Microplastics in shrimp, laundry water and atmosphere

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Abstract

In recent years, the use of plastics around the world has increased. According to the Environmental Protection Agency survey, 8 million plastics are discarded in daily life every year in Taiwan. Plastic products are discarded through water circulation and they are harmful since they enter the food chain. This study is divided into three parts, the first part is whether there are microplastics in white shrimp. The second part is to observe their color distribution, and to find that the number of microplastics in the intestines of shrimps sold in two different shops is not the same, and we speculate that they may be related to farm feeding; It was found that the amount of microplastics of laundry water is significantly higher than that of other water bodies, and the third part we use dehumidifier to explore the microplastic in atmosphere. We try to understand the relationship between the number of microplastics, PM2.5, pH and water temperature in the atmosphere. We hope that this study will call on everyone to use environmentally friendly goods.

Keywords: microplastics, water circulation, biological physiological functions and ecological damage, different waterbody, dehumidifier

Research question

1.whether there are microplastics in white shrimp?
2.whether there are microplastics in tap water, distilled water and laundry water?
3.Are there any relationships between microplastics in the atmosphere, PM2.5, and pH, water temperature through dehumidifier?

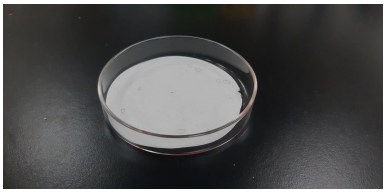
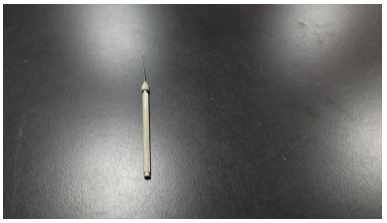
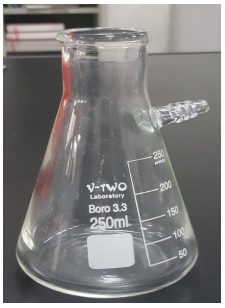
Introduction

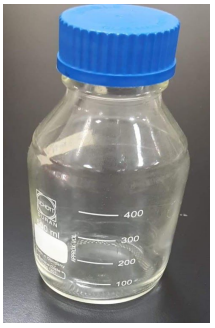
Definition and source of microplastics

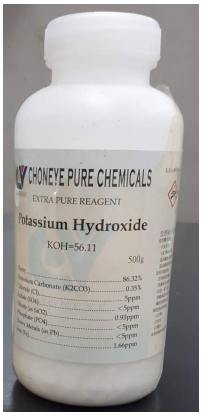
Since plastic was made, traces of plastic have been found in the living environment. But these are visible to the naked eye, there is still some invisible plastic around us, that is, "microplastics".Microplastics are mostly large pieces of plastic that are decomposed and become smaller and smaller than five millimeters long (V. Hidalgo-Ruz et al. 2012).

We do not know its source, what is the environmental impact? And will it harm living things? We began to study microplastics. Microplastics can be found in soil, ocean and digestive tract of vertebrates (H.S. Auta et al., 2017). In the experimental group of shrimp intestines can see a large number of microplastics, which can be seen that organisms are not easy to metabolize microplastics, uncertain of the impact on organisms, this experiment can be seen the main source of microplastics, from which the study can be seen that the largest amount of microplastics in laundry water, it can be seen that the plastic in clothing can greatly reduce the amount of microplastics by changing the raw materials of clothing, to reduce the harm caused by microplastics to biological.(Mei-Chi Chen,2018)

Materials and methods

1.filter paper 	**2.petri dish** 	**3.dissection needle** 
4.biological dissection microscope 	**5.Filtering flask** 	**6.water-fiow pump** 

7.Suction filter funnel 	**8.dehumidifier** 	**9.PM2.5 detector** 
10.pincers 	**11.aluminized paper** 	**12.Serum bottle** 
11.elongation 	**12.dissecting tray** 	**13.zippo** 

1.gloves 	**15.dissecting scissors** 	**16.dissecting knife** 
17.water pruifier 	**18.potassium hydroxide** 	**19.sodium chloride** 
20.electronic balance 	**21.dry oven** 	**22. pH/thermal meter** 

Study sites

This study was conducted at Long'an Rd., Xinzhuang Dist ,New Taipei City , Taiwan (R.O.C).(25.020764" N, 121.415369"E) during 17 October to 4 March, 2021.

