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"Silicatization of Fly Ashes – a harmless way of the wastes utilization".

Key words: fly ashes, silicatization, heavy metals

Abstract: The achievements in the field of fly-ashes utilization in forming of the Fly-Ash Composites are described in the paper. The Fly-Ash Composites are the mixtures of fly ashes, soluble silicates (water-glass solutions) and/or lime (more often waste lime). There are presented two principal composites: the Fly-Ash Composite and the Liquid Fly-Ash Composite. The theoretical principle of the composites creation, their basic physico-mechanical properties, their way of formation and mainly the directions of their application are shortly presented. The influence of fly ashes on the environment is also taken into account.

Introduction

The research on production of strengthening and sealing mass made of fly-ashes was started at the beginning of seventies and are being carried on till now. As a result of those works several home patent applications were made during the recent years [1, 2, 3].

The developed technologies of soil improvement may be divided in two groups, according to two types of applied materials. These materials are called: the Fly-Ash Composite and the Liquid Fly-Ash Composite. Both composites are produced on the base of fly ash, soluble silicates solution (water-glass solution) and - if necessary - lime, most often waste lime. These composites are inexpensive, they base on reclaimed materials (wastes from power industry), and - in spite of their derivation - they are inert for the environment and they are widely applicable in building practice.

Comprehensive characterization of materials

From the point of view of the proceeding processes, the presented methods are the typical unisolution silicatization. The fact, that fly ash itself is a coagulating agent is an essential difference in relation to the conventional silicatization. Strictly speaking, the soluble elements of fly ash react as the coagulant. Thus, the soluble silicates solution and soluble parts of fly-ash take part in the process of delayed coagulation, and clearly - delayed gelation.

As it was mentioned above, this paper describes in principle two types of materials. First of them - the Fly-Ash Composite - is a material, that is produced by

mixing, in adequate proportions, the fly ash and water-glass solution, and - next - by its compaction. Because of the necessity of compaction, the quantity of solution must correspond to the optimum water content of applied fly-ash.

In the second case - the Liquid Fly-Ash Composite - one deals with similar material. The difference lies in the quantity of added water-glass solution, which must be much higher than the optimum water content. The quantity ratio of fly ash to the solution can vary in the range from 1:0.5 to 1:5.

The mentioned composites differ very much in the technology of formation and in their properties. Those differences will be discussed in further parts of this paper.

PHYSICO-MECHANICAL PROPERTIES

Fly Ash Composite

The unconfined compressive strength (Rs) and the coefficient of permeability (K10) are the main physico-mechanical properties of the Fly Ash Composite. The values of these parameters can vary in wide ranges, depending on many factors. The factors, which mostly influence those two parameters are: the chemical composition (mainly calcium oxide content) and the quantity of colloidal silica added with the water-glass solution.

The value of the unconfined compressive strength varies from a fraction to ca. 5 MPa with an increasing tendency, and the value of the coefficient of permeability - in range: 10-9 - 10-11m/s with the decreasing tendency in time. The results of the investigation of practically applied composites (four different places) are presented in Tables 1 and 2.

When the calcium content in fly ash is very low, it is necessary to enrich the fly ash with this element by adding the material of high calcium concentration. It is recommended to use different kinds of lime, especially the waste lime, such as carbide lime.

Table 1.

Changes of the unconfined compressive strength in time [MPa]

Age	Object			
[years]	I	II	III	IV
"0"	1.2	1.2	3.2	3.9
1	1.3	1.3	3.6	4.0
2	1.6	2.6	4.5	4.8
3	2.3	3.7	4.7	5.2
4	2.4	3.8	4.9	5.3
5	3.5	3.9	5.0	5.6
6	3.6	3.9	5.2	5.6
7	3.7	4.0	5.2	5.7
8	3.7	---	5.2	---
9	3.8	---	---	---

Table 2.

Changes of the coefficient of permeability in time [m/s]

Age	Object			
[years]	I	II	III	IV
"0"	$6.7*10^{-8}$	$9.7*10^{-9}$	$3.3*10^{-8}$	$8.9*10^{-9}$
1	$3.5*10^{-8}$	$4.3*10^{-9}$	$1.2*10^{-8}$	$8.2*10^{-9}$
2	$9.7*10^{-9}$	$9.9*10^{-10}$	$1.3*10^{-8}$	$7.8*10^{-9}$
3	$3.2*10^{-9}$	$8.8*10^{-10}$	$1.1*10^{-8}$	$6.8*10^{-9}$
4	$2.0*10^{-9}$	$2.8*10^{-10}$	$1.0*10^{-8}$	$2.2*10^{-9}$
5	$1.2*10^{-9}$	$2.1*10^{-10}$	$1.0*10^{-8}$	$2.1*10^{-9}$
6	$6.6*10^{-10}$	$2.1*10^{-10}$	$1.1*10^{-8}$	$2.1*10^{-9}$
7	$5.6*10^{-10}$	$2.1*10^{-10}$	$1.3*10^{-8}$	$1.8*10^{-9}$
8	$5.8*10^{-10}$	---	$1.2*10^{-8}$	---
9	$5.6*10^{-10}$	---	---	---

Two parameters of the highest importance were mentioned above. In many cases a more accurate characterization of the Fly-Ash Composite appears to be imperative. It would be useless to describe the methods and the results of the investigation. However it might be worth adding, that the investigation, that has been made until now, allows to define the effect of initial composition on such parameters as: frost susceptibility, resistance to static and dynamic water activity, resistance to the activity of many mechanical and chemical agents, modulus of elasticity, rheological properties and many others [6, 7]. One should emphasize, that the Fly-Ash Composite formed in accordance with the author's instruction, shows the sufficient resistance to the activity of most external agents.

