AMERICAN Journal of Language, Literacy and Learning in STEM Education
Volume 3, Issue 11, 2025 ISSN (E): 2993-2769

Scientific Methodical Bases of Integrative Improvement in the Teaching of the "General Chemistry" Course in Technical Higher Education Institutions. (In the Case of Food Technology)

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Abstract. *In this article, integrative methods of teaching "General Chemistry" of Food Technology students are given, and the process of integrating food chemistry, biochemistry and physical chemistry into chemistry is carried out. Also, the integration of dark sciences was studied as a research for three years.*

The results of the tests were conducted mainly in the form of test control of students. The results showed that the indicator in the experimental groups was higher than in the control groups, it was determined by mathematical and statistical calculations. It was recommended that the integration of experts in this field in the process of training will be of great importance in the professional activities of future engineers-technologists.

Key words: *Integrative, integration, food chemistry, biochemistry, physical chemistry, carbon, silicon, nitrogen, phosphorus, calcium, magnesium, zinc.*

In the educational experience of developed countries, attention is paid to improving the teaching of chemistry on an integrative basis. This is of great importance in teaching students an integrative approach to the teaching of chemistry (Integrative - acting together), mastering educational materials based on the principles of interdisciplinarity, gaining professional competence, and directing them to independent research activities.

In the world, an integrative approach to the teaching of chemistry and its purposeful implementation, development of modern trends, practical competences of students based on an integrative approach, creation of educational motivation, orientation to independent scientific and research activities, and training of mature specialists are priorities.

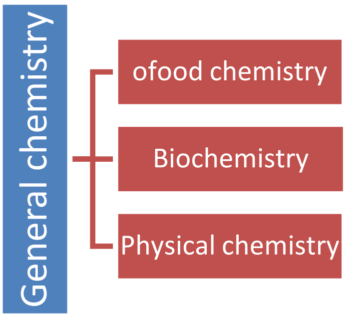
The implementation of such important tasks is the improvement of educational activities using innovative technologies, the development of professional competence of students, the provision of interdisciplinarity within the framework of chemistry, the creation of integration between science and education production, integrative information It is significant because it is aimed at the solution of issues of formation of scientific thinking based on it[1].

The issue of high-quality teaching of the "Chemistry" course in the training of future engineers-technologists is considered an urgent pedagogical and psychological problem. Conducted by M. Jumanov, O.O. Orinova, A. Abdusamatov, R. Ziyaev, B. Akbarov, M. Ajieva, B. Akhmedov, H. M. Rajabov.

Taking into account the great importance of "Chemistry of Elements" in improving the quality of training of future engineers-technologists in the education of students of the "Food Technology" direction, the integrative improvement of the content of this department is shown to be one of the urgent tasks of the day.

In order to raise the level of professional training of future engineers-technologists, the main attention should be paid to the above issues when teaching the "General Chemistry" course [2].

Methodological part. In teaching the "General Chemistry" course - food technology students, the integration of food chemistry, biochemistry and physical chemistry in the organization of lessons in an integrative way will increase the students' scientific outlookin the lessons



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In our article, we recommend our three-year scientific research as well as recommending it to all chemistry teachers.

In the process of learning the chemical properties of inorganic and organic substances, the students are given lessons based on the science of food chemistry and biochemistry, that is, based on integration.

In inorganic chemistry lessons, more attention is paid to the study of the meeting and obtaining of group elements in nature, physical and chemical properties, food chemistry, biochemistry and physicochemical properties and importance of these elements. The course of inorganic chemistry has been mastered by students at the stages of secondary education and professional education. The main part of obscure topics is given as independent education for students, and it is connected to more integrated subjects, while the lesson is more interesting and effective, and it is of great importance in the development of students' professional activities.

For example: on the subject of group II metals.

1. General description of group II elements.

2. The occurrence of Group II metals in nature.

3. Extraction of group II metals.

4. Physical and chemical properties of group II metals.

5. Importance of group II metals.

At all levels of education, group II metals and other group elements are taught in traditional or non-traditional form based on the above plan. Work programs of the technical higher education institution are created in this way. In order to prevent repetition of the masking process for students, as an addition to the above plan, the importance of "group II metals in the food industry and the human body", lecture, practical training, laboratory and seminar will be included in the training plan[3]

Conducting education using modern interactive methods depends on the professional activity or skill of the teacher. We used modern interactive methods and traditional methods to organize education in lectures, practical training, laboratory and seminar classes.

In the course of the lesson, the students will use the "Ven Diagram" to obtain alkaline earth metals and their properties based on the above plan. Using the same method II the properties of the metals in the group are also compared.

