



ASPECTS OF THE ENVIRONMENT POLLUTION WITH INORGANIC SUBSTANCES

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Abstract:

The purpose of this paper is to correlate aspects of chemical pollution of the air, water and soil with inorganic substances with ecological education to increase awareness regarding environmental issues among young people, entrepreneurs and others.

In the paper will be presented examples for all type of pollution mentioned. We will have in view some of the laboratory experiments provided in curriculum for high schools and universities.

In laboratory are uses, for experiments, substances that can pollute the environment. To protect it we must work at mini-scale, recycle residues and transform products in non-toxic forms. Much more, we have the possibility to simulate dangerous experiments using computer software.

Today, the society through social ideal commands an educational ideal, a type of personality with all these components of education: intellectual, moral, juridical, esthetical, physical, sanitary, and ecological.

Ecological education is the first step in the chain process of transmitting scientific and technological knowledge to all.

Keywords:

*Chemical pollution, ecological education,
laboratory experiments, de-pollution, simulation.*

INTRODUCTION

We consider pollution to be a process consisting of a bad modification of the environment due, in principal, to human activities from a super industrialized society.

In this respect, environmental pollution can be classified using the following criteria:

- according to the origin of the factors, into:
 - natural pollution resulting from volcanoes, hurricanes, earth quakes, sand storms;
 - artificial pollution resulting from human activities: industry, agriculture, households;

- according to the type of the pollutants, into:
 - physical pollution: heavy sounds, radiations;
 - chemical pollution: combustion products (CO, CO₂, NO_x), sulphur compounds, nitrates, phosphates, heavy metals, etc.;
 - biological pollution: pathogenic microorganisms, death organic materials.
- according to the polluted medium, into:
 - air pollution resulting from gases, powders from factories, vehicles, stinks from farms;
 - soil pollution resulting from non-ecological tourism, waste grounds, car cemeteries, foams, insecticides;
 - water pollution resulting from oil, foams, discharges of industrial residues (tin, salts, etc.) [2].

Pollution with nitrogen oxides is correlated with reduction of stratospheric ozone, a problem which what we confront these days [4].

In this paper we gave our attention to chemical inorganic pollutants as following:

- gaseous pollutants: oxides (SO₂, NO₂, CO), compounds of hydrogen with non-metals (NH₃, H₂S, HCl, HF)
- solid pollutants: heavy metals, soluble salts (Table 1), [6,7].

Table 1 Inorganic pollutants

Pollutant	Sources of origin	Directly Polluted medium	Biological actions
SO ₂	Volcanoes, industry, transports	air	Expectoration, spasms, respiratory difficulties, bronchitis
NO ₂	Volcanoes, industry, transports	air	Metha-hemoglobin that restrains the transport of oxygen to the tissues,
CO	Transports,	air	Carboxyhemoglobin that generates dizziness, asphyxia due to oxygen deficiency
NH ₃	Industry, agriculture	air, soil	Irritations of the nasal mucous
H ₂ S	Industry, anaerobic fermentations with sulpho-bacteria	soil, water	Troubles of the nervous system functions and of the sanguine circulation
HCl	Industry, transports	air	Respiratory diseases, cancerous effects
HF	Industry	air	Bleedings, loss of the visual acuity, vomit, cerebral diseases.
NH ₄ ⁺ , NO ₃ ⁻ , NO ₂ ⁻	Farms, factories that produce nitrogen	soil, water	Respiratory diseases, cancer
Pb	Heavy industry, transports	air	Intoxications, hemoglobin alteration, disturbances of the liver and kidney functions
Hg	Industry	soil, water	Caught, insomnia, hallucinations
Zn	Industry	air, water	Corrosive action on the tissues, muscular, cardiovascular and nervous systems diseases

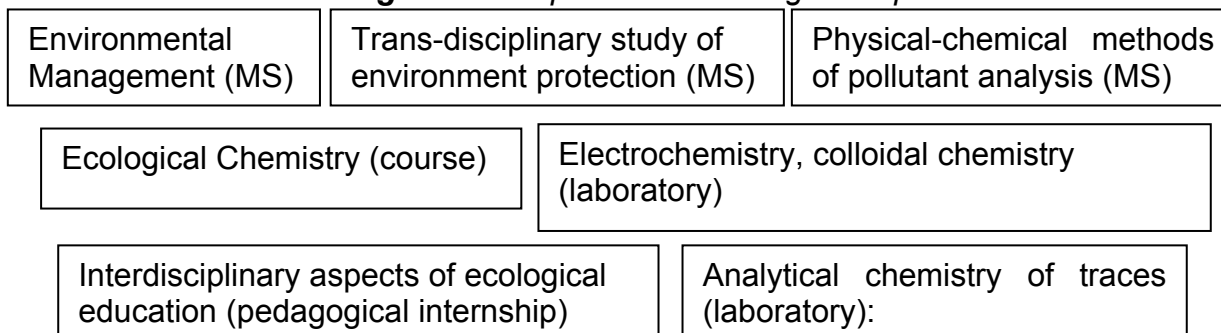
INVESTIGATIONS AND DISCUSSIONS

To make people aware of pollution's causes and effects is possible through education at different levels.

