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OPTIMIZING POLYCYCLIC AROMATIC HYDROCARBONS EXTRACTION METHODS FOR SMOKED CATFISH SPECIES IN NIGER STATE, NIGERIA

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ABSTRACT

This study delves into the assessment and optimization of extraction methods for determining the Polycyclic Aromatic Hydrocarbons (PAHs) content in smoked catfish species sourced from Niger State, Nigeria. PAHs are environmental contaminants and potential carcinogens that can accumulate in smoked fish during the smoking process. We evaluated various extraction techniques to assess their efficiency in quantifying PAHs in catfish samples. The findings from this research not only contribute to our understanding of PAH levels in smoked catfish but also offer insights into improving the precision and accuracy of analytical methods for monitoring PAHs in smoked fish, thereby enhancing food safety in the region.

KEYWORDS

Polycyclic Aromatic Hydrocarbons (PAHs); Smoked catfish; Niger State, Nigeria; Extraction methods; Food safety; Carcinogens; Environmental contaminants; Analytical techniques

INTRODUCTION:

Niger State, situated in Nigeria, boasts a rich culinary tradition that includes smoked catfish as a beloved delicacy. However, this dietary delight is not without its concerns, particularly when it comes to food safety. One of the significant concerns is the presence of Polycyclic Aromatic Hydrocarbons (PAHs), environmental contaminants that have garnered attention due to their potential carcinogenic properties. These PAHs can accumulate in smoked fish during the smoking process, making the assessment of their content in smoked catfish a matter of considerable importance.

Smoking is a traditional method of fish preservation that imparts unique flavors and extends shelf life. However, the combustion of organic materials during the smoking process can lead to the generation and deposition of PAHs on the fish. Prolonged exposure to these compounds has raised questions about the safety of consuming smoked fish, particularly in regions like Niger State, where it is a dietary staple.

This study is a response to the critical need to evaluate and optimize extraction methods for determining PAH content in smoked catfish species from Niger State, Nigeria. The significance of this research lies not only in its contribution to our understanding of the levels of PAHs in smoked catfish but also in its potential to enhance food safety practices in the region. By systematically assessing and optimizing extraction techniques, we aim to provide more accurate and precise data on PAHs, which can, in turn, inform risk assessments and regulatory measures, ultimately safeguarding the health of those who relish the flavors of smoked catfish in Niger State.

METHOD

The process of optimizing Polycyclic Aromatic Hydrocarbons (PAHs) extraction methods for smoked catfish species in Niger State, Nigeria, was conducted systematically to ensure the accuracy and reliability of the results. The following steps outline the methodology in detail:

Sample Collection and Preparation:

To begin, a diverse and representative sample of smoked catfish was collected from various markets and fisheries across Niger State. The selection of samples considered factors such as species, smoking techniques, and geographical locations. These samples were carefully processed, first by creating homogenized subsamples. These subsamples were then finely ground into a uniform powder, ensuring consistency and facilitating subsequent extraction processes.

Assessment of Extraction Techniques:

Multiple extraction techniques were evaluated to identify the most effective method for PAH isolation. These techniques included Soxhlet Extraction, chosen for its ability to extract PAHs through continuous refluxing with organic solvents. Ultrasound-Assisted Extraction (UAE) was used to enhance efficiency, applying high-frequency ultrasound waves to expedite PAH extraction. Solid-Phase Microextraction (SPME),

a non-invasive method, relied on the adsorption of PAHs onto a specialized fiber coating. Each technique was rigorously tested to determine its suitability for the specific catfish samples.

Solvent Selection:

The choice of organic solvents is critical in the extraction process. Various solvents were evaluated for their ability to efficiently extract PAHs from the catfish samples. Solvent selection was based on considerations of polarity and efficiency, ensuring the optimal recovery of PAHs.

Quality Control and Calibration:

To maintain the quality and accuracy of the data, standard reference materials and spiked samples were employed for quality control purposes. Calibration curves were constructed using standard PAH solutions, allowing for the quantification of PAHs in the catfish samples. These controls and calibrations were essential for ensuring the precision and reliability of the results.

Through this rigorous process, the study aimed to optimize and standardize extraction methods, providing a reliable foundation for the accurate assessment of PAH content in smoked catfish from Niger State, Nigeria. The systematic approach ensured the production of robust data for further analysis and regulatory considerations in safeguarding food safety in the region.

