



EDUCATIONAL SOFT FOR CHEMISTRY

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ABSTRACT

This educational soft is intended for students who have in their curricula qualitative analytical chemistry laboratory. Initially, the issue of identifying cations is approached, taking into consideration possible interferences, then separation of cations within the group occurs. A process of identifying and separating cations within a complex sample is simulated in order to consolidate the knowledge.

KEYWORDS

educational soft, analytical chemistry laboratory, students, chemical stability, homogeneous and heterogeneous systems, application, experimental methods

1. INTRODUCTION

In order to accomplish a correct qualitative analysis, there are different stages you need to undergo, every stage corresponding to a method. These methods are: take the sample for analysis, dissolve the sample, precipitate the compound elements to separate them, filter and wash the precipitants, evaporate solutions and calcine the residues, avoid losses, accomplish recognition reactions, solve reaction interferences, etc. Each one of these stages and methods must be undertaken very carefully since the accuracy of the information and thus the analytical results depend on these, eventually.

The educational soft of cations identification is intended for students who have in their curricula qualitative analytical chemistry laboratory, and it is a modern method to teach theoretical and practical notions about chemical stability within homogeneous and heterogeneous systems.

Identification of inorganic substances is accomplished with the help of specific reactions of cations and anions, only after these have been previously classified into analytical groups.

The paper is structured as it follows:

- description of analytical groups from I to V;
- final evaluation – cations separation and identification within a compound;

The application is intended as a method complementary to teaching and to other experimental methods, and its purpose is to increase the students' interest in applied research and to offer a different perspective on using informatics for academic education.

2. OBJECTIVES

From a psycho-pedagogic point of view, the aims of this educational soft are:

- to initiate a modern way to teach and learn the theoretical notions about chemical stability within homogeneous and heterogeneous systems;
- to facilitate acquisition and assimilation of knowledge on cations behavior toward specific inorganic and organic reactives;
- skills formation to manipulate the laboratory utensils;
- to evaluate specific knowledge after using the program.

3. GENERAL STRUCTURE OF APPLICATION - DESIGN AND NAVIGATION ELEMENTS

To make the program easy, we use a simple interface (Fig. 1). This contains the theoretical elements as well (Fig. 2);

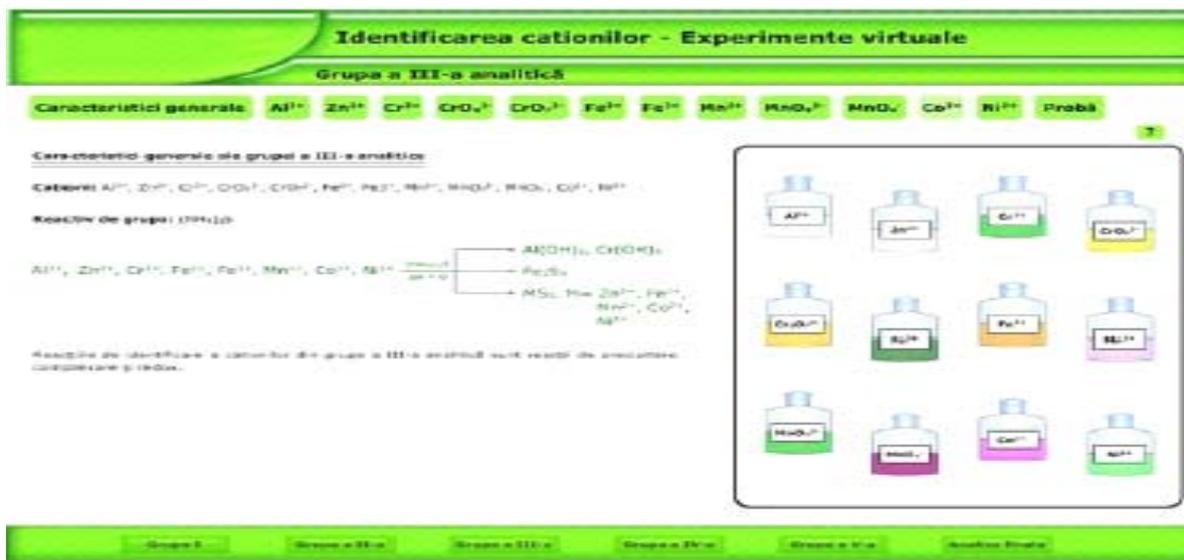
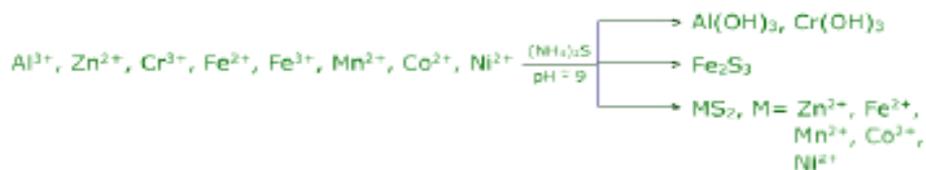