Liquid Fly Ash Composite

Similarly to the case of the Fly Ash Composite, two parameters are of the highest importance in characterization of the Liquid Fly-Ash Composite. These are: the unconfined compressive strength (Rs) and the coefficient of permeability (K10). The latter one is almost independent of the material composition, and except for special cases, when technological requirements are not accomplished, it varies most often in the range from 10-11 to 10-12 m/s.

The unconfined compressive strength of the Liquid Fly-Ash Composite depends principally on three factors: calcium oxide content, concentration (density) of the water-glass solution and the quantity ratio of fly ash to the solution. According to those three factors the strength of the composite varies from fraction to over 10 MPa.

In case of Liquid Fly-Ash Composite, the calcium oxide content and the density of water-glass solution must be much higher than in case the instance of Fly-Ash Composite. There is no problem with application of a higher density solution - the lower dilution of trade product is proper. The condition of higher calcium content is more difficult to execute. Only lignite fly ashes satisfy that requirement. However, it appears that the

difficulties can be overcome by addition of materials with the high calcium content in the quantity that ensures the reaching of total calcium content not less than 15 per cent.

The Liquid Fly-Ash Composite can be used in the cases of high water content or even under water. It is possible to select its composition in such a way, that the dilution with water, inevitable in such conditions, does not deteriorate the parameters of the composite, and even intensifies its setting.

TECHNOLOGY OF FORMATION

Fly Ash Composite

Low costs and especially simplicity of formation are the most important advantages of the presented method. Each time, the whole practical work consists in realization of several steps, turned one after another consecutively:

- supply of the fly-ash from storage or from Electric Power Station;
- formation of the layer of loose fly-ash on the ground surface;
- addition of lime, if necessary, and accurate mixing with fly-ash;
- preparation of water-glass solution and sprinkling the fly-ash with diluted solution;
- compaction.

The equipment applied in technical formation of the lining made of the Fly-Ash Composite can vary and depends on accessibility, a scale of enterprise and also a performer's inventiveness. The experience, that has been achieved until now, proves that the best results are obtained when one applies simple and accessible equipment, such as a bulldozer, agricultural fertilizer distributor, soil miller, electric or petrol powered pump (e.g. fire pump) etc. Application of more complicated equipment does not bring better results and increases the costs of an enterprise. It is, however, allowed to apply different technologies and equipment, of course after prior consultation

.

Liquid Fly-Ash Composite

Technology of the Liquid Fly-Ash Composite formation is similar to concrete technology. Components of the Composite are blended in a stirrer such as a concrete mixer, and after several minutes, the mixture is poured into a place of destination. The Liquid Fly-Ash Composite does not require compaction.

In case of the Liquid Fly-Ash Composite with short setting time it is necessary to keep the proper order of dosage of components, viz.: water – fly ash - concentrated water-glass solution. When the composite is applied under water it is recommended to use the water-glass solution with the density not less than 1120 kg/m^3.

ENVIRONMENT PROTECTION

The fly ashes can be threatening to the environment. Very often, when the fly ashes are moved in a wrong way, they really are the source of environment pollution, mainly by dustiness and by heavy metals leaching. This problem is often presented in enormous proportions, however it exists and must be included. In Table 3 there are presented the ranges of concentration of some heavy metals in fly ashes from several Polish Electric Power Stations. Those results are presented in comparison with the medium concentrations of these metals in farming soils in Poland.

Table 3.

Heavy metals contents in fly ashes and soil in Poland [ppm]

Metal	Fly ashes	Soil
Lead Pb	12 - 340	39
Zinc Zn	130 - 610	50
Copper Cu	50 - 150	12
Cadmium Cd	0 - 12	< 1
Cobalt Co	12 - 43	6
Manganese Mn	300 - 3000	333
Chromium Cr	120 - 2000	31
Nickel Ni	60 - 190	15

The results of the performed investigation [4, 5] establish that the information about the total contents of heavy metals is not completed. In the most unfavourable circumstances of static leaching, at most 1/3 of the included metals can be rinsed out. While the filtration of water through the fly ash is going on, the problem of heavy metals leaching seems to be different. In such appearance heavy metals can be rinsed out in the quantity of 70-80 per cent of their total contents. Thus, the practical fly-ash threat to the environment depends on the scale of the problem.