RESULTS:

The study's systematic approach to optimizing Polycyclic Aromatic Hydrocarbons (PAHs) extraction methods for smoked catfish species in Niger State, Nigeria, yielded valuable results. The assessment of different extraction techniques, including Soxhlet Extraction, Ultrasound-Assisted Extraction (UAE), and Solid-Phase Microextraction (SPME), revealed notable variations in their efficiency. UAE demonstrated the highest PAH extraction efficiency, followed by Soxhlet Extraction, while SPME showed lower efficiency.

The choice of organic solvents played a critical role in the extraction process. Solvent polarity and efficiency were considered in this selection. The results indicated that specific solvents were more effective at extracting PAHs, with the choice depending on the PAH composition in the smoked catfish.

Quality control measures, including standard reference materials and spiked samples, enabled accurate quantification of PAHs. Calibration curves constructed using standard PAH solutions provided a reliable basis for quantifying PAH content in the catfish samples.

DISCUSSION:

The results of this study underscore the importance of optimizing extraction methods when assessing PAHs in smoked catfish. The variations in extraction efficiency between different techniques and solvents highlight the need for a systematic approach to method selection. UAE emerged as the most efficient technique for PAH extraction, followed by Soxhlet Extraction. This finding emphasizes the value of utilizing UAE for future analyses of PAH content in smoked catfish from Niger State.

The choice of organic solvents proved critical in PAH extraction, as solvent polarity and efficiency influenced the recovery of PAHs. Researchers must consider the specific PAH composition in smoked catfish when selecting the most suitable solvent. This information enhances our understanding of the complexities involved in PAH extraction and analysis.

The quality control measures, including standard reference materials and spiked samples, ensured the accuracy and reliability of the results, thus enhancing the credibility of the data generated.

CONCLUSION:

In conclusion, this study has successfully optimized Polycyclic Aromatic Hydrocarbons (PAHs) extraction methods for smoked catfish species in Niger State, Nigeria. The systematic approach encompassing various

extraction techniques, solvent selection, and quality control measures has provided a foundation for reliable and accurate assessment of PAH content in smoked catfish.

The findings have practical implications for food safety in the region. The identification of more efficient extraction methods and suitable solvents ensures more precise and comprehensive analysis of PAHs in smoked catfish. This, in turn, can inform regulatory measures and dietary practices, safeguarding the health of those who enjoy smoked catfish as a cherished culinary tradition in Niger State.

Ultimately, this research contributes not only to our understanding of PAHs in smoked catfish but also to the enhancement of food safety practices in the region, demonstrating the value of systematic optimization in analytical methodology.

REFERENCES

1. Ajai AI, Suleiman MAT, Dauda BEN, Sadiku SOE and Aberuagba F. 2010.
2. Determination of polycyclic aromatic hydrocarbons in some selected smoked fish species in Gwarjiko area of Niger state, Nigeria. International J of Chemical Science, 3 (2): 2006-3350.
3. Andrzej S and Zdzislaw E S. 2005. Polycyclic aromatic hydrocarbons in smoked fish: critical review. J. of Food Chemistry,91: 303-311.
4. Lijinsky W and Shubik P. 1965. Polynuclear hydrocarbons carcinogens in cooked meat and smoked foods. Industrial Medical Surgery. 34: 152 – 154.
5. Majors R E. 1995. Current trends and developments in sample preparation. Liquid Chromatography-Gas Chromatography International, 8: 128.
6. Prinsen A J and Kennedy W B H 1977. Quantity of alpha – benzopyrene in smoked food aroma and flavouring substances Bilthoven, National Institute of Public Health and Environmental Protection. Report No 11: 1 – 11.
7. Scientific Committee on Food. 2002. Opinion of the Scientific Committee on food on the risk to human health of polycyclic aromatic hydrocarbons in food. SCF/CS/CNTM/PAH/29 Final. Brussels: European Commission, Health and Consumer Protection Directorate General.
8. Shewan J M. 1977. The bacteriology of fresh and spoiling fish and the biochemical changes induced by bacterial action. In handling, processing and marketing of tropical fish. London, Tropical Products Institute, 185.

9. Simko P. 2002. Determination of polycyclic aromatic hydrocarbons in smoked meat products and smoked flavouring additives. J of Chromatographica B. 770: 3-18

10. Steinig J and Meyer V. 1976. 3, 4 – Benzo(a)pyrene contents in smoked fish depending on smoking procedure,. Lebensmittel unters forsch, 162: 235 – 242