

## GAS CHROMATOGRAPHIC BEHAVIOUR OF VARIOUS TYPES OF ORGANIC COMPOUNDS ON PORAPAK R

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Porapak R, a vinyl pyrrolidone copolymer with vinyl benzene, was characterised by gas chromatography for *n*-pentane, *n*-hexane, *n*-heptane, *n*-octane, *n*-nonane, *n*-decane, *cyclohexane*, benzene, toluene and ethyl benzene at four different temperatures in the range 160–190°. Plots of  $\log V_R$  vs reciprocal of absolute temperature were linear with correlation coefficients between 0.991 and 0.999.

### INTRODUCTION

Gas-solid chromatography is mainly used for the separation of low molecular-weight compounds. A variety of materials such as carbon, silica, alumina and molecular sieves were first used as adsorbents in gas chromatography. The introduction of porous polymers has almost replaced these classical adsorbents. The main reason for their wide use as separating media in gas chromatography lies in their excellent performance in handling a great number of compounds. Although organic in nature, porous polymers have been found to separate most of the inorganic gases very efficiently, and, in addition, all classes and types of organic compounds. The first separations on polyaromatic polymer beads were described by Hollis [1, 2]. Since then various types of porous polymers have been studied by gas chromatography, and the range of separations which they can achieve has multiplied very rapidly. The gas chromatographic behaviour of Porapak and Chromosorb Porous Polymers was investigated by analysing mixture of hydrogen, carbon dioxide, methane, ethylene and ethane at different temperatures on columns packed with various types of beads of Porapaks and Chromosorbs [3, 4].

### EXPERIMENTAL

All gas chromatographic measurements were made using a *Parker* Elmer model F-30 Gas Chromatograph, equip-

ped with a flame ionization detector.

Stainless steel column (2 m. long and 1/8" outer dia.) was packed with the Porcous Polymer, Porapak R, under pressure and vibration. The column was conditioned for 3 hr. at 220° in a flow of nitrogen, which was used as carrier gas.

0.2  $\mu$ l each of reagent grade *n*-pentane, *n*-hexane, *n*-heptane, *n*-octane, *n*-nonane, *n*-decane, *cyclohexane*, benzene, toluene and ethyl benzene were injected through the injector of the gas chromatography by means of 1  $\mu$ l Hamilton syringe at four different temperatures ranging from 160 – 190°. The injector was connected to the inlet end of the column, which was suspended in an oven. The oven temperature was maintained at a selected isothermal value. Vapour sample of *n*-heptane, *n*-octane, *n*-nonane, *n*-decane and toluene were also injected at the same four temperatures as for the liquid samples.

### RESULTS AND DISCUSSION

0.2  $\mu$ l of each of the hydrocarbon samples were injected on Porapak R column. Their retention times  $t_R$  (the time from the sample injection to the peak maximum) were measured at four temperatures ranging from 160 – 190°. The retention volumes ( $V_R$ ) and adjusted retention volumes ( $V'_R$ ) were calculated from the retention time ( $t_R$ ).

From the data obtained,  $\log V'_R$  was plotted against

$1/T$  (reciprocal of absolute temperature) for all samples. The plots are shown in Fig. 1. All plots were linear with correlation coefficients between 0.991 and 0.999. The plots of  $\log V_R$  vs  $1/T$  for the vapour - phase injections of various compounds on Porapak R are shown in Fig. 2. Different injection volumes were used. Liquid =  $0.2 \mu\text{l}$  and vapour  $0.001 \mu\text{l}$ .

There were small changes in retention volume with a change in the sample size of several orders of magnitude. It was noted that the retention times of successive members of a homologous series ( $n$ -pentane to  $n$ -decane) increased exponentially with column temperature, and the general relationship is  $\log V_R = C_{1n} + C_{2n}$  where  $n$  is the number of carbon atoms in each successive member of a homologous series, and  $C_1$  and  $C_2$  are constants. A straight line relation was found between the retention characteristics and the number of carbon atoms in the molecules of  $n$ -hydrocarbons on the surfaces of graphitized carbon black, microporous silica and the porous polymers, and it has assumed that the hydrocarbon chains lie flat on the surface [5].

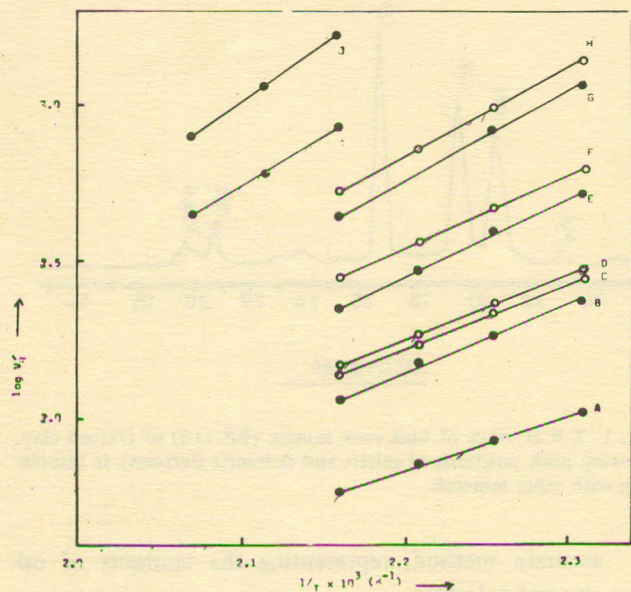


Fig. 1. Plot of  $\log V_R$  versus  $1/T \times 10^3 (\text{K}^{-1})$  for various compounds on Porapak R.

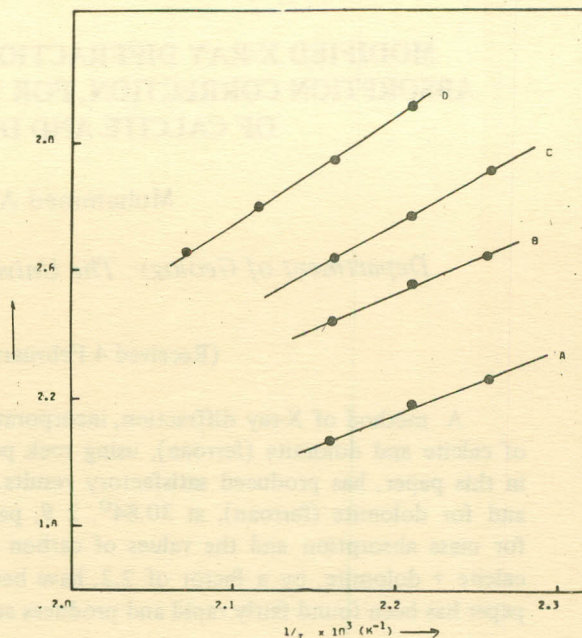


Fig. 2. Plot of  $\log V_R$  vs  $1/T \times 10^3 (\text{K}^{-1})$  for vapour phase injections of various compounds on Porapak R.

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