Available online www.jocpr.com

Journal of Chemical and Pharmaceutical Research, 2015, 7(2): 908-909

Research Article

ISSN : 0975-7384
CODEN(USA) : JCPRC5

Statistical derivation of a new formula of specific refraction for organic compounds

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ABSTRACT

The measurement of refractive index and optical activity of organic liquids is of great importance in chemistry. These measurements provide invaluable information regarding the molecular structure, purity of organic compounds and the composition of binary mixtures. Early year there are so many formulae found out by the various scientists. Amongst Lorenz and Lorentz formula is very familiar for the calculation of specific refraction of the organic compounds. It is worthwhile to suggest one more empirical formula for the calculation of specific refraction of organic compounds. This formula is known as Patel Desai Joshi (PDJ)'s formula.

Keywords: Density, Refractive index, Specific refraction, Patel Desai Joshi (PDJ), Lorenz and Lorentz.

INTRODUCTION

Physical properties of a substance are broadly defined as those which could be studied and measured (if measurable) without causing any chemical change in it. Properties like taste and odors do not lend themselves to any quantitative measurement. Decisions about precise molecular structures of substances cannot be based on them. The physical properties like refractive index[1-9], dipole moment[10-16] and surface tension[17] can be measured quantitatively with sufficient precision to serve on basis of deductive information and it is these and some other similar properties, which have been employed for deciding molecular structures. The measurement of refractive index and optical activity of organic liquids is of great importance in chemistry.

EXPERIMENTAL SECTION

It is seen from all the formulae of calculating specific refraction from refractive index 'n' and density 'd' , it is found that refractive index 'n' is always found in numerator and 'd' in denominator. So, the simplest formula should be very likely to be n/d, but it is not so simple and therefore, some factors must be incorporated in the above simple formula and therefore the general formula should be,

$$R = \frac{n - x}{y} \times \frac{1}{d} \quad (1)$$

To find out the values of specific refraction of organic compounds, CRC handbook[18] is employed. From the calculation of specific refraction "R", refractive index "n", density "d" the mean values are calculated as follows,

R=0.2721208,
n=1.4699,
d=1.0251

Substituting the above values of n and d in equation (1) should be,

$$R = \frac{1.4699 - x}{y} \times \frac{1}{1.0251} \qquad (2)$$

For different values of R different values of x and y were used. Using different values of x and y the values R is obtained which is nearest to 0.2721208.With the above modification it is found to be x=0.91, and y=2.06 by comparing the above with Lorenz and Lorentz it is found that the proposed formula hold good to extend of the 99.97 %.

RESULTS AND DISCUSSION

It is also observed that the suggested formula is in good agreement within the limit of ± 0.0001 to ± 0.0183 a marginal difference with Lorenz and Lorentz formula. So the suggested formula can be written as under,

$$R = \frac{n - 0.91}{2.06} \times \frac{1}{d} \qquad (3)$$

This is known as "PDJ" formula of specific refraction. [19]

PDJ formula of specific refraction is nearly equal to the Lorenz and Lorentz formula to the extent of 99.97% when it is applied to organic liquids.

Acknowledgement
I am thankful to The H. N. S. B. Ltd Science College, Himatnagar for providing the research facilities.

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