In the instance of fly-ash utilization as a component of the Fly Ash and Liquid Fly Ash Composites, the above mentioned question is almost negligible. The investigation of composites solubility repeated many times has proved, that the leaching of heavy metals from those materials had never exceed the value of 5 per cent of the total content. It must be added, however, that in several cases the concentration of determined metals in eluates exceeded the concentration permissible for potable water (according to Polish legislation rules). Those excesses were small and were found only in very small quantities of filtrates, while the filtration was started. If one includes the value of the coefficient of permeability, and so the yield of filtration through the composites layers, it is possible to ignore the

threat of fly ash to the environment. The exemplary results of such study are presented in Table 4.

Table 4.

Heavy metals leaching in filtration process

Metal	Degree of leaching	Medium concentration*	Maximum concentration	Potable water
---	%	ppm	ppm	ppm
Zinc Zn	2.86	0.900	13.6	5.0
Lead Pb	2.20	2.060	2.11	0.1
Copper Cu	0.07	0.008	0.12	0.5
Cadmium Cd	0.43	0.008	0.12	0.05

*/ examination was stopped in the moment when the filtrates composition has not differed from water

APPLICATION

The formation of horizontal and vertical hydroisolating cut-off walls is a principal direction of the application of both composites. It refers to sealing of bottoms and slopes of existing and newly built water reservoirs, sealing of hazardous waste dumps, isolation of water reservoirs and waste-dumps with the vertical sheet-pile wall, sealing of earth dams and river embankments, and so on.

The use of the Fly Ash Composite in civil engineering and road construction, as a road and car park foundation and also as a foundation layer under the floor in factory buildings, warehouses etc., is a second direction of its application.

Possibility of grass growing on the Fly Ash Composite predisposes it to application as a cover lining of different landfills, i.e. to the role of a recultivated layer. Detaching of deposited wastes from the atmosphere is a principal purpose of such lining.

The Liquid Fly-Ash Composite can be satisfactorily applied in clogging the mine- and bore-holes, stabilization of vertical excavation walls by the gunite method and also in dumps of toxic wastes.

A number of the above mentioned trends of composite application are shown in Figure 1.

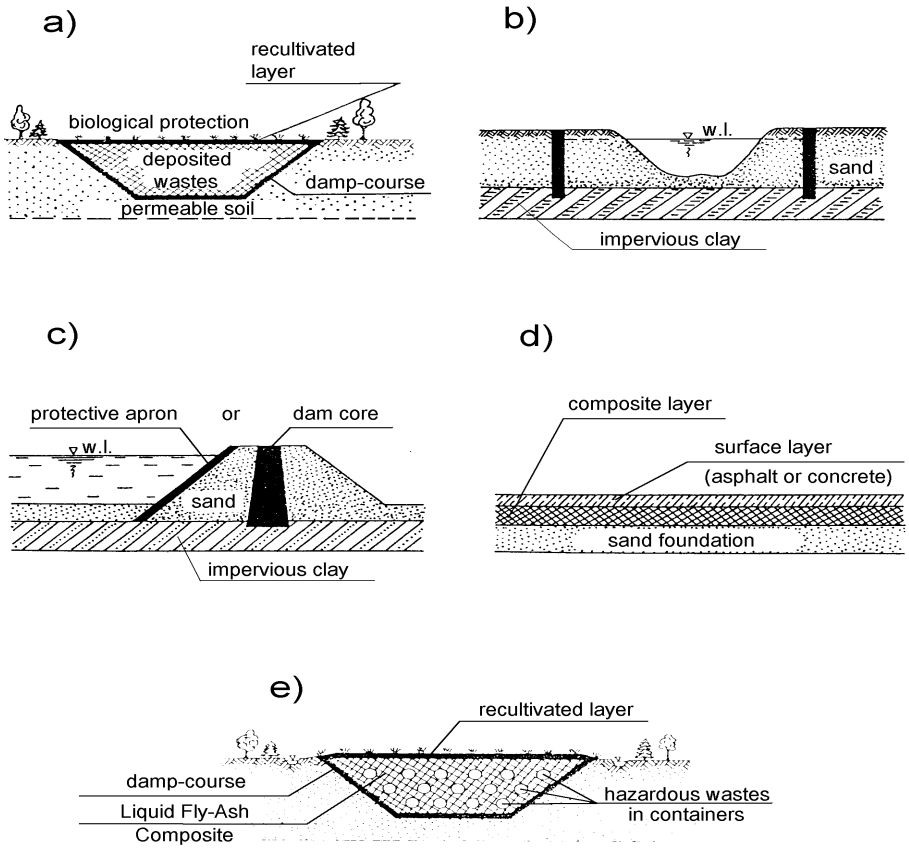

Figure 1. Directions of application of Fly-Ash Composites

The Fly-Ash Composite has been practically applied in over 30 places in Poland. The costs appeared 2-3 times lower in relation to traditional methods (geomembranes, clay etc.). The assumed physico-mechanical properties of the linings made of the Fly-Ash Composite were achieved each time. The unconfined compressive strength increased and the coefficient of permeability decreased with time (see Tables 1 and 2).

