MODERN INTEGRATION INTO THE WORLDWIDE EDUCATION PROCESS ON THE EXAMPLE OF THE TOXICOLOGICAL CHEMISTRY DISCIPLINE UNDER THE INFLUENCE OF THE BOLOGNA SYSTEM IN UKRAINE

Iryna Nizhenkovskaya, Elena Welchinskaya, Bogomolets National Medical University in Kiev,
elena_wwu@ukr.net

On the current moment of time one of most important strategic tasks of modernization of the system of higher education in Ukraine is the education of high quality provided to the pharmacists in order to satisfy the worldwide needs. Therefore, the improvement of higher education system and formatting of new conceptual directions of its development on the basis of analytical marking and strategic approaches are very important for studying of pharmaceutical courses, namely Toxicological chemistry. Nowadays people live in the conditions of toxicological strain; therefore, we have an important task to give the complete, systematic and accessible knowledge of Toxicological chemistry to the future pharmacists. The purpose of this work is the implementation of new pedagogical, psychological, statistical, chemical, analytical and biochemical methods into the studying of Toxicological chemistry in the conditions of Bologna System in Ukraine. Testing control is the first most important modern diagnostic and control instrument used for the evaluation of students' activities in the conditions of credit-modular system. The second most important instrument is a complex of principles used during the studying of this course such as "general-to-specific and specific-to-general" and "from simple to complex, from complex to simple", "synthesis and analysis of information", "visualization of toxicological processes on the new schemes", work "on-line". The third important instrument is the connection with modern sciences. All these instruments are provided by credit-modular educational system.

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Introduction

One of modern diagnostic and controlling tool for the assessment of students' activities in the conditions of credit-modular system is knowledge assessment via a testing control. During the studying of Toxicological chemistry the testing control mostly used knowledge assessment tool at the Pharmaceutical Faculty of National Medical University of A. A. Bogomolets.

There are basic testing ("Step II") and the testing developed by the professors of this discipline. Toxicological chemistry is the discipline among other pharmaceutical disciplines that investigates the characteristics of toxic and strong substances, their actions in a human body and in the cadaveric material, the ways of segregation, the methods of qualitative detection and quantitative definition of

the poisons and their metabolites. During the studying of this course the testing control is based on basic and specific topics according to the principle “general-to-specific and specific-to-general”. And the summary testing by the discipline of Toxicological chemistry helps to get the generalization of knowledge.

Methods

The main methods used during the discipline studying are pedagogical, psychological, statistical, chemical, analytical and biochemical. The testing control by basic topics contains the questions related to general characteristics of poisons: objects of study, the methods of isolation of substances, general regularities of toxic dynamics and toxic kinetics, general methods of qualitative detection and quantitative definition and the scheme of metabolism on the phase's I and II. The testing control by specific topics contains the questions related to each representative of the class. These are specific and additional objects of study, the ways of isolation, toxic dynamics and toxic kinetics, the methods of qualitative detection and quantitative definition, the scheme of metabolism on the phases I and II. Herewith the special attention is paid to the complex approach to the studying of biotransformation of toxic substances in the aspects of biochemistry as well as of toxicology. The students have the opportunity to work independently with the base of the testing control questions in the Internet, to get the tasks from the professor and prepare them on-line.

Results and discussion

One of the most important classes of toxic substances being studied at the course is the class of "volatile" poisons. This class of poisons includes aliphatic alcohols, aldehydes and ketones, hydrocyanic acid, phenols, carboxylic acids, etc. The definite representatives of this class of "volatile" poisons are methyl and ethyl alcohols. Methyl alcohol by its smell and taste, is almost indistinguishable from ethanol that is why there are many cases of methanol poisoning, which was accidentally consumed instead of ethanol. It is widely used in the industries and chemical laboratories as a solvent for paints, inks, for denaturation of ethanol; it is also a consistent element of anti-freezes. Ethyl alcohol is delivered by the fermentation of starch products (corn, potatoes), fruits and sugar (Alexandrov & Emelianov, 1990; Knunyants, 1992; Ling et al., 2006; Strube, 1984). Ethanol is widely used in industries and chemical laboratories as a solvent and for the synthesis of new organic compounds in the medicine. Methyl and ethyl alcohols can enter the human body by inhalation and through the digestive canal and skin. Under the influence of methyl alcohol the damage of the retina and optic nerves is possible. Methyl alcohol disturbs oxidative processes and acid-base balance in cells and tissues. The death occurs as the result of respiratory arrest, cerebrum and lungs edemas, collapse, and uremia. Several authors explained the loss of sight not due to the influence of methyl alcohol, but due to its metabolites such as formaldehyde and formic acid. The lethal dose of methyl alcohol (including individual sensitivity of the organism) comprises 30-100 ml (Bayerman, 1987; Ellenhorn, 2003; Luznikov, 1994; Trachtenberg, 2008; Stepanov, 1951). The strong dosage of ethyl causes the oppressions of the functions of spinal cord and medulla, as well as long-lasting deep anaesthetic state with the deprivation of reflects and the oppressions of vital centres. Ellenhorn (2003) reported that “in result of long-lasting consumption of ethyl alcohol a number of disturbances appear such as cirrhosis, degeneration of the heart muscle and kidneys, sustained vasodilatation of face ("red nose"), trembling muscles, hallucinations, exuberant ravings ("clanks"), degeneration of the male and female gonads and in result alcoholics give birth to babies with mental and physical impairments”.