(a)

(b) (c)

Figure 1. Map of Taiwan (R.O.C) and study site at Long'an Rd., Xinzhuang Dist., New Taipei City. (a) Taiwan (R.O.C) (b) New Taipei City(c) New Taipei Municipal DanFeng High School

Data Collection

Microplastic experiment was conducted in Long'an Rd., Xinzhuang Dist., New Taipei City at 25.020764" N latitude and 121.415369"E longitude in October 2020. We collected the microplastic at shrimp intestines, microplastic in different waterbody and microplastic in the atmosphere**.**

Shrimp sample preparation

1. We cut shrimp intestines *(Litopenaeus vannamei*) in Carrefour(n=69) and Wellcome(n=60) into small pieces and were taken into a serum bottle.
2. Then we poured 100 ml of 10% potassium hydroxide in the bottle and placed it in a 60-degree oven for more than 24 hours (digestive fluid).
3.When the digestion was completed, we added 400ml saturated NaCl solution and kept for 2

hours.
4.The sample was filtered through a filter paper (20 microns diameter) and dried at 60 °C for 1 hours.
5.Afterwards microplastics were observed under microscope. Examinations of number, color of the microplastics using hot needle test.
6.We repeat this protocol for three times.

Water body sample preparation

1.The sample collected from tap water, distilled water and laundry water.
2.The sample was filtered through a filter paper (20 microns diameter) and dried at 60 °C for 1 hours.
3.Afterwards microplastics were observed under microscope. Examinations of number and color of the microplastics using hot needle test.

Dehumidifier sample preparation

1.The sample collected from dehumidifier (Figure 2).
2.The sample was filtered through a filter paper (20 microns diameter) and dried at 60 °C for 1 hour.
3.Afterwards microplastics were observed under microscope. Examinations of number and color of the microplastics using hot needle test.
4.We add some filters on the machine and get water from the atmosphere, to make sure that microplastics are not from the machine.
5.The number of microplastics, water temperature, water pH, and PM2.5 are also measured.

Figure 2. Dehumidifier(left) and dehumidifier with filter paper(right)

Hot needle test

Hold hot needle as close as microplastic,the plastic material which melt and distort by the hot needle is a microplastic.

Statistical analysis

Independent sample-t tests were used to test the differences in numbers of microplastics between shrimp intestine (Carrefour) and distilled water. Correlation was used to find some association between water pH , PM2.5 and the number of microplastics.

Results

Experiment 1: Comparison the number and color of microplastics in white shrimp and distilled water.

There are more microplastic in shrimp (Carrefour) than distilled water.(Figure 3).Among different coloured microplastics,blue,purple and red coloured microplastic were higher in numbers than white,green and black coloured microplastics(Figure 4).

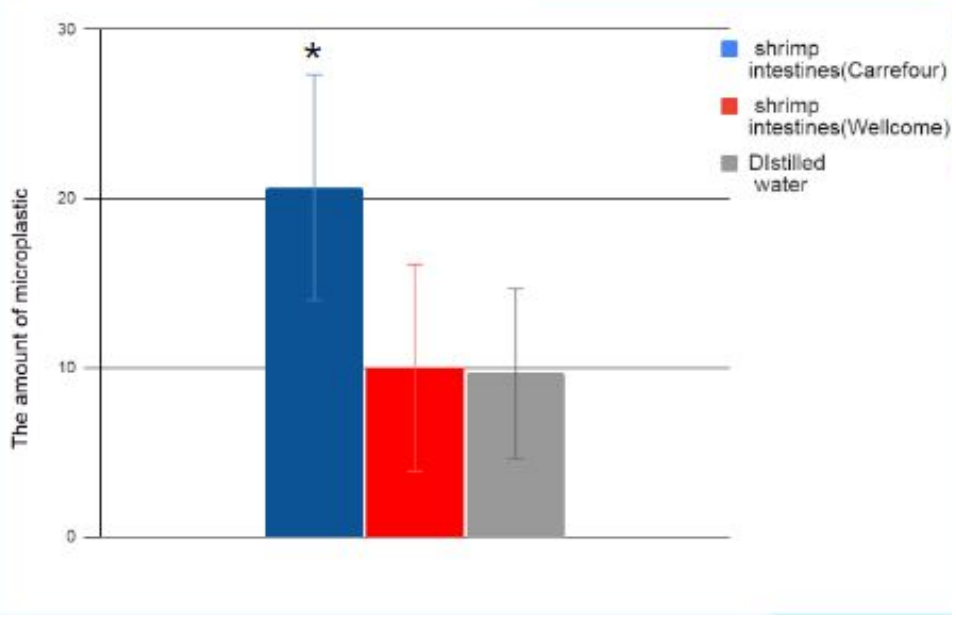


Figure 3. The number of microplastic in Carrefour's shrimp, Wellcome's shrimp and distilled water. *indicates P < 0.05