CONCLUSION

The paper presents two types of composites based on silicatized fly ash. One of them was applied in practice and its predicted properties were confirmed. The examination of ground water under and around the waste-dumps proved the efficacy of the applied solution. Apart from the mentioned properties, it should be added, that the Fly-Ash Composite is characterized by very good adhesion to soil and to concrete and its shrinkage is almost unnoticeable. Finally, it does not require expansion joints during practical formation.

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"Institut für Energie und Umwelt e.V., wirtschaftsnahes Forschungsinstitut – Verbindung zwischen der Fachhochschule und der regionalen Industrie"

Abstract:

Das Institut für Energie und Umwelt wurde am 08. Juli 1997 gegründet. Das Institut ist ein eingetragener Verein mit 14 Mitgliedern, bestehend aus Professoren und wissenschaftlichen Mitarbeitern der Fachhochschule. Seit dem 29. Juli 1999 ist das Institut als An-Institut der Fachhochschule Stralsund anerkannt.

Schwerpunkte der Aktivitäten:

- Durchführung von Forschungs- und Entwicklungsarbeiten in Kooperation mit der Fachhochschule Stralsund und der Technischen Universität Stettin in den Bereichen erneuerbare Energien, rationelle Energieanwendung und Energie-Flusssteuerung
- Erstellung von Machbarkeitsstudien zur dezentralen Energieversorgung
- Weiterbildung von Ingenieuren
- Möglichkeit der Durchführung von Praxissemestern
- Ausbildungszentrum für Doktoranden
- Akquisition von neuen Forschungsprojekten
- Schaffung nationaler und internationaler Netzwerke für gemeinsame Forschungsvorhaben sowie die Zusammenarbeit mit industriellen Partnern zur Forcierung des Technologietransfers

(Tłumaczenie abstraktu)

Instytut Energii i Środowiska e.V., Instytut Naukowo-Badawczy – działania pomiędzy wyższą szkołą techniczną i przemysłem z regionu.

Instytut Energii i Środowiska został założony 08 lipca 1997.
Jest on związkiem 14 członków, profesorów i współpracowników naukowych szkoły. Od 29 lipca 1999 uznany za instytut podległy (filię) wyższej szkole technicznej (politechnika) w Stralsundzie.

Główne założenia i zakres działania.

- prowadzenie prac badawczych i rozwojowych w kooperacji z wyższą szkołą techniczną (politechniką) w Stralsundzie i Politechniką Szczecińską w obszarach: odnawialne źródła energii, racjonalne gospodarowanie energią i energia wód płynących;
- prace badawcze nad pozyskiwaniem energii z małych źródeł;
- dalsze kształcenie inżynierów;
- możliwości przeprowadzania praktyk semestralnych;
- centrum kształcenia doktorantów;
- promowanie i wdrażanie nowych projektów badawczych;
- tworzenie narodowych i międzynarodowych połączeń sieciowych dla wspólnych przedsięwzięć badawczych oraz współpraca z partnerami przemysłowymi w celu wdrażania nowych technologii poszukiwania nowych źródeł energii.

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"Integration of environmental education in the Baltic Sea Region".

Abstract:

The Baltic Sea is a unique sea (reservoire). It is very sensitive to any stress resulting from excessive pollution discharge. 14 countries exploite our sea. The intensive exploitation result in many environmental problems like increase of bottom deserts areas, increase of eutrophication, drop of the fish catchments, intensive algae blooming, disaperance of many original species, etc. The awarenace of the impact of human activity to the condition of the Baltic Sea is of great importance. The increase of the societies knowledge is a great chalange for the education. Integration of the education within the region will give better results than individual universities efforts. A very good example can be the Baltic University Programme.

The Baltic University Programme is a co-operative network of universities in the Baltic Sea region. The project started in 1991. Today some 150 universities or other institutions of higher learning in 14 countries within or touching the Baltic Sea drainage area take part. Some 800 researchers and teachers at the universities active within environmental science but also humanities and social science participate. The Programme is coordinated by Uppsala University. The Programme strives to create truly international university coursess with relevance for countries in the Baltic region.

These courses demands interdisciplinarity, so the co-operation within the university but also with other institutions in society, e.g. local governments, trade and industry and associations is needed. High priority is to connect theoretical research with practical reality in creating a sustainable society. As sustainability is not an established academic discipline, teaching this course will be a great chalange.

Another aspect is to learn from each other, to spread „best practice", projects that have been successful.

The different fields clearly show the complexity in teaching this course, but also possibilities in developing new methods within university education.

The courses are delivered with using classical methods like lectures, seminars, but also group discussions and international contacts by audio- and video- conferences. The group discussions is of priority technique. One of the suggestion is local panel discussion, with participation of local authority representatives or other experts. Study visits give a chance

to learn from reality. International students cooperation can be strengthened by the common projects preparation. The internet contacts facilitate the exchange of the experience and the knowledge among students from different countries.
The modern technical solutions like ISDN connectivity or First Class conferencing system. Make it quite easy.

One of the BUP activity is organization of the summer students courses, where they meet each other in bigger, international groups.
The aim of the course is to make students familiar with the different severe environmental problems typical for the Baltic region. Students will attend the lectures given by the scientists, present chosen topics from their own country, participate in storm-brain discussion.. They visit many places to learn more in practice.