It is the purpose of this paper to present aspects from our department's activities regarding the ecological education in the primary formation of the students, giving references of the methodical and scientific preparation with implications in the permanent formation of chemistry teachers.

Specialization is being done through courses, laboratories, and research themes as part of the MS program (examples in Figure 1)

Figure 1 Disciplines with ecological impact



The Ecological Chemistry course (taught in the IVth year of study) also implied research papers regarding the degree of pollution in the western part of the country, research conducted between 2000-2002. Here are a few titles:

- Pollution of Deva Caused by the Thermocentral of Mintia
- Air Pollution Sources in Resita
- Pollution of Arad Caused by Auto Transports
- Study on Air Pollution in Lugoj
- Pollution of the Town Baia Mare
- Environment Pollution of Marasesti
- Pollution Effects with Wastewater of the River Nadragel
- Pollution of the Rivers in Petrosani
- Risks of Pond Decantation in Baia Borsa [1,8]

The students were involved in research projects conducted all over the country, but mostly in the areas intensely polluted with inorganic substances: metals, oxide, acids, bases, salts.

At the same time, they are aware of the fact that this kind of pollutants can be transformed into non-toxic products.

The results of the research projects show the following:

Pollution with metals

Maximal values of the medium concentrations per 24 hours for specific pollutants are presented below (Table 2)

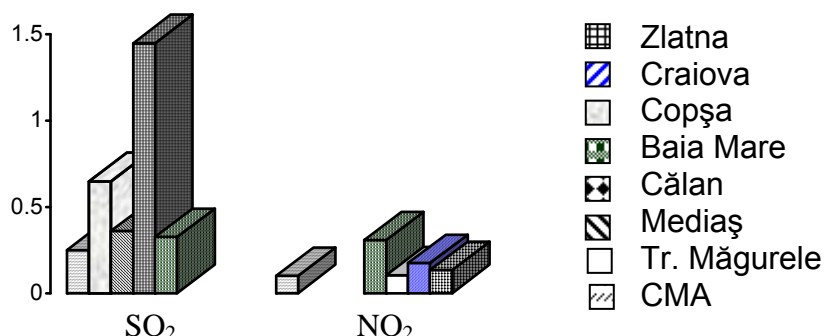
Table 2 MAC for Cd and Pb

• cadmium -MAC – 0,0002 mg/m ³	Copşa Mică – 0,0008 mg/m ³ ; Baia Mare – 0,0002 mg/m ³ ; Mediaş – 0,0005 mg/m ³ ; Zlatna – 0,0002 mg/m ³
• lead -MAC – 0,0007 mg/m ³	Baia Mare – 0,017 mg/m ³ ; Copşa Mică – 0,020 mg/m ³ ; Mediaş – 0,016 mg/m ³ ; Zlatna – 0,0007 mg/m ³

Pollution with oxides

Towns where exceeding values of MAC for SO₂ and NO₂ at 24 hours have been recorded (Figure 2):

Figure 2 Towns polluted with SO₂ and NO₂

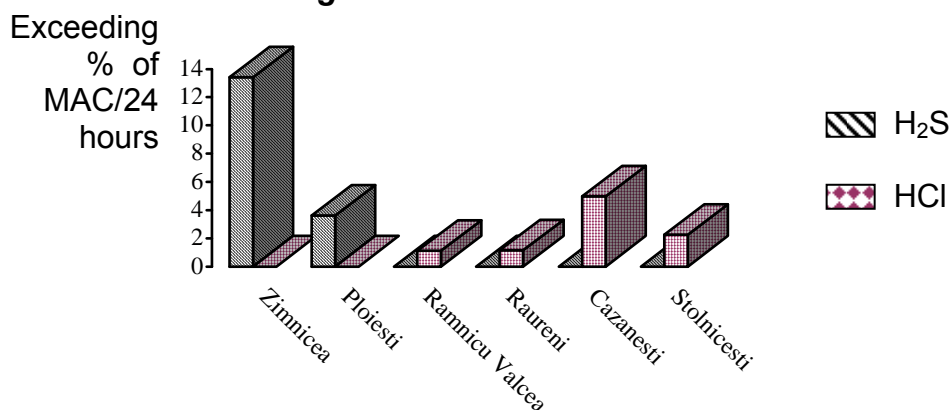


Pollution with acids (Table 3, Figure 3)