In the process of integration, the importance of carbon, silicon, nitrogen and phosphorus elements from the group of elements in the food industry and food in the body is given as information in the main part of the lesson [4].

Knowledge and skills are created in lectures, practical training, laboratory and seminar classes.

This knowledge, skills and abilities are determined by special pedagogical methods, using comparative study of scientific and scientific-methodical literature, observation, interview, questionnaire survey, test, pedagogical experiment-test, mathematical-statistical methods.

Carbon is the basis of all organic compounds in the body. It enters the body through food products, as well as with drinking water in the form of carbonates and bicarbonates. 90% of it leaves the body through exhalation. It is one of the main macrobiogenic elements. Its amount in the body is 20.2%. 52% of it is in proteins, 37% is in DNA and RNA, enzymes, hormones, vitamins [5].

Silicon microelement participates in the formation and regeneration of bones, bone tissue and tooth enamel. The physiological function of silicon is related to the synthesis of glycosaminoglycans and collagen. Silicon plays an important role in a number of other metabolic processes. For example, silicon concentration in human aorta decreases not only with age, but also during the development of atherosclerosis. The body's daily need for silicon, as well as the permissible level of its elemental decrease, have not been determined. In developed countries, as a rule, 20-50 mg of silicon falls through food and water, and 15 mg through air. Excessive exposure of silicon through the air (in the form of an aerosol) (in industrial conditions) leads to the development of occupational silicosis. The main sources of silicon are legumes, cereals, legumes, pasta, and when their amount is low, beer can be in the diet. Although bananas are among the products containing a lot of silicon (5.4 mg per 100 g), micronutrients are poorly absorbed from them. 1/3 of silicon enters the body with water. The amount of absorption of silicon in the intestine is 40-85%, in which a strange rule for microelements is noted: the absorption of silicon from solid food rich in indigestible components does not differ from its absorption from mineral waters. When absorbed, silicon enters into an antagonistic relationship with molybdenum and manganese [6]

Nitrogen - nucleic acids, proteins, vitamins, enzymes, phospholipids and nitrogenous organic compounds in the human body are found in amino acids. Man absorbs nitrogen through plants and spends it in energetic processes. The energetic properties of proteins are determined by nitrogen content. It generates energy in the amount of 4.1 kj/m from the oxidation of proteins. There are many food products in food technology from organic nitrogen-containing compounds; used in the production of sausages, pasta, meat products, various drinks, dry food products and additional feed. [7]

As food products are obtained from natural plants, students should also study the processes of formation of plant nutrients.

Under natural conditions, plants absorb nitrogen in the form of NO3- (nitrate) NH4+ (ammonium) with the help of soil colloidal particles and turn it into amino acids, amides and proteins through complex changes. The plant does not synthesize nitrogen from nitrate ion for amino acid. It turns into ammonia by enzymatic means. We must remember that nitrates are a harmless substance for plants. But some nutrients can slow down the germination of plants when carbohydrates are not enough. Due to this, the amount of ammonia in the soil increases and ammonia poisoning occurs. Conversion of nitrate to ammonia through various stages:

$HNO_3 \rightarrow HNO_2 \rightarrow 2HNO_2 \rightarrow NH_4OH \rightarrow NH_3$

The use of ammonia and nitrate nitrogen by plants depends on internal and external factors, on the biological characteristics of the crop, on the supply of carbohydrates, on the absence of Ca^{2+}, Mg^{2+}, K^{+} and macroelements. Plant nitrogen absorption depends on the environment and the amount of Ca, Mg, K ions, for example, ammonia nitrogen is better absorbed than nitrate in a neutral environment. If there is a lot of phosphorus in the soil, the plant absorbs nitrate well [8].

Deficiency of element Mo in plants reduces the reduction of nitrogen in nitrates.

When there is a lack of nitrogen, the growth of plants slows down sharply, the leaves are small and light green in color, turn yellow quickly, the branches become thinner and do not branch well, the formation of seeds deteriorates, the yield and the amount of protein in it decrease sharply.

The main amount of nitrogen in seeds (90% of the total amount) is included in protein. Plant proteins contain an average of 16% nitrogen.

Leguminous and oilseeds have the highest amount of protein and, consequently, nitrogen, while the grain of legumes has the lowest amount.

In order to get a good harvest, the plant absorbs a large amount of nitrogen from the soil: cereal crops 100 kg from the soil on 1 ha; corn, potatoes, sweet potatoes absorb 150-200 kg of nitrogen.

On average, 40% of nitrogen is absorbed from the fertilizer applied to the plant. The amount of nitrogen in the soil depends on the amount of humus in it. The total amount of nitrogen in black soils reaches 0.4-0.5% (12-15 t/ha N) and in gray soils 0.05-0.15% (3-6 t/ha N).