Teachers in the Baltic University Network are provided with material developed at the universities or institutions cooperation within the Proggramme.

Interactivity between students and experts is important. In earlier courses TV space bridges and students conferences were organised. Lately, the direct communication through tele-, audio- and video-conferencing is realising.

The effort has been spent in developing new courses dealing with the future of our region in terms of sustainable development. The long term goal of BUP is the strenghthening the the network of the cooperative structure and more intensive exploitation of the modern information technologies.
The development of the new courses on a sustainable development of our region or the extention and updating the running courses is our task.

Till that moment the following courses are offered:
Peoples of the Baltic, Baltic Sea Environment, Sustainable Baltic Region, Sustainable Water Management, Sustainable Community Development and Urban Planning, and the last one Environmental Science.

The cooperation among the teachers is realized in the teachers meetings where the merit content and didactic methods are discussed, as well, as a new courses concept is discussed. The teachers can also learn about a new methodologies and the training in the use of advansed techniques is possible.

The possibility of the exchange of informations about the environmental situation in the countries in the region is also very important. The common projects on research in the environmental topics are also one of the results of this integration in education.

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"The scope of the education in ecology in Liepaja".

Abstract:

Liepaja is the third biggest city of Latvia with population about 88 712. The main advantage of Liepaja during last two centuries has been its ice-free port. 1997 Liepaja Special Economic Zone (SEZ) was established. SEZ includes the port, most important industrial areas and transport junctions.

The main city development direction is improving the quality of life including business development.

The environmental actualities of Liepaja Municipality are:

- **Solid waste management** and regional landfill building;
- **European Blue Flag Campaign**;
- **City green zone management** (output of requirements for city green zone management, inventory and restore of old plantations, green zone structure formation for new living areas);
- **Decrease of biological diversity and landscape degradation** (output of Liepaja lake management plan, secure of dune zone);
- **Environmental education and communication** (accessibility of environmental information, mass media involving).

Liepaja is also the education centre of western Latvia. There are 6 higher educational establishments.

There is the extramural study programme "Environmental Management" at Liepaja Academy of Pedagogy. But environmental issues are also included in other study programmes. The goals of the study programme "Environmental Management" comply to the mission and goals of LPA - the education of qualified specialists significant for further development of Kurzeme region, including environmental specialists for work in state institutions, municipalities, commercial and consultant companies using up-to-date methods.

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"The assumptions of the waste management programme in Elblag".

„ZAŁOŻENIA PROGRAMU GOSPODARKI ODPADAMI W ELBLĄGU"

Już w 1995 r. Rada Miejska podjęła uchwałę w sprawie udziału miasta Elbląga w programie "Lokalna Agenda 21" potwierdzając pełną akceptację dla ustaleń tzw. szczytu Ziemi – konferencji przedstawicieli rządów 180 krajów Świata pod egidą ONZ w Rio de Janeiro - w czerwcu 1992 r , w tym w szczególności dla Globalnego Programu Działań u progu XXI wieku. Głównym celem tych działań jest wprowadzenie w sposób zintegrowany ładu ekologicznego , ekonomicznego ,społecznego i przestrzennego z uwzględnieniem podstawowych i uniwersalnych zasad ekorozwoju , w tym m.in. praworządności, likwidacji zanieczyszczeń u źródła , uspołecznienia , ekonomizacji i regionalizacji oraz etapowania działań.

przedsięwzięcia inwestycyjne w tym:
- zakończenie budowy Zakładu Utylizacji Odpadów w Rubnie
- budowę i uruchomienie Szkoły Edukacji Ekologicznej w Piaskach
- rekultywację wysypiska w Gronowie Górnym
- rozwiązanie problemów utylizacji odpadów z zakładów opieki zdrowotnej

przedsięwzięcia świadomościowe w tym:
- pogłębianie świadomości ekologicznej mieszkańców
- współpraca z miastami bałtyckimi w zakresie ochrony Bałtyku
- uczestnictwo w akcjach ekologicznych

Konsekwentna realizacja w/w przedsięwzięć przez władze miasta ale i mieszkańców Elbląga została zauważona i doceniona.
- zasadniczą zmianę systemu funkcjonowania administracji publicznej
- wprowadzenie nowego sposobu finansowania inwestycji lokalnych
- stworzenie możliwości korzystania ze środków UE
- nowe szanse i możliwości rozwoju Miasta wynikające ze współpracy w obszarze Europy Bałtyckiej

Wizja i cele określone w „Strategii rozwoju Elbląga 2001-2015”

Główne zadania i przedsięwzięcia służące realizacji celu 6 “Elbląg przyjazny środowisku naturalnemu” to:
- aktywny udział miasta w realizacji programu Agenda 21; pogłębienie świadomości ekologicznej wszystkich mieszkańców Elbląga.
- rozbudowa i modernizacja infrastruktury ochrony środowiska o znaczeniu ponadlokalnym i lokalnym ważnym dla zrównoważonego rozwoju miasta:
    - sukcesywna modernizacja oczyszczalni ścieków
    - Zakład Utylizacji Odpadów etap II – rozbudowa składowiska odpadów komunalnych, prowadzenie segregacji
    - budowa nowoczesnej spalarni.

