Introduction

The role that modern gas chromatographic (GC) techniques can play in improving the efficiencies of process operations and product specification testing is receiving more attention in the petroleum industry. A major area of interest is the calculation of physical properties relating to gasoline volatility from GC data. These properties are normally defined by the ASTM Test for Distillation of Petroleum Products (D 86-67), Reid vapor pressure (RVP), or the temperature for a given vapor to liquid \((T \ V:L)\) ratio or all three. Since the development of the ASTM Test for Boiling Range Distribution of Petroleum Fractions by Gas Chromatography (D 2887-73), there has been particular interest in applying this method and other related methods to the determination of volatility characteristics of gasolines. Gas chromatography provides a more fundamental approach than the older, empirical methods; and, analyses can be made rapidly and with good precision.

Because of the widespread interest in applying GC data, particularly that from ASTM Method D 2887-73, to the calculation of physical properties, Section L of Research and Development Division IV, ASTM Committee D-2 on Petroleum Products and Lubricants, sponsored an informal one day symposium on this subject at the meeting of ASTM Committee D-2 in Dallas, Tex., Dec. 1973. The purpose of this symposium was to present a state-of-the-art review of applications of data from ASTM Method D 2887-73, but other noncorrelative applications of GC methods were also presented. The contributions included in this publication represent a good cross section of the petroleum industry with papers from six major companies including two outside the United States.

Several papers presented practical applications of GC data to calculate product inspection properties. One paper, in fact, describes applications of GC in daily refinery gasoline blending operations that permit on-stream prediction of ASTM Method D 86-67 and RVP of motor gasoline. A significant advantage of the technique over conventional testing procedures is that both ASTM Method D 86-67 and RVP determinations are obtained
with excellent reliability from a single GC run with an analysis time of less than half that of the combined conventional methods.

Other papers also describe correlations and comparisons with other ASTM distillation methods for materials of higher boiling ranges than gasolines. Correlation equations are presented and evaluated for calculation of ASTM Test for Distillation of Petroleum Products at Reduced Pressure (D 1160-61), vacuum distillation, from ASTM Method D 2887-73 data with a variety of intermediate and finished products. Comparisons between ASTM Method D 2887-73 on narrow boiling and wide-boiling fractions, including crude oils, showed good agreement between data from ASTM Method D 2887-73 and ASTM Distillation of Crude Petroleum (15 Theoretical Plate Column) (D 2892-73) (15/5) for true boiling point (TBP) distillation.

In the papers presented, detailed discussions and equations are given for the various procedures used to calculate physical properties. In general, the procedures can be grouped as empirical correlations or mathematical models. The former are generally considered to be a short-range approach during the implementation of ASTM Method D 2887-73. In time, the older, conventional methods, such as ASTM Method D 86-67 and RVP, may be replaced or at least used infrequently as ASTM Method D 2887-73 or other similar GC methods are included in specifications. Thus the need for correlations eventually will be eliminated.

Mathematical models were used by several authors as a more fundamental approach to the calculation of the desired physical properties. This is particularly illustrated in one paper in which RVP calculations are made from detailed component analysis by GC.

The symposium indicated that significant progress has already been made in developing and implementing procedures for calculating physical properties from ASTM Method D 2887-73 and similar GC data. Sufficient interest was generated by this symposium to assure that this work will continue, and routine utilization of GC methods as primary test procedures will continue to increase rapidly.

This publication should be of interest to both producers and customers of petroleum products. It should be especially helpful to those actively engaged in specification testing, establishing specification test methods, and process design. This publication presents information and guidelines for the practical use of GC data to calculate physical properties of petroleum products and indicates directions for future research toward better and fewer test procedures.

We wish to thank the many members of ASTM and the Institute of Petroleum who helped to make the symposium a success. We are grateful to the authors and their respective companies for permission to publish
this work. The contributions from our overseas colleagues are especially appreciated.

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