These alcohols are isolated from biological material by the method of steam distillation, as they are collected in a cooled receiver. The qualitative detection of methyl and ethyl alcohols is performed in the following order: preliminary test to methyl and ethyl alcohols in blood and urine; preliminary reactions to methyl and ethyl alcohols (additional): the reaction of ester delivery is non-specific, sensitive, confirming; the reaction of iodoform delivery is non-specific, sensitive, confirming; the reaction of methanol oxidation to formaldehyde (with potassium permanganate in sulfuric acid and acid chromotropic acid) is non-specific, sensitive, confirming.

The most specific reactions to methanol are the reaction of delivered formaldehyde with the solution of codeine (morphine) in sulfuric acid environment and the reaction of delivered formaldehyde with fuksinsulfide acid.

The most specific reactions to ethanol are the specific reaction of acetic ether (ethyl acetate), the specific reaction of acetaldehyde delivery and the specific reaction of ethyl benzoate delivery (Belova, 1976; Kramarenko, 1995; Nizhenkovska, Welchinska, & Kucher, 2012).

The general chemical procedures used can be seen on Schemes I-III.

Scheme I: Preliminary reaction on methanol and ethanol alcohols at the blood and urine

Source: Authors, Kramarenko V.P. (1995)

Scheme II: Preliminary reaction on methanol and ethanol alcohols (additional)

Source: Authors, Kramarenko V.P. (1995)

Scheme III: More specific reactions on ethyl alcohol

Results and Discussions

Lethal dose of methanol (with taking into account individual susceptibility of the organism) is 30-100 ml. Methyl alcohol in small amounts allocated without metabolism from the air is exhaled. The reaction is catalyzed by the enzyme glucuronyl-transferase.

Lethal dose of pure ethanol (taking into account individual susceptibility of the organism) is 6-8 ml per 1 kg of body weight or 200-300 ml. While methyl and ethyl alcohols have very similar boiling points it is quite difficult to separate them from each other, their quantitative determination is performed by one basic method – Gas-liquid Chromatography.

During the studying of biotransformation of methyl and ethyl alcohols in the human body, it is important to pay attention to the fact that their metabolic conversions are performed not only according to the defined scheme, but in the complex with organism's substances as well (Lakin & Krilov, 1981; Park, 1973; Nizhenkovska, Welchinska, & Kucher, 2012).

Welchinska (2013) noted that the main metabolite of methanol is the product of its oxidation by the enzyme alcohol dehydrogenases (ADH) formaldehyde, which is oxidized to formic acid under the influence of the enzyme oxidase, part of which is under the influence of decarboxylase enzyme breaks down into carbon monoxide (IV) and water. 90% of ethyl alcohol is oxidized by the enzyme alcohol dehydrogenase (ADH) to acetic aldehyde, and then by the enzyme of oxidase is oxidized to acetic acid or to carbon monoxide (IV) and water (Welchinska, 2013)). The general biotransformation procedures of alcohols can be seen on schemes IV, V.

Scheme IV: Biotransformation of methanol

Source: Authors

Scheme V: Biotransformation of ethanol

Source: Authors

Conclusion

Thus, it is shown on the example of studying of the class representatives of "volatile" poisons - methyl and ethyl alcohols in the course of Toxicological chemistry, how the comprehensive and specific materials are studied. The testing control of knowledge helps students to realize comprehensive and modern approach to the study of general theoretical and specific topics of the course of Toxicological chemistry that is the mainstay of the provision of high quality preparation of the future pharmacists according to the level of international requirements.

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