Gleby: rekultywacja terenów zdewastowanych przyrodniczo.

1. Poprawa jakości wody poprzez wdrażanie szeregu zadań przyjętych w opracowanym programie ochrony środowiska.
2. Poprawa jakości powietrza poprzez działania przewidziane w programie ochrony środowiska.

3. Zmniejszenie poziomu hałasu szczególnie w śródmieściu uzyskiwane różnymi metodami i działaniami zapisanymi w programie ochrony środowiska.
4. Poprawa bezpieczeństwa miasta przed powodzią:
- budowa wrót przeciwsztormowych w rejonie Nowakowa
- budowa obiektów małej retencji
- regulacja rzeki Babicy
- regulacja rzeki Kumieli.
5. Ochrona zasobów przyrodniczych:
- aktywna ochrona zasobów przyrodniczych , walorów krajobrazowych , rejonów rekreacyjnych,
- utrzymanie zieleni w parkach , ciągach ekologicznych , komunikacyjnych , skwerach, zakładanie przy nowych obiektach,
- ochrona istniejących w obrębie miasta lasów oraz ich renowacja , budowa szlaków turystycznych.
- ochrona pomników przyrody i użytków ekologicznych.
6. Ochrona wód powierzchniowych:
- odbudowa biologiczna cieków i jezior,
- sukcesywne modernizowanie istniejących kolektorów deszczowych.

Program zrównoważonego rozwoju ochrony środowiska dla miasta Elbląga na lata 2000-2010 przewiduje działania w obszarach:

- zasoby przyrodnicze
- gospodarka odpadami
- gospodarka wodno-ściekową
- ochrona powietrza i ochrona przed hałasem.

Ze wszystkich omówionych programów wynikają podstawowe elementy gospodarki odpadami uwzględniające wymagania Unii Europejskiej.

- zapobieganie powstawaniu lub ograniczenie ilości wytwarzanych odpadów
- odzysk odpadów mogących być ponownie wykorzystanych
- tworzenie stałych , bezpiecznych punktów zbiórki odpadów w specjalnych pojemnikach
- planowe i częste usuwanie odpadów z pojemników
- właściwe unieszkodliwianie odpadów.

Zakład Utylizacji Odpadów

Zakład Utylizacji Odpadów został oddany do eksploatacji 1998 , a z dniem 1.07.1999 r. został przekształcony w Zakład Budżetowy . Rocznie do Zakładu Utylizacji odpadów przyjmowane jest ok. 50 tys. ton odpadów , w tym ok. 45 tys. ton odpadów komunalnych. Zlokalizowany jest na terenie po eksploatacji piasku i żwiru, otoczonym wzgórzami oraz zadrzewieniami. Rzędne dna układają się na poziomie 9,0 – 16,5 m n.p.m. Na powierzchni ponad 10 ha zlokalizowano następujące obiekty:
- Kopiec bioenergetyczny,
- Kwatera balastu,

- Zespół oczyszczalni odcieków z kopca,
- Magazyn do czasowego przechowywania odpadów niebezpiecznych,
- Budynek socjalno-administracyjny z wagą samochodową,
- Brodzik dezynfekcyjny,
- Zespół kruszący,
- Kwatera odpadów wielkogabarytowych,
- Wiata garażowa z magazynkiem paliw i dystrybutorem,
- Wiata – magazyn surowców wtórnych,
- Plac składowania i sortowania surowców wtórnych.

W rejon kopca BIO – EN – ER doprowadzone są instalacja odgazowująca – przyłączona do gazociągu doprowadzającego biogaz do Małej Elektrowni na Miejskiej Oczyszczalni Ścieków.

Kierunki rozwoju gospodarki odpadami

a) organizacja i zarządzanie
- -zwiększenie zasięgu terytorialnego wywozu odpadów,
- -wydawanie decyzji i kontrola firm zajmujących się świadczeniem usług odbieranie odpadów komunalnych od właścicieli nieruchomości,
- -forma organizacyjna mienie komunalnego (ZUO) winna być ściśle powiązana z majątkiem gminnym,
- -stymulowanie racjonalnego gospodarowania odpadami w mieście poprzez rozwijanie świadomości ekologicznej oraz edukację i eksponowanie pozytywnych wzorców do naśladowania;

b) zasady polityki cenowej i taryfowej
- usługi komunalne w zakresie gromadzenia i unieszkodliwiania odpadów muszą być płatne, ustalając taryfy opłat należy kierować się zasadą samofinansowania działalności,
- opłaty powinny spełniać funkcje :
    - dochodową- składniki opłat powinny zawierać koszty bieżące eksploatacji, koszty remontowe oraz koszty odtworzenia majątku i rozwoju,
    - informacyjno-motywacyjną – informacja mieszkańców o koszcie usług i stymulowanie racjonalnego zagospodarowania odpadów;