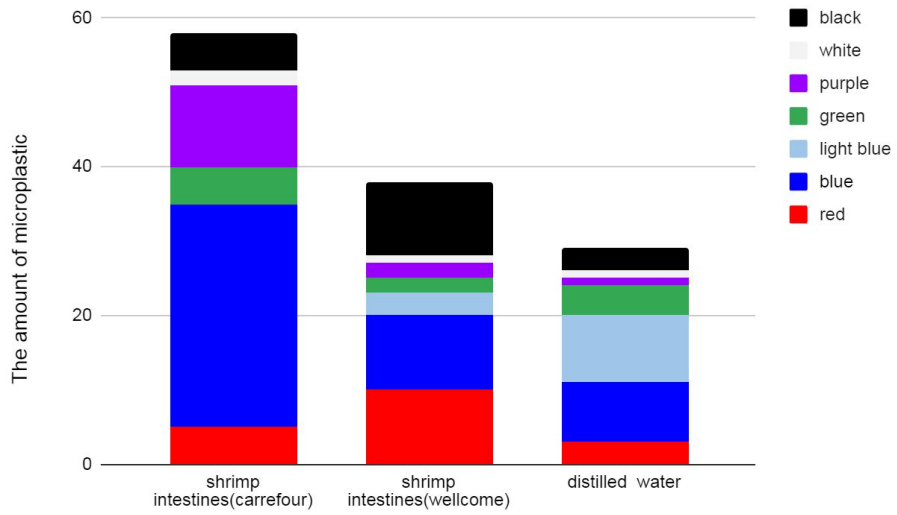


Figure 4. The color of microplastic in Carrefour's shrimp, Wellcome's shrimp and distilled water.

Experiment 2:The amount and color distribution of microplastics in water bodies (tap water, distilled water, laundry water).

The amount of microplastic in laundry water is more than distilled water and tap water (Figure5). In different water bodies, among different coloured microplastics, light blue, blue and purple coloured microplastic are higher in numbers than white, green and black coloured microplastics (Figure6).

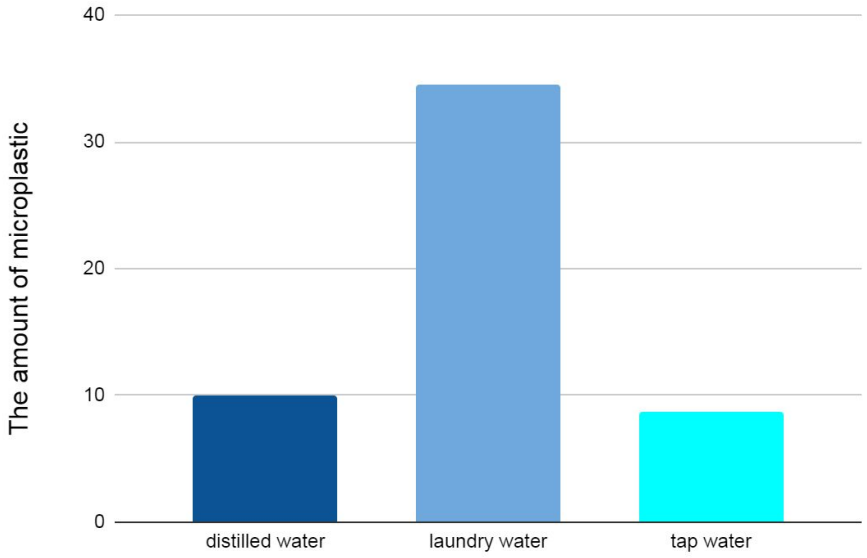


Figure 5. The number of microplastic in distilled water, laundry water and tap water.

