

Studies on the aging behavior of the Arabian asphalts

Mohammad Nahid Siddiqui and Mohammad Farhat Ali
Department of Chemistry
King Fahd University of Petroleum & Minerals
Dhahran 31261, Saudi Arabia

ABSTRACT

In this study the rheological, physical, and chemical properties of asphalts procured from Ras Tanura, Riyadh, Kuwait, and Bahrain refineries were evaluated. The rolling thin-film oven (RTFO), termed as short-term aging, and the pressurized aging vessel (PAV), termed as long-term aging, tests were used to simulate asphalt aging. Viscosity, penetration, softening point, and weight loss tests were applied to investigate the rheological properties of fresh and aged Arabian asphalts. The Corbett method was used to separate asphalts into asphaltene, polar aromatic, naphthene aromatic, and saturate fractions. Asphaltene contents and Gaestel index (I_c) were found to increase linearly with aging process. It was found that PAV has more severe effects on the rheological and chemical properties of asphalt than RTFOT method. Using infrared spectroscopy, it was found that on aging the weight percent of oxygen as carbonyl and sulfur as sulfoxide group types increased in asphaltenes. Significant differences were observed between the structure and composition of fresh and aged asphaltenes of Ras Tanura (RT) asphalt.

(Key words: asphalt; aging; asphaltenes)
(Abbreviated title: asphalt aging behavior)

INTRODUCTION

Asphalt has a very delicate balance of polar to non-polar, homogenous to heterogeneous, small compounds to large compounds, associating components to dispending solubilizing components, and aromatic to paraffin components and some metals. This delicate mixture balance plays a key role in the aging and performance properties of asphalt. Any imbalance in the chemistry of this delicate mixture results in incompatibility, poor performance and lessened durability of asphalt because one type of compound dominates the mixture at the cost of another group of compounds¹. Temperature has a great influence on the flow, brittleness, and consistency of asphalt. Since asphalt is composed of enormously large hydrocarbons, the temperature gradually changes its physical and chemical composition from semi-solid to fluid. Thus the aging or oxidation of the asphalt is one of the key parameters used for the characterization of asphalt properties.