Project Title:

Detail Heavy Hydrocarbon Analysis in Natural Gas by Using GC/MS

Department:	Chemistry and Process Research Department	***Employer:***	Research Assistant
Project/Program Manager:	Majid Ghahraman Afshar	***Executor:***	Mehdi Salehirad
Project Financial Code:	216000	***Project Quality Code:***	PPCPN11
Type of Project/Program:	Idea - Test	***Assistant:***	Research Assistant

Project Staff: Farzad Borahan Azad

Keywords:

Detail Hydrocarbon Analysis, Natural Gas, Heavy Hydrocarbon, Light Hydrocarbon, Gas Chromatography, Dew Point,

Project Necessity:

Natural gas analysis, based on the type of the hydrocarbon, is necessary to obtain a suitable mixture for different applications. Several methods that are applied for natural gas analyzing can be classified in two groups: chromatographic and non-chromatographic methods. Chromatographic method are commonly used in rapid and detailed analyzing on natural gas composition. Such methods like thin layer chromatography-flame ionization detection (TLC-FID) and clay-gel adsorption chromatography are considered as rapid determination methods. On the other hand, capillary gas chromatography (GC) coupled with FID and mass spectroscopy (MS) are detailed analysis methods.

Project Goals:

In this paper, a standard detailed hydrocarbon analysis method was used for characterization of natural gas samples from Qeshm power plants. As this power plant is not equipped with a refinery unit, the mentioned method represented desirable results for determination of natural gas composition. Two types of capillary columns with optimized condition were used for standard and real samples and column parameters were investigated to improve separation efficiency. Nonpolar PONA column, due to its narrow nonpolar coating, could not determine light polar component like Methane, Nitrogen and carbon dioxide at the beginning of chromatogram. Using column with more polarity and temperature programming effectively improved separation efficiency and led to characterize 123 from 188 components of standard DHA sample and consequently Qeshm natural gas sample.

Abstract:

Natural gas, as a mixture of light and heavy hydrocarbons, should be analyzed by gas chromatography (GC) method to prevent the possible technical problems, generated from the heavy hydrocarbons, in pipe line of fuels, combustion chambers and boilers in power plants. Incomplete distillation, type of reservoir and some other factors are responsible of the presence of these compounds in natural gas. In this research the chromatography method has been developed by using a 120 m DB-1 column (including two 60 m columns which were connected to each other by a silicon connector and resin) and has been applied to the Qeshm power plant gas samples. In this case study the appropriate optimization steps have been considered to have a precise mass spectroscopy (MS) detection of light and heavy hydrocarbons in natural gas by a detailed GC/MS analysis. Moreover, a thermal jacket has been utilized due to the two-phase (Gas+Liquid) samples obtained from Qeshm power plant, in order to have a one-phase (Gas) sample injection. The developed method has been resulted in an accurate separation of light and heavy hydrocarbons, which leads to eliminate the possible subsequent problems in Qehshm power plant.

Steps and Methodologies:

In this case study, a detailed hydrocarbon analysis (DHA) has been applied for separation and determination of extracted natural gas components from Qeshm Island power plant in south of Iran. Many efforts have been carried out to resolve the subsequent fundamental problems, originated from the heavy hydrocarbons. Therefore, a standard DHA method using a polar column, MS detector and thermal jacket has been employed to separate 120 unknown components of Qeshm sample during a simple and fast procedure.

Main Results (technical outputs, patents, papers, books, reports, etc.):

1 full report, 2 applied projects and one oral presentation

The fast method is used for analyzing linear hydrocarbons (C_1-C_6) in 65 min yielding separation of 11 compounds. This method is not able to separate heavy liquid hydrocarbons, ring compounds and isomers. In the other method, which its total runtime is 190 min, the standard gas sample is injected through the loop and the gaseous standard sample with a syringe, simultaneously. The determination of unknown natural gas compounds was done successfully and in the end 11 gaseous samples and 140 isomers were detected. Ultimately, application of this method in combination with thermal jacket is recommended for gaseous samples containing heavy compounds.