Fig. 1. Interface application

Caracteristici generale ale grupei a III-a analitice

Cationi: Al^{3+} , Zn^{2+} , Cr^{3+} , CrO_4^{2-} , CrO_7^{2-} , Fe^{2+} , Fe^{3+} , Mn^{2+} , MnO_4^{2-} , MnO_4^- , Co^{2+} , Ni^{2+}

Reactiv de grupa: $(NH_4)_2S$



Reacțiile de identificare a cationilor din grupa a III-a analitică sunt reacții de precipitare, complexare și redox.

Fig. 2. The theoretical aspects presentation

4. CONTENT PRESENTATION

4.1. Analytical groups

Each presentation of an analytical group includes:

- general characteristics;
- identification of each cation considering possible interferences;
- separation of cations within a random sample from a predefined series.

General characteristics of cations within a group include: the list of cations separated and identified within the analytical chemistry laboratory, group reactant,

general equation of reaction with group reactant and work conditions, reactions that involve certain cations (complexation, precipitation, redox,), and the ions solutions colour.

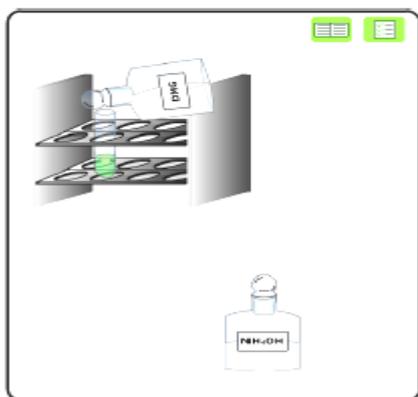


Fig. 3. Virtual experiment – identification Ni^{2+}

The identification of each cation is interactive. The user views a short theoretical presentation on identification reactions and he can switch between **reaction animation** and **virtual experiment** (Fig. 3).

For these experiments the user has at his disposal all the substances and utensils he needs for laboratory work. To move objects, “drag&drop” commands are being used. The work mode and the objectives of the experiment are to be found in cascade windows, active when the corresponding buttons are pressed.

