ABSTRACT

Szeged index – Applications for drug modeling

By
Prof. Vijay K. Agrawal
QSAR and Computer Chemical Laboratories,
A.P.S. University, Rewa-486 003, India

In 1994 Ivan Gutman wanted to examine a few Wiener number related graph invariants, which could be considered as generalizations of the Wiener number concept. One of them was symbolized as W*. This quantity has numerous properties. First of all, $W^* = W$, if G is a tree. But $W^* = W$ holds also for some cycle-containing graphs e.g. for the complete graphs. During the aforementioned period the problem of W^* of benzenoid chains i.e. non-branched catacondensed benzenoids was investigated. It was conjectured that if G and H are isomeric catacondensed systems, then $W^*(G) \equiv W^*(H)$ (mod **8**) and may be even $W^*(G) \equiv W^*(H)$ (mod **16**). Ultimately in 1995 the above-mentioned congruence relations were solved proving $W^*(C_h) \equiv W^*(C'_h)$. This result can even be extended to branched catacondensed systems. He named this descriptor as Szeged index (Sz).

In 1998, Gutman published a review: The Szeged index –A Success Story. This review leads to a series of studies on Sz index, resulting in more than 40 publications upto1998. Furthermore, this review was mainly concerned with the definition, theory and characterization of *Sz* index along with applications of *Sz* index in developing Quantitative Structure-Property-Activity-Toxicity Relationships (QSPR, QSAR, and QSTR).

In addition to the above, the Indian group under the leadership of Prof. P.V. Khadikar carried out an exhaustive research on the applications of *Sz* index for drug modeling as well as for modeling physicochemical properties and toxicity related to organic compounds acting as drugs. This resulted into as many as 80 additional publications related to QSAR/QSPR/QSTR in that either Sz index was used alone or was used in combination with other molecular descriptors including other topological indices. Thus, to-date the total publications on *Sz* index reached around 130. It is, therefore,

important to summarize and discuss the potential of this index in QSAR/QSPR/QSTR studies.

Many physicochemical properties related to organic compounds acting as drugs were modeled by using Szeged index to develop structure-property-relationships. Important physicochemical properties which were modeled using Szeged index are: molecular weight (MW) , density (d) , boiling point (bp) , vapor pressure (VP) , molar volume (MV), molar refraction (MR), parachor (PR), van der Waals volume (Vw), equalized electronegativity (χ_{eq}), dipole moments (μ), proton-ligand formation constants and polarizability (α). In addition, some spectroscopic parameters, such as infrared (i.r.) group frequency, edge-shift (ΔE) in the extended X-ray absorption fine structure spectroscopy, isomer shift (IS) and quadrupole splitting (QS) in Mössbauer spectroscopy, and chemical shifts (δ) in Nuclear Magnetic Resonance Spectroscopy (NMR Spectroscopy) are also modeled using Szeged index.

In addition to the above, Sz index has also been found useful in modeling various biological activities viz. antihypertensive, antimalarial, antituberculotic, anti HIV, CA inhibitory antagonists, Lipoxygenase inhibitory activity, lipophilicity etc.

In this lecture some very useful models which have been derived for modeling properties and activities of biological systems using this important index (Sz.) will be discussed.