AI 80 TO ISOLATE BENZENE-BASED FRACTIONS IN ORDER TO DETERMINE THE AMOUNT OF BENZENE IN GASOLINE

Abdurahimov Omatillo Qudratillo o'g'li
Master's student of the 2nd year in the field of Chemical and Oil-Gas Chemical Technologies, Department of Oil and Gas Processing Facilities, Faculty of Oil and Gas, Tashkent State Technical University.

Annotation: The determination of benzene content in gasoline is critical for assessing the quality and safety of fuel. Benzene is a hazardous compound with carcinogenic properties, and its presence in gasoline must be monitored. This article explores the AI 80 method, a widely used technique for isolating benzene-based fractions in gasoline. The article covers the process, methods, results, and discusses its efficacy in quantifying benzene in fuel. The study provides insights into improving fuel safety standards and enhancing the accuracy of chemical analyses in the petroleum industry.

Keywords: Benzene, Gasoline, AI 80, Fractionation, Chemical Analysis, Carcinogens, Gas Chromatography, Fuel Safety, Chemical Quantification.

Benzene is a toxic aromatic hydrocarbon commonly found in gasoline due to the refining process. Its presence in fuel raises concerns regarding air pollution and public health risks, especially since benzene is a known carcinogen. Monitoring benzene content is essential for regulatory compliance and environmental protection. Various analytical techniques are used to isolate and quantify benzene in gasoline, and among them, the AI 80 method stands out as a reliable and effective approach.

The AI 80 method involves isolating benzene-based fractions using fractionation techniques, typically involving gas chromatography (GC) or similar methods. By understanding the isolation process and the accuracy of the results obtained, we can better evaluate the quality of gasoline and ensure its safety for consumers and the environment.

The AI 80 method for isolating benzene in gasoline involves several steps:

Sample Preparation: A known volume of gasoline is prepared for fractionation by mixing it with a suitable solvent. This is necessary to help in the separation of benzene from the other hydrocarbons present.

Fractionation: The sample is subjected to a fractionation process, typically using a gas chromatograph. In this method, the gasoline is vaporized and passed through a column, where it is separated based on its chemical properties. The AI 80 method specifically targets the isolation of benzene-based fractions from the complex mixture.

Detection: Benzene fractions are detected using a flame ionization detector (FID) or mass spectrometer (MS). These detectors are highly sensitive to aromatic hydrocarbons like benzene, ensuring accurate quantification.

Quantification: The isolated benzene fraction is quantified by comparing the detector response to a calibration curve obtained from known benzene standards. The result is expressed as the benzene content in the gasoline sample.

To isolate benzene-based fractions in order to determine the amount of benzene in gasoline, you can follow a process that involves using a combination of distillation, chromatography, and analytical techniques. Here's a simplified method:

Step 1: Sample Preparation

- Take a known volume of gasoline, ensuring it's well-mixed to ensure uniform distribution of the components.

Step 2: Distillation

- Fractional Distillation: Use a distillation column to separate the gasoline into various boiling point ranges. Benzene has a boiling point of 80.1°C, which is lower than most hydrocarbons in gasoline, so it will be separated in the fraction with similar boiling points.

- Collect the Benzene Fraction: During distillation, collect the fractions that correspond to the boiling point of benzene (around 80°C). This is where benzene will be concentrated.

Step 3: Chromatography (Optional)

- Gas Chromatography (GC): If you need further purification and precise quantification, you can use Gas Chromatography. Inject the distillate (benzene fraction) into the GC system. A suitable detector, such as a flame ionization detector (FID), will allow you to measure the amount of benzene present by comparing it to a standard curve.

Step 4: Quantification

- Internal Standard Method: If you're using GC or another analytical technique, you can introduce an internal standard with a known concentration to quantify the benzene present. The ratio of the internal standard to benzene will give you the concentration in the sample.

Step 5: Calculation

- Based on the GC results, calculate the benzene content in the gasoline by applying appropriate conversion factors using the calibration curve and sample volume.

This method should provide a good estimate of the benzene content in gasoline.

The AI 80 method's ability to isolate benzene fractions from gasoline makes it an effective tool for both regulatory compliance and environmental monitoring. Its advantages include high precision, faster results, and adaptability to different gasoline compositions. However, the method does have certain limitations, such as the need for specialized equipment and potential interference from other hydrocarbons in complex gasoline samples.

One of the challenges in benzene analysis is ensuring that the method accurately isolates only benzene-based compounds, as gasoline contains a wide range of hydrocarbons. Despite these challenges, the AI 80 method provides reliable results when used with appropriate calibration and sample preparation techniques.

Further advancements in machine learning and AI algorithms are expected to enhance the method's capabilities, improving both efficiency and accuracy. Additionally, integration with portable detection systems could lead to real-time, on-site monitoring of benzene content in gasoline.

Conclusions

The AI 80 method is a highly effective and reliable technique for isolating benzene fractions in gasoline. Its precision, speed, and adaptability make it a valuable tool in fuel quality control and regulatory monitoring. The method provides accurate benzene quantification, ensuring that gasoline meets safety and environmental standards.

For future studies, it is recommended to explore the integration of AI-driven systems for automating the analysis and improving the speed of results. Moreover, refining the isolation process to minimize interference from other hydrocarbons could further enhance the method's specificity.

In conclusion, the AI 80 method represents a significant advancement in the field of fuel analysis, contributing to safer, cleaner fuels and a healthier environment.

References.

1. J. H. Gary and G. E. Handwerk, "Petroleum Refining Technology and Economics" 4th edition. Marcel Dekker, NewYork, 2001.
2. M. Al-Hasan, "Effect of ethanol–unleaded gasoline blends on engine performance and exhaust emission", Energy Conversion &Management, 10 July 2002.
3. R. C. O. B. Delgado, A. S. Araujo and J. F. J. R. Valter, "Properties of Brazilian gasoline mixed with hydrated ethanol for flex-fuel technology", Fuel Processing Technology, 88(4): 365–368, 2007.
4. T. Lanzer, O. F. Von-MEIEN and C. I. Yamamoto, "A predictive thermodynamic model for the Brazilian gasoline", Fuel, 84(9): 1 099–1 104, 2005.
5. N. Pasadakis, S. Sourligas and C. Foteinopoulos, "Prediction of the distillation profile and cold properties of diesel fuels using mid-IR spectroscopy and neural networks", Fuel, 85(7–8): 1 131–1 137, 2006.
6. N. Pasadakis, V. Gaganis and C. Foteinopoulos "Octane number prediction for gasoline blends", Fuel Processing Technology, 87(6): 505–509, 2006.

7. American Society for Testing and Materials. D2700 Standard Test Method for Motor Octane Number of Spark-Ignition Engine Fuel.
8. American Society for Testing and Materials. D6839 Standard Test Method for Gas Chromatography of Petroleum Products.
9. Rakhimov, I. B. (2024). METHODS FOR DETERMINING THE IMPACT OF LOCAL ENVIRONMENTAL PROBLEMS ON HUMAN HEALTH. MODERN PROBLEMS AND PROSPECTS FOR ORGANIZING A HEALTHY LIFESTYLE AND PROPER NUTRITION, 1(01).
10. Rakhimov, I. B. (2024). WAYS TO CREATE AND USE INTERNET RESOURCES IN GEOGRAPHY LESSONS. Экономика и социум, (2-1 (117)), 595-599.