Phosphorus is absorbed into the human body from plants and performs various functions in the body. In the process of teaching phosphorus and its compounds, we pay attention to the stages of absorption by the plant from the soil and its transfer from the plant as nutrients.

Phosphorus is involved in metabolism, cell division, reproduction, transmission of genetic characteristics and other complex processes in the body.

It is a part of complex proteins (nucleoproteins), nucleic acids, phosphatides, enzymes, vitamins, phytin and other biologically active substances. A large amount of phosphorus is present in plants in mineral and organic forms. Phosphorus mineral compounds are in the form of phosphoric acid and are primarily used by plants in carbohydrate metabolism. These processes contribute to the accumulation of sugar in sugar beets, starch in potato tubers, and in legumes [9].

The role of phosphorus, which is part of organic compounds, is especially large. A significant part of it is presented in the form of phytin - the usual reserve form of organic phosphorus. Most of this element is located in reproductive organs and young tissues of plants, where intensive synthesis processes take place. Experiments with labeled (radioactive) phosphorus showed that it is several times more abundant in the growth points of the plant than in the leaves. [9].

Phosphorus can move from old plant organs to young organs. Phosphorus is especially necessary for young plants, because it helps the development of the root system, increases the intensity of processing grain crops. Phosphorus has been found to increase the winter hardiness of autumn crops by increasing the amount of soluble carbohydrates in the cell sap.

Like nitrogen, phosphorus is one of the important plant nutrients. At the beginning of growth, the plant increases the need for phosphorus, which is covered by the reserves of this element in the seeds. In soils of low fertility, young plants show signs of phosphorus deficiency after phosphorus consumption from seeds. Therefore, it is recommended to apply granulated superphosphate in rows at the same time as planting in soils with a small amount of mobile phosphorus.Fosfor, azotdan farqli o‘laroq, ekinlarning rivojlanishini tezlashtiradi, urug‘lantirish, mevalarning shakllanishi va pishishini rag‘batlantiradi[11].

The main source of phosphorus for plants is the salts of orthophosphoric acid, usually called phosphoric. Plant roots absorb phosphorus in the form of anions of this acid. The most favorable for plants are water-soluble monosubstituted salts of orthophosphoric acid:

$Ca(H_2PO_4)_2 \cdot H_2O$, KH_2PO_4, $NH_4H_2PO_4$, NaH2PO4, $Mg(H_2PO_4)_2$.

Phosphorus and its compounds are widely used in the production technology of various nutrients in the food industry; widely used in the production of meat, milk and flour products, additional food products, beverages and dry feed products [12].

Conclusions

In the process of integration, knowledge and skills were formed on the example of all group elements of inorganic chemistry. Students' knowledge and skills were assessed based on the test. Test questions are based on general chemistry and integrated sciences. It was found that the mastery levels in the experimental groups were higher than the mastery indicators of the control groups.

Pedagogical experimental work was carried out for three years. Pedagogical experimental work was conducted on the example of students of "Food technology" courses[13].

1. Indicators in control groups.

Average mastery rate:

$X=\frac{1}{n}\sum x_i n_i \frac{1}{67}(2\cdot18+3\cdot26+4\cdot19+5\cdot4)=\frac{1}{67}(36+78+76+20)=\frac{1}{67}\cdot200=3{,}13$

So X=3,13 in percent $X\% = \frac{3{,}13}{5}\cdot 100\ \% = 62{,}6\ \%$

2. Indicators in the control group.

Average mastery rate:

$Z=\frac{1}{n}\sum x_i n_i \frac{1}{67}(2\cdot19+3\cdot25+4\cdot20+5\cdot3)=\frac{1}{67}(38+75+80+15)=\frac{1}{67}\cdot208=3{,}1$

So Y= 3,1 $Z\% = \frac{3{,}1}{5}\cdot100\% = 62\%$

3. Indicators in the experimental group.

Average mastery rate:

$Y=\frac{1}{n}\sum x_i n_i \frac{1}{65}(2\cdot4+3\cdot20+4\cdot31+5\cdot10)=\frac{1}{65}(8+60+124+50)=\frac{1}{65}\cdot242=3.72$

So Y= 3,72 $Y\% = \frac{3.72}{5}\cdot100\% = 74{,}4\%$

Improving the teaching of "general chemistry" using innovative technologies, developing professional competence in students, ensuring interdisciplinarity within chemistry, creating integration between science and education, forming scientific thinking based on integrative information It is important because it is aimed at solving problems[14].

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