in Table 3. When the concentration is 5 mg \ L, the water filtration rate reaches the maximum value of each concentration, and the effect is relatively good; when the concentration is

above 5 mg \ L, the water filtration rate gradually decreases, and when the concentration reaches the intensity pollution, the water filtration rate It was severely affected and reached the lowest value of 2.16 L \ g * h, and the treatment room reached a significant level, which indicated that when the concentration was less than 5 mg \ L, it had almost no effect on oysters.

**Table 3.** Effect of different concentrations of microplastics on the water filtration rate of oysters

| Concentration （mg\L） | 0 | | | 5 | | | 10 | | | 15 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| Water filtration rate （L\g*h） | 4.56 | 4.69 | 4.45 | 5.21 | 5.03 | 5.11 | 3.20 | 3.33 | 3.21 | 2.31 | 2.03 | 2.15 |
| Average | 4.57 b | | | 5.12 a | | | 3.25 c | | | 2.16 d | | |

**Note:** Those with different letters in the same column indicate significant differences (P <0.05), and those with the same letters indicate no significant differences.

### 2.2 Effect of Different Concentrations of Microplastics on the Feeding Rate of Oysters

The effects of different concentrations of microplastics on the oyster feeding rate are shown in Table 4. When the concentration is 5 mg \ L, the feeding rate value reaches the maximum of each concentration, and the effect is relatively good; when the concentration is above 5 mg \ L, the feeding rate gradually decreases, and when the concentration reaches the intensity pollution, the feeding rate is seriously affected It reached the lowest value of 10.41 L \ g * h, and reached a significant level between treatments, which indicated that when the concentration was less than 5 mg \ L, it had little effect on the oyster feeding rate.

**Table 4.** Effect of different concentrations of microplastics on the feeding rate of oysters

| Concentration （mg\L） | 0 | | | 5 | | | 50 | | | 250 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| Ingest rate （each\ g*h） | 14.45 | 14.23 | 14.21 | 16.07 | 16.15 | 16.24 | 12.21 | 12.54 | 12.31 | 10.33 | 10.43 | 10.45 |
| Average | 14.31 b | | | 16.15 a | | | 12.36 c | | | 10.41 d | | |

**Note:** Those with different letters in the same column indicate significant differences (P <0.05), and those with the same letters indicate no significant differences.

## 3. Discussion and Conclusion

There are many factors influencing shellfish feeding. For the existing pollution situation, the impact of microplastics has become an important factor. This is mainly because a large number of plastics are made of chemical content products. During shellfish's biochemical respiration and self-digestion process, certain chemical mucus will also be secreted, and the contact between the two will produce certain physiological effects.

Water filtration rate and food intake rate are the key indicators of feeding ability. The selected species has strong water filtration ability, which is accompanied by strong feeding ability. Even if there are many studies, there have been many studies on shellfish. There will be some differences in the test conditions and measurement methods, so that there will be some differences in the water

filtration value and food intake rate. The sink method was used in this study to make shellfish grow in a viable environment to the maximum extent, and the test results were relatively stable and reliable. In the experiment, when the concentration is 5 mg \ L, the water filtration value reaches the maximum value of each concentration, and the effect is relatively good; when the concentration is above 5 mg \ L, the water filtration rate gradually decreases; when the concentration is 5 mg \ L At L, the feeding rate value reached the maximum of each concentration, and the effect was relatively good; when the concentration was above 5 mg \ L, the feeding rate gradually decreased.

Studies on mussels in other studies have shown that the water filtration value and feed rate are similar to the price of long oysters. When exposed to microplastic water in water bodies, when the content reaches a certain amount, the mussel filtration value and feed rate will Significant reduction [5]. In 2008, Browne et al. [6] found that after mussels were grown for 3 days at 3.0 μm and 9.6 μm microplastic microspheres, it was found that the substances in the micro plastic gradually transferred to the lymphatic system. They also speculated through experiments that when the microplastic size is less than 10 μm, systemic circulation can be performed through mussel cell tissue.

According to the results of this study, when the concentration is 5 mg \ L, the feeding ability of oysters is ideal, which is suitable for the transformation and circulation of oysters in vivo.

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