c) system gromadzenia odpadów
- kontynuowanie istniejącego systemu gromadzenia odpadów z równoczesnym porządkowaniem miejsc poprzez budowę obudów,
- wprowadzenie w większym zakresie systemu selektywnej zbiórki odpadów,
- wprowadzenie na terenach osiedli domków jednorodzinnych i Starym Mieście selektywnej zbiórki odpadów "u źródła" za pośrednictwem kolorowych worków,
- wprowadzenie na terenach stacji paliw pojemników na odpady niebezpieczne(baterie , puszki po farbach , świetlówki , itp.),
- wprowadzenie systemu zbiórki leków przeterminowanych we wszystkich aptekach na terenie miasta;

d) system wywozu odpadów
- kontynuowanie na terenie miasta przesypowo-wymiennego systemu wywozu odpadów,
- poprawa obsługi komunalnej rejonu Starego Miasta,
- rozwiązanie problemu obsługi posesji jednorodzinnych w zakresie wywozu odpadów wielkogabarytowych i poremontowych,
- wprowadzenie sezonowej obsługi terenów ogrodów działkowych;

e) unieszkodliwianie odpadów
- polepszenie istniejącego systemu poprzez sortowanie odpadów użytkowych na ciągu technologicznym umożliwiającym oddzielenie szkła, opon, złomu, makulatury, plastyk, puszek,
- odpady niebezpieczne i problemowe utylizować przez pirolizę lub magazynować tymczasowo do chwili przekazania do utylizacji lub pojawienia się technologii umożliwiającej utylizację, priorytetem w tworzeniu nowoczesnego systemu gospodarki jest dążenie do ograniczenia deponowania odpadów na składowisku oraz utylizacja odpadów przemysłowych niebezpiecznych.

RACJONALIZACJA GOSPODARKI ODPADAMI KOMUNALNYMI I REKULTYWACJA SKŁADOWISK W ELBLĄGU

Rozbudowa Zakładu Utylizacji Odpadów

Rozbudowa zakładu utylizacji odpadów faza I:
- budowa sortowni odpadów,
- budowa linii do czyszczenia i sortowania szkła,
  budowa wiaty oraz zakup i montaż urządzeń do rozdrabniania opon, odpadów wielkogabarytowych,
- zakup i montaż urządzeń do termicznego unieszkodliwiania odpadów medycznych i weterynaryjnych,
- - budowa urządzeń do odzysku biogazu,
- - rozbudowa budynku administracyjno-socjalnego.

Rozbudowa zakładu utylizacji odpadów faza II:

- budowa kwater na odpady komunalne,
- budowa kompostowni,
- budowa linii technologicznej do kasacji pojazdów samochodowych,
- budowa linii do utylizacji sprzętu elektronicznego, sprzętu artykułów gospodarstwa domowego,
- budowa linii do przerobu tworzyw sztucznych,
- zakup sprzętu technicznego, (kompaktory , ładowarki , spychacze , wózki widłowe, zamiatarka samojezdna),
- budowa linii do przerobu makulatury.

Intensyfikacja selektywnej zbiórki odpadów:

- zakup pojemników do selektywnej zbiórki,
- zakup pojemników do zbiórki sprzętu elektronicznego,
- zakup pojemników do transportu odpadów.

Zakup i montaż urządzeń do termicznego unieszkodliwiania odpadów.

Węzeł do termicznego unieszkodliwiania odpadów składać się będzie m.in. z:
- pieca do spalania typu o wydajności 250 kg na 1 cykl,
- instalacji do odzysku ciepła ze spalonych odpadów,

Rekultywacja składowisk w Elblągu

1/ Rekultywacja składowiska odpadów komunalnych w Gronowie Etap II, polegać będzie na:
- odtworzeniu warstwy glebowej,
- biologicznej zabudowie terenu poprzez wykonanie zadarniania, zadrzewienia i zakrzewienia terenu.

2/ Rekultywacja trenu Modrzewiny polegać będzie na:
- likwidacji obiektów wojskowych,
- przeróbce gruzu i transporcie na składowisko,
- likwidacji dzikich składowisk odpadów komunalnych i gruzu i transporcie na składowisko.

Koszt całości zadania wynosi:
- koszt całości zadania 15 mln EURO
- w tym z funduszu spójności 10,5 mln EURO

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"The ecology education in the Elblag region".

Characteristic of the town

Elbląg is a town with 750 years history. Destroyed in near 80 % during the II World War it was rebuilt after 1945. About 130 000 inhabitants live in Elbląg.
It is situated in west-eastern part of Poland at the riversite – Elbląg, near Vistula Lagoon, in the area so-called „The Green Lungs of Poland". It develops very dynamically. „Development Strategy for the Town", „Local Agenda 21" and „Sustainable Development of Environment Protection Programme for Elbląg 2000-2010" indicate the directions of development.