Table 3 MAC for H₂S and HCl

<ul style="list-style-type: none"> hydrogen sulphide MAC - 0,05 mg/m³ 	Zimnicea – 0,059 mg/m ³ ; Ploiești – 0,056 mg/m ³
<ul style="list-style-type: none"> acid chloride MAC - 0,100 mg/m³ 	Râmnicu Vâlcea – 0,140 mg/m ³ , Răureni – 0,160 mg/m ³ ; Căzănești – 0,140 mg/m ³ ; Stolniceni – 0,120 mg/m ³

Figure 3 Polluted zones with acids



In general, exceeding values of MAC have been recorded over 24 hours for specific pollutants due to the fact that the monitoring points have been placed in areas where these pollutants are eliminated into the atmosphere.

Table 4 Zone with intense acid precipitations

Nr.	Zone	pH	Conductivity (μS/cm)
1	Arad	5,40	132,30
2	Brasov	5,0	149,50
3	Bucuresti	4,39	113,02
4	Medias	5,40	124,00
5	Zalau	4.41	258,00
6	Herculane	5,00	522,00
7	Baia Mare	5,15	503,50

Pollution with salts (Table 5)

Table 5 Zones where precipitation with high loading of ions

Nr.	Town	Pollutant	Maximal Concentration (mg/l)	Observations
1	Bistrița	Cl ⁻	24,82	The high concentrations of sulfates and chlorides determine acid water rains; concentrations of ammonia determine base water rains. Both processes have negative effects on the vegetation, water, soil and construction.
2	București	NO ₃ ⁻	31,30	
3	Cluj	SO ₄ ²⁻	104,00	
		NO ₃ ⁻	57,74	
4	Copșa Mică	SO ₄ ²⁻	203,87	
5	Galați	SO ₄ ²⁻	51,18	
		NO ₃ ⁻	29,00	
6	Giurgiu	Cl ⁻	24,40	
7	Herculane	SO ₄ ²⁻	68,86	
		NO ₃ ⁻	18,76	
8	Jimbolia	NO ₃ ⁻	31,40	
9	Miercurea Ciuc	NH ₄ ⁺	22,63	
10	Semenic	SO ₄ ²⁻	100,49	
		NH ₄ ⁺	17,61	
11	Tulcea	NH ₄ ⁺	18,94	
12	Zalău	NO ₃ ⁻	16,68	
13	Baia Mare	SO ₄ ²⁻	151,20	

The students were studying the pH of the rain water by taking probes from 15 in 15 minutes. So, they observed the pH growth in time and made the correlations between the obtained pH values and the consumption of sulphur and nitrogen oxides.

The actual school curriculum for chemistry involves scientific experiments as a teaching and learning method.

Performing experiments students and teachers are often dealing with inorganic substances - reactants or products of reactions - that could be a source of pollution for the environment.

Thus, we were choosing some examples of obtaining pollutants:

- NO, NO₂ - reactions of some metals with HNO₃ conc.;
- decompositions of some nitrates.
- SO₂ - reactions of some metals with H₂SO₄ conc.;
- S and H₂S combustion;
- reactions between sulphur and certain oxides.
- HF - from calcium fluoride and H₂SO₄;
- silver fluoride and HNO₃;
- the use of HF on glass writing.
- H₂S - reactions between some sulphides with strong acids;
- using it at identification of cations from second analytical group.
- NH₃ - reactions of ammonium salts with alkaline oxides or bases.
- PH₃ - reactions between phosphorides and water or phosphorus with bases.

- AsH₃ - by reduction of arsenium trioxide.
- Hg - by decomposition of some oxides and salts.
- Pb, Sn, Ag - by their substitution from salts with heavy metals [3].

To prevent the environment pollution we consider that such experiments have to be conducted demonstratively by the professor. Sometimes we have the possibility to replace some substances with other much more harmless for the medium. Also, we can present movies or simulate these experiments using computer software.

As teachers we can spread scientific knowledge among students, entrepreneurs and others about what chemical methods are available to remedy the polluted air, water and soil.

For example:

- the remediation at micro-scale of a simulated wastewater from a dye-house by electroflotocoagulation;
- the purification of a simulated contaminated soil (kaolin) by electrolysis (for pottering or cosmetic industry) [5].

CONCLUSIONS

The aim of our paper was to point out some aspects regarding the air, water and soil pollution with inorganic substances as a result of an interdisciplinary research.

The examples and models from this paper attest the implication at different levels of the educative factors, in actions made to reduce the pollution.

We presented some of the laboratory experiments made by our students in their initial formation as future chemistry teachers, partly for their educational value and partly for their relevance to scientific research.

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