



## Identification of Difficulties and Misconceptions in the Study of Organic Chemistry in High School

A. Naumoska, S. Aleksovska

*Institute of Chemistry, Faculty of Natural Sciences and Mathematics, Ss. Cyril and Methodius University in Skopje, Republic of N. Macedonia*

*[\\*aleksandra.naumoska@pmf.ukim.mk](mailto:aleksandra.naumoska@pmf.ukim.mk)*

In much of educational research, organic chemistry is considered as one of the more difficult areas of chemistry. It is due to the amount of content to be taught, but mostly to its complexity, and consequently to the misconceptions in the basic concepts that might arise. Among the most difficult topics in organic chemistry are those concerning the concepts of stereochemistry, such as isomerism, and the concept of aromaticity of organic molecules. Stereochemistry is considered a difficult topic to study because it requires students to have the ability to mentally visualize the three-dimensional structures of organic molecules and accurately represent them with formulas.

In order to determine the specific difficulties that students face in understanding the spatial arrangement of atoms and the stereochemistry of organic molecules, research was conducted using an anonymous test as a quantitative research method. The test was distributed to 194 students from three secondary schools in the Republic of Macedonia, where classes were conducted in different languages of instruction, namely Macedonian and Albanian.

The students' answers on the test were analyzed, and the results obtained revealed several difficulties and misconceptions in understanding stereochemistry concepts. It was found that most of the students cannot determine whether a cyclic molecule is planar or three-dimensional, based on a written structural formula, and consequently to determine its aromaticity according to Huckel's rule. The students do not identify the existence of isomerism when four different groups are connected to two double-bonded carbon atoms. Therefore, it can be concluded that they do not clearly understand the restricted rotation around double bond, and the geometric isomerism, in general. In addition, some of the students think that only one type of isomerism can be present in a molecule. Most of the students are able to identify the most stable conformation based on Newman's formulas.

All these results point out that new methods of teaching stereochemistry must be introduced in the secondary school education, such as three-dimensional physical models, IT technology etc.

**Keywords:** education, organic chemistry, stereochemistry, isomerism, misconceptions