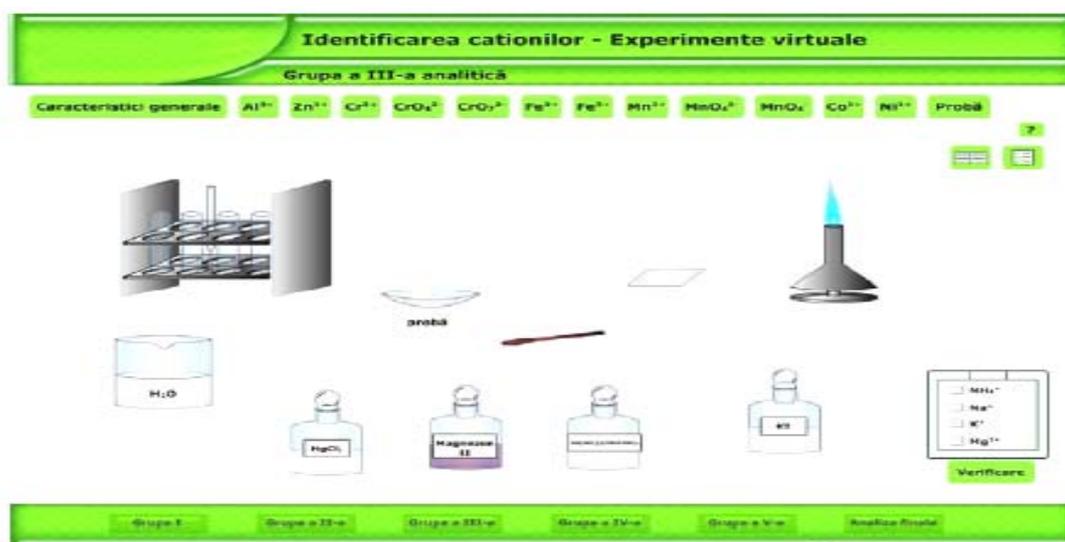


Fig. 4. The virtual experiment – The identified of cations



Fig. 5. The evaluation and the user's answers

The function of virtual experiments is to accustom the user with theoretical notions and laboratory utensils usage by offering a realistic approach and consequently the user attains certain skills and abilities. At the end of each chapter a virtual experiment (Fig. 4) is assigned for the user to evaluate specific knowledge acquired. The user must identify the cations in a given sample within the experiment. The sample composition is randomly selected from a predefined set.

At the end of the experiment the user must choose from a list the identified cations. By pressing the “Check” button, the user's answers are assessed and marked properly (Fig.5).

4.2. Final evaluation –cations separation and identification within a compound

Final evaluation consists of a virtual experiment and the user must identify cations in a given sample. The sample composition may be randomly selected from a predefined set or may be found in a “.txt”file created by the teacher.

To create a “.txt”file, the sample generator is used (Fig. 6). The needed cations are selected from the list, then click on “generate sample” button to write the sample composition in the “.txt” file. Variables within the file are automatically loaded in final evaluation section.

Selectați cationii doriți și apăsați butonul "Generează proba".

Grupa I	Grupa a II-a	Grupa a III-a	Grupa a IV-a	Grupa a V-a
<input type="checkbox"/> NH ₄ ⁺	<input type="checkbox"/> Ba ²⁺	<input type="checkbox"/> Co ²⁺	<input type="checkbox"/> Hg ²⁺	<input type="checkbox"/> Ag ⁺
<input type="checkbox"/> Na ⁺	<input type="checkbox"/> Ca ²⁺	<input type="checkbox"/> Ni ²⁺	<input type="checkbox"/> Bi ³⁺	<input type="checkbox"/> Hg ₂ ²⁺
<input type="checkbox"/> K ⁺	<input type="checkbox"/> Sr ²⁺	<input type="checkbox"/> Fe ²⁺	<input type="checkbox"/> Cu ²⁺	<input type="checkbox"/> Pb ²⁺
<input type="checkbox"/> Mg ²⁺		<input type="checkbox"/> Fe ³⁺	<input type="checkbox"/> Cd ²⁺	
		<input type="checkbox"/> Mn ²⁺	<input type="checkbox"/> As ³⁺	
		<input type="checkbox"/> Zn ²⁺	<input type="checkbox"/> As ⁵⁺	
		<input type="checkbox"/> Al ³⁺	<input type="checkbox"/> Sn ²⁺	
		<input type="checkbox"/> Cr ³⁺	<input type="checkbox"/> Sn ⁴⁺	

Generează proba

Fig. 6. The sample generator

5. CONCLUSIONS

The application is created with Macromedia Flash. To run the application the following programs are needed:

- Macromedia Flash Player
- Internet Explorer

As for hardware support, the application can run on a PC with 32MB of SDRAM, 200MHz processor, 2MB of video memory. However, to ensure a better graphic resolution, 32 MB of video memory is needed.

Students specific acquisitions at the end of these laboratories are:

- cations classification in analytical groups;
- group reactants;
- work conditions for reactions with group reactant;
- reactions specific to each analytical group (complexation, precipitation, redox);
- cations separation into analytical groups;
- cations separation within analytical groups;
- interferences elimination if identified;
- selective reactions for each cation;
- cations separation and identification within a complex sample.

BIBLIOGRAPHY

- [1.] C. Liteanu, E. Hopârtean, Quantity analytic chemistry Volumetria, EDP., Buc., 1972
- [2.] Al. Duca, Al. Nacu, Cl.Calu, Chemistry analytic and analysis instrumentală, vol.I, IPI 1980.
- [3.] S.Jitian, S. Șerban, Technologies by analysis to the material, ED. Mirton, Timișoara, 2003
- [4.] *** - User Manual for Macromedia Flash 4.0
- [5.] Sabin Buraga - Proiectarea siturilor Web