Determination of Benzopyrene in edible fish

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Abstract. Benzopyrene is a kind of polycyclic aromatic hydrocarbons and a strong carcinogen. Now, more attention has been paid to benzopyran pollution in food. In this paper, taking the edible fish in Yingkou area as the representative, the extraction solution was determined by UV-Vis spectrophotometer. The results showed that the content of benzopyrene in the three kinds of edible fish was less than the national standard among them, the benzopyrene content of sea catfish is high, and then the risk of carcinogenesis and pollution are analyzed, the results are within the safe range.

1. Introduction
In recent years, the quality of people's life is improving day by day, people are more and more in pursuit of better living conditions, more and more attention is paid to environmental security. More and more attention has been paid to organic pollution in food, among which polycyclic aromatic hydrocarbons (PAHs) are important organic pollutants. Benzopyrene, as an important food pollutant in PAHs, has attracted much attention because of its strong harm to human body [1]. At the same time, fish, as an important source of high quality protein, is being eaten more and more frequently. Therefore, it is very important to study the content of benzopyrene in eating fish. In this paper, the content of benzopyrene in three kinds of edible fish in Yingkou area was studied.

2. Experimental preparation
This experiment selected fresh light fish bought in Yingkou market, Spanish mackerel, perch, each buy three. After the purchase, wash the three kinds of fish with seawater, remove the skin and take out their back muscles, and then mash the tissues to make even meat, and store them for later use.

2.1. Drawing of a standard curve
The benzopyrene reference solutions were configured with concentrations of 0.0000 g/mL, 0.0100 g/mL, 0.0200 g/mL, 0.0400 g/mL, 0.0500 g/mL, and 0.0800 g/mL respectively. Uv-vis spectrophotometry was used to measure the solutions numbered from low to high concentration. The results are shown in Table 1:

| Numble | Scheme 1 | Scheme 2 | Scheme 3 | Scheme 4 | Scheme 5 | Scheme 6 |
|--------|----------|----------|----------|----------|----------|----------|
| Concentration (µg/mL) | 0.0000 | 0.0100 | 0.0200 | 0.0400 | 0.0500 | 0.0800 |
| Absorbance (Abs) | 0.000 | 0.064 | 0.162 | 0.304 | 0.396 | 0.610 |

Table 1. Absorbance of benzopyrene at different concentrations
2.2. **Stability experiment**

The standard benzopyrene solution of 400 μL was accurately added in a 10 mL volumetric flask with a pipette, and then diluted to the volume by cyclohexane to obtain a 0.0400 μg/mL benzopyrene solution. The diluted solution was put into a brown bottle, and the absorbance of the solution without benzopyrene was determined by UV spectrophotometry at the wavelength of 383 nm for 10 min, 20 min, 30 min, 60 min and 24 h respectively.

**Table 2.** Stability measurement results

| Number | 10min | 20min | 30min | 60min | 24h | Average | RSD (%) |
|--------|-------|-------|-------|-------|-----|---------|---------|
| Absorbance (Abs) | 0.306 | 0.305 | 0.304 | 0.303 | 0.301 | 0.3038 | 0.63    |

The absorbance was determined by ultraviolet spectrophotometer at the wavelength of 383 nm. The absorbance value was between 0.301 and 0.306, with an average value of 0.3038 and a relative standard deviation of 0.63%. It was proved that benzopyrene was stable after being stored in a brown bottle and could meet the test requirements.

3. **Experimental results**

3.1. **Determination of benzopyrene in food fish**

The sample of edible fish was washed with seawater and the muscle tissue was taken to make homogenate. Weigh the sample of 40g that has been made into homogeneous minced meat, add 40g anhydrous sodium sulfate, grind evenly and place the sample in a beaker. Add 160 mL n-hexane-dichloromethane (2:1) solution, fully mix it and then ultrasonic extraction for 30 min. After that, vacuum filtration was carried out and the filtrate was transferred to 500 mL distillation bottle. The absorbance of sea catfish (A1, A2, A3), Spanish Spanish fish (B1, B2, B3) and Sea bass (C1, C2, C3) purchased from yingkou market were tested by UV spectrophotometry. The determination results of benzopyrene in the three fish are shown in Table 3:

**Table 3.** Levels of benzopyrene in three fish species

| Species     | Group | Weight (g) | Abs | Concentration (μg/kg) |
|-------------|-------|------------|-----|-----------------------|
| Sea catfish | A1    | 40         | 0.250 | 4.069                |
|             | A2    | 40         | 0.216 | 3.518                |
|             | A3    | 40         | 0.225 | 3.664                |
|             | B1    | 40         | 0.170 | 2.773                |
| Spanish mackerel | B2 | 40         | 0.178 | 2.903                |
|             | B3    | 40         | 0.208 | 3.389                |
|             | C1    | 40         | 0.133 | 2.174                |
| Sea bass    | C2    | 40         | 0.140 | 2.287                |
|             | C3    | 40         | 0.080 | 1.315                |

Experiments show that in Yingkou district in the widely used three kinds of fish, (catfish, Spanish mackerel, sea bass) contains both of benzopyrene, GB2762-2017 and national standards of fish of benzopyrene content in the limit is 5 μg/kg, and Yingkou region of the three types of fish body benzopyrene content is below the limit, but the sea catfish and Spanish mackerel benzopyrene content is high in the body.

3.2. **Source analysis of benzoyl pyrene in sea catfish**

1. which may be associated with sea catfish habit, like living in the water bottom mud, sea catfish and contained more organic pollutants in sediments of this experiment in Chinese have reflected, in the bay of benzopyrene content in the sediment of up to 14.2 μg/kg [2], sea catfish long prostrate on the ground floor and sediments benzopyrene may enter the sea catfish through gills.
2. Due to the cold winter in the north, sea catfish generally can not overwinter, so in Yingkou area sea catfish are generally young fish, and young fish metabolism active and frequent exchange of substances in the water [3], so the benzo a pyrene in the sea catfish enrichment more.

3.3. Risk assessment for benzopyrene carcinogenesis

Cancer risk calculation formulas are as follows:

\[
\text{BEC} = C \times \text{TEF} \tag{1}
\]

\[
\text{ILCR} = \frac{\text{BEC} \times \text{IR} \times \text{EF} \times \text{ED} \times \text{SF} \times \text{CF}}{\text{BW} \times \text{AT}} \tag{2}
\]

The mean value of the three types of fish was used to calculate the carcinogenic risk index ILCR=9.77×10^{-6}. USEPA usually defined the maximum acceptable risk value as ILCR ≤ 10^{-5}, and ILCR ≥ 10^{-4} as the risk of cancer [4]. The ILCR value of fish in Yingkou area was less than 10^{-5}, which was within the range of the maximum acceptable risk value. It is worth mentioning because fried and smoked will increase in the number of benzopyrene content in food, especially when the fish occurred anxious burnt benzopyrene content will increase rapidly, pay attention to the above points can reduce the risk of cancer [5].

4. Conclusion

The region's three kinds of food fish benzo pyrene content did not exceed the standard, carcinogenic risk level is also within a safe range, between the three kinds of fish benzo pyrene content: sea catfish > spanish mackerel > sea bass.

References

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