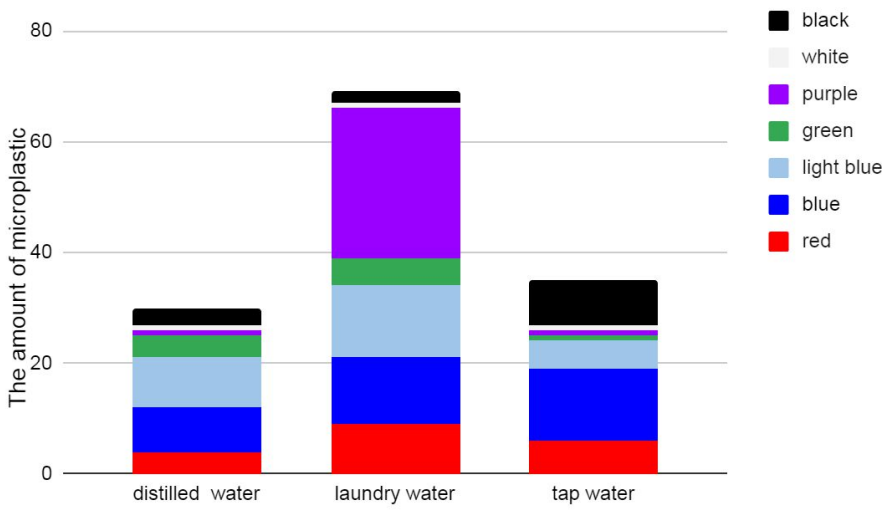


Figure 6. The color of microplastic in distilled water, laundry water and tap water.

Experiment 3: The amount and color distribution of microplastics in the atmosphere.
The amount of microplastics detected on different days are different. Among different coloured microplastics, there are more blue,red,and white coloured (Figure 7). The dehumidifier with filter receives less amount of microplastics in the water (Figure 8). After the experiment, we found that there was obvious correlation between pH value and PM2.5 (Figure 9). But there are no correlation between PM2.5 and the amount of microplastics (Figure 10). There are no correlation between pH value and the amount of microplastics (Figure 11). There was obvious correlation between water temperature and the amount of microplastics(Figure 12).The atmosphere also contains microplastics, through transportation, industrial emissions or living output, through the wind to all parts of the world. The microplastics are mostly gathered together (Figure 13), and the colors are mostly blue and white.

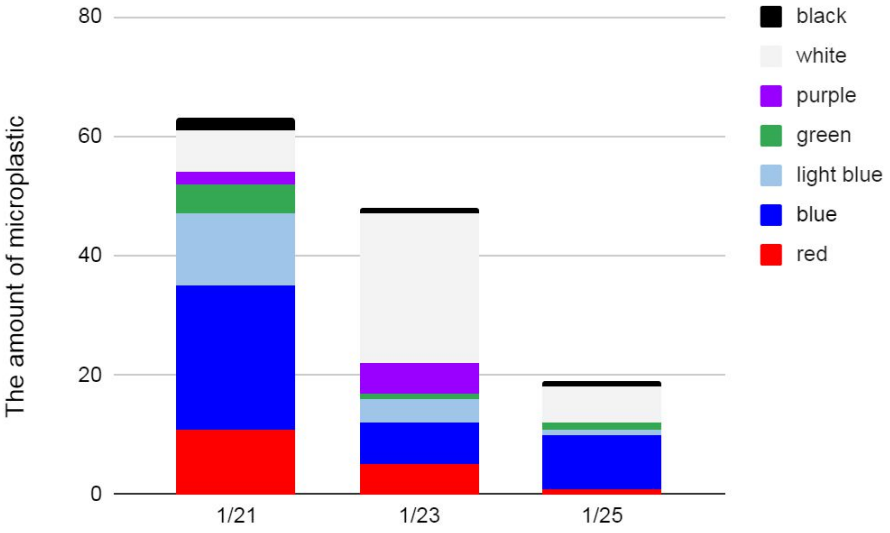


Figure 7. The color of microplastics in the water vapor through dehumidifier on different days.

