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Introduction. The aim and scope of the studies

X-ray diffraction is a very efficient method of studying the structure of matter in both solid and liquid phase [1]. WAXS research, apart from spectroscopic methods, is one of the most important ways to learn about the mutual arrangement of molecules in the liquid phase. Recently [2–4] it has been shown that the X-ray diffraction method on liquid media allows not only determination of interatomic distances in a molecule but also brings information on the kind of interaction among the molecules and degree of their ordering.

This work has been stimulated by reports on specific physical properties of solutions [5, 6].

The aim of the study was to obtain information about the structure and intermolecular interactions of selected binary solutions by X-ray diffraction. X-ray investigations concerned solutions of certain dipolar liquids with non-dipolar solvent. The results of the X-ray structural analysis of the solutions studied were used to explain how the solvent molecules are arranged relative to the dissolved substance. The purpose of X-ray structural studies was to determine the effect of the position isomerism of the chlorine atom in chloroanisole on the methods of spatial distribution of molecules in the studied solutions.

In this work the new method of the liquid solutions structure analysis was formulated. The method was tested on different kind of materials: 10% the binary solutions of *o*-Chloroanisole (*o*-ClA) in *p*-Xylene (*p*-X), *m*-Chloroanisole (*m*-ClA) in *p*-X and *p*-Chloroanisole (*p*-ClA) in *p*-X. The X-ray diffraction patterns were measured using the Bragg-Brentano technique.

Quantitative structural analyses of liquid solutions were performed using a new method in which some modifications have been introduced to previously developed methods such as those introduced by: Mozzi et Warren [7] and Blum

et Narten [8]. For the first time the method of reduction proposed by Mozzi-Warren with modifications introduced by the author [9] has been applied to verify the assumed models of the molecules studied and to separate the intra- from intermolecular interactions.

In the X-ray diffraction method the values of radii and number of coordination spheres were compared to the theoretical values calculated for typical crystalline structures. Then, the hypothetical "unit cell" of the analysed material might be chosen for the determination the packing coefficient. A values of the packing coefficients of molecules was proposed to be a criterion of correctness of the liquid structure models determined. The approach proposed in this work gives a good description of intermolecular interactions in liquid binary solutions and is a useful X-ray method for their analysis.

The knowledge of atomic and molecular structure of liquids and binary solutions and the mechanism of the structural processes taking place in them is of fundamental importance in comprehensive explanation of their physical and chemical properties. The X-ray structural analysis of selected dipolar liquids has explained the phenomenon of association of molecules.

This monograph is a generalization and systematic approach to the author's results from the years 2004–2019 in the field of X-ray short-range ordering in molecular liquids and binary liquid solutions. The main results of the work were also presented at international scientific conferences in Cracow (2004) [10], Granada (2010) [11], Warsaw (2011) [12], Cracow-Tyniec (2012) [13], Vilnius (2013) [14], London (2014) [15], Ustroń-Jaszowiec (2016) [16] and Poznan (2019) [17].