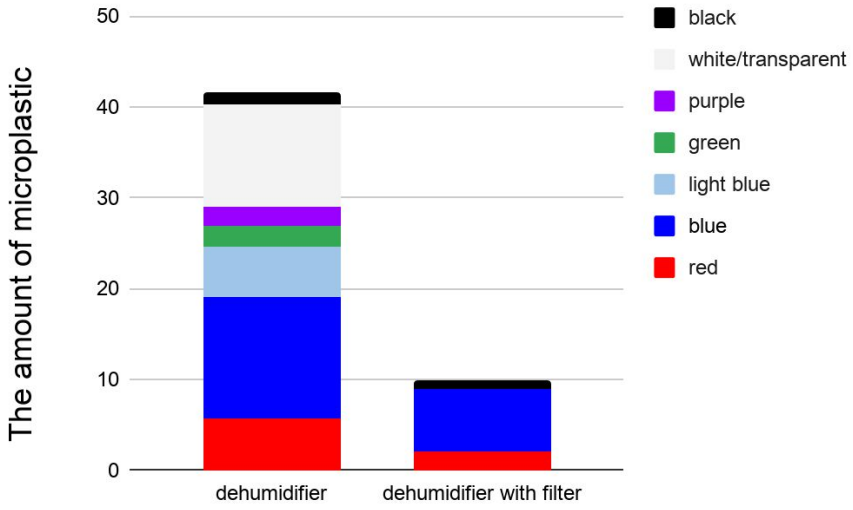


Figure 8. The color of microplastic in the atmosphere through dehumidifier and dehumidifier with a filter.

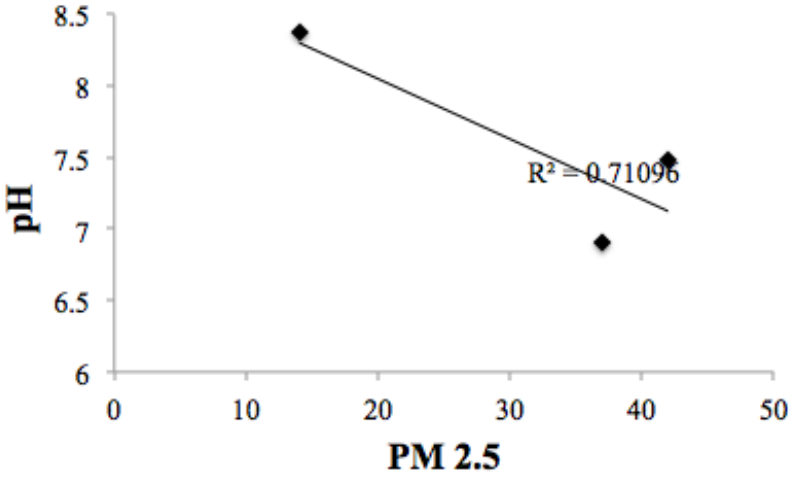


Figure 9. The correlation between PM2.5 and pH

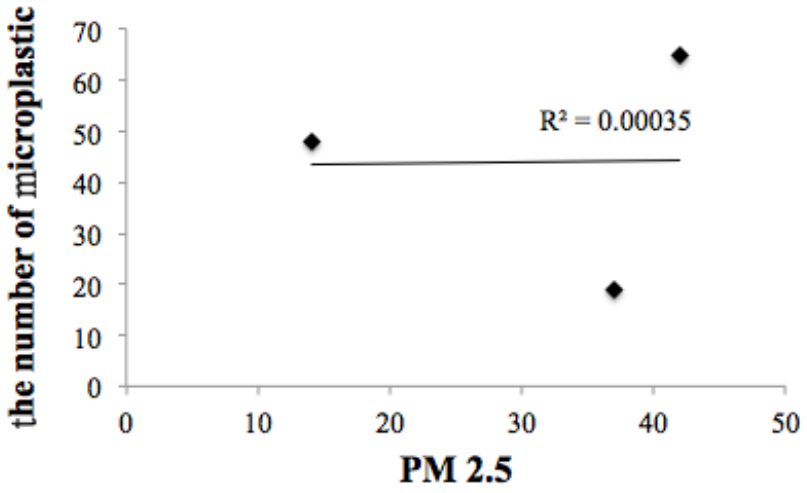


Figure 10. The correlation between PM2.5 and microplastics

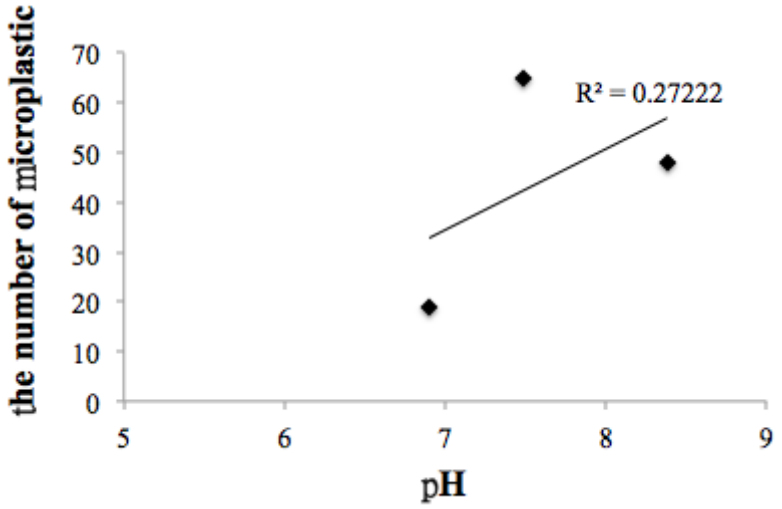


Figure 11. Correlation between pH value and microplastics

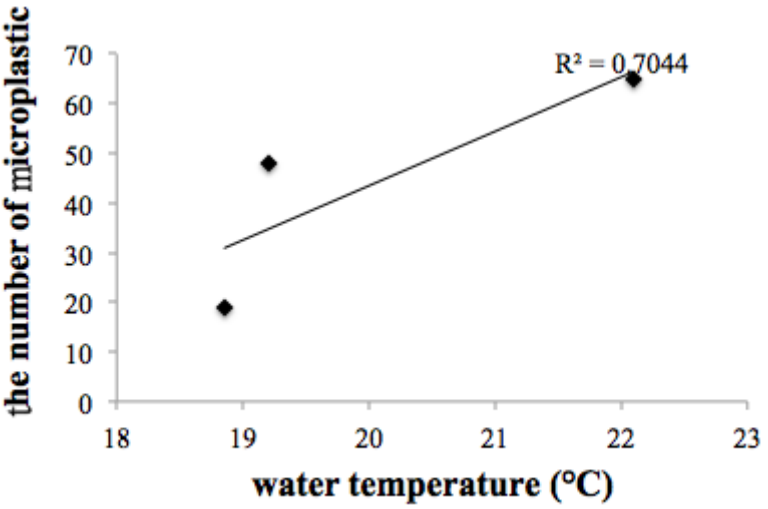
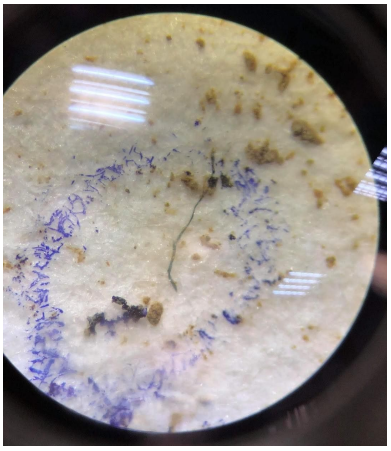


Figure 12. Correlation between water temperature and microplastics


(a)


(b)


(c)

Figure13. Different picture of microplastics. (a) The green microplastic in shrimp (b)microplastic in dehumidifier, (c)microplastic in dehumidifier.

Discussion

It is speculated that the blue microplastics are mostly because the cap of the Bott bottle is mostly blue.It can be found that although blue microplastics are not the largest, but in almost every microplastic literatures, blue microplastics are the top three(Mei-Chi Chen et al., 2018). Most microplastics are produced by rotation or friction(Anna Winklera et.al, 2019).

In our research, microplastics my come frome washing clothes, we can see that the atmosphere is also rich in a large number of microplastics, some of which flow into the sea, the microplastics are eaten by small organisms such as fish and shrimp, and these fish and shrimp are purchased by us in the big market, by that because of the biomagnification theory, the final microplastics will remain in the human body and cannot be metabolized, which will greatly affect the organism(Chien-Te Wu et.al, 2006).

The distribution of microplastics in each sample, tap water is more unstable, may depend on the weather of the day, and shrimp intestines can be more because most of the microplastics are concentrated in the ocean, and finally by shrimp and other marine life to eat.

In our study shows that the purple microplastics in the laundry water, probably because there are more purple clothes washed at that time.

We found that lower vapor pH, the higher PM2.5 in the atmosphere, and we speculate that the more serious the air pollution, the lower the pH. However, in our study shows that pH and PM2.5 have a low correlation with the number of microplastics, we speculated that the more pollution in the atmosphere,the more microplastic there is.

In our study shows that the higher the water temperature, the higher the amount of microplastics , we speculate that the higher water temperature, the greater the amount of evaporation, so the more microplastics. However, due to insufficient current data,we want to follow on research in the future.

Conclusoin

There are more blue, red microplastics in white shrimp than black, white and green. We found more microplastics in laundry water than tap water and distilled water. Subsequent experiments have been conducted to show there are microplastics in the atmosphere and water pH and PM2.5 in the atmosphere are related.

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