The aim of the town authorities activities is to provide inhabitants needs as best as possible but in full harmony with natural environment.
Environment protection in Elbląg is seen in complex and multifarious way. Elbląg of to day is in possession of:
full guaranty in water,
sanitary and storm-water drainages,
mechanical-biological sewage treatment plant,
modern waste treatment plant,
central heating system,
ecological education center.
Numerous activities for environment protection are undertaken, in this:
ecological education is carried on regularly,
a calendar of ecological ventures was introduced, in this different competitions regarding ecology are organized,
selective waste collection was implemented.

Education of ecology

Education of ecology and propagation pro-ecological activities have not direct effect on environment improvement but is good base for future activities.
Ecological education in Elbląg is realized since 1995 in continuous and complex way according to „Local Agenda 21" and „Environment Education Programme" Its main aim is increasing ecological awareness of Elbląg inhabitants.

Introduction of selective waste collection was preceded by intensive propagation among school children and adults. Education in this field is continued.

All schools and kindergartens in Elbląg have got separated containers for glass, plastic and waste paper and also containers for electric batteries collection. Three petrol

stations have got containers for hazardous wastes and in pharmacies there are containers for not used medicines.
Ecological education starts at kindergarten and at school and then it is steered to all inhabitants of our town.

In 2001 every primary school and kindergarten got the educational game: „Green paths" which promotes, among other things, selective waste collection. To school and pre-school children plastic competitions are addressed. Ecology is their subject, e.g.: „Selective waste collection", Elbląg – friendly for environment" etc. Competitions named: „The most beautiful balcony and the most beautifully managed area around the apartment buildings" is steered to adult inhabitants.
Thanks to „Education Programme" carried out in kindergartens, schools and local medias children and young people participate very actively in all ecological activities.
Every year „Day of the Earth" is an occasion to reward the best in ecological activity pupils. Awards are handed by President of Elbląg. During „Day of the Earth", „World Day of Environment Protection", „International Day of Environment Protection" conferences, seminars, meetings are organized.

Since 2002 President of Elbląg has conferred the „Certificate of Ecological School"on the best in ecology schools.

Very important for forming pro-ecological attitudes is Center of Ecological Education at Piaski. Here, every year pupils from the 6th class participate in one-week, very attractive ecological trainings.

In 1999 and 2001 Elbląg got the highest distinction for activities according environment protection, in this: for correct waste management and ecological education.

Activities for ecology in the field of education and investment resulted in many distinctions and prizes, in this:
European Union diploma of honour for particular achievement in ecology (1999),
Baltic Sea Society distinction for ecological education programme (1999),
Flag of Council of Europe for activity on the arena of international policy (2000),
European Union diploma of honour for particular achievement in ecology: implementation, integration, education (2001),
Certificate „Friendly for Environment Gmina" (2001/2002, 2002/2003),
Title: „Mecenas of Polish Ecology" (3 Feb. 2003).

(Summary: Krystyna Terlikowska; Institut for Land Reclamation and Grassland Farming at Falenty, Research Division in Elbląg)

PROF. DR HAB. INŻ. MATTHIAS AHLHAUS

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"Liquid biofuels and biohydrogen for transportation".

Abstract:

Feedstock and possibilities to produce liquid biofuels as well as biobased gases will be explained and dicussed in relation with an european well-to-wheel (WTW) study. The aim and structure of a WTW-study is defined.It is devided two parts: Well-to-Tank (WTT) as the fuel-production-chain and Tank-to-Wheel (TTW) for the use in vehicles; boundary conditions are explained.
Conventional fuels based on mineral oil are compared with alternative fuels based on natural gas, electricity and biomass. The vehicle-drive comprises conventional and novel concepts based on internal combustion engines (ICE), fuel-cells and hybrids.
Benefits in fuel consuption and greenhouse-gas (GHG)-emissions of different drive concepts as main result of the WTW-analysis are presented: Hybridisation reduces fuel consumption; fuel-cell propulsion-systems show benefits compared to ICE-concepts; biofuels offer reduced emissions. The future role of biohydrogen as a transportation fuel is critical discussed.

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"Environmental Simulations – Information Technology application in Environmental Crisis".

Keywords: sustainable development, risk management systems, environmental simulation models, virtual world, decision support systems, information technology, environmental protection

Abstract: Over the past few decades, there has been an increasing concern that human actions and natural catastrophes have been adversely impacting the environment, and posing serious ecological and health hazards. This concern has led to an increased emphasis on environmental risk assessment studies all over the world.

Environmental risk assessment aims at studying the nature of environmental hazards, (emission of a pollutant/contaminant, natural hazard events, use of a hazardous technology, or any possible combination of these), and estimating the associated probability of occurrence of such events. The study also aims at characterizing the adverse effects of environmental hazards resulting from human and ecological exposures.

Environmental risk management seeks to minimize the impact of natural catastrophes, based on a detailed analysis of the risk assessment results. This helps in effective planning of the remedial steps, prioritizing of the action items, and early decision-making. This also helps in the quick enforcement of suitable policy or regulatory mechanisms. Today, environmental risk management is practiced by a wide range of industry segments, such as general and life insurance, real estate and construction, government and development funding organizations, agriculture, and utilities sectors.

The usage of GIS in environmental risk management ranges from development of databases/inventory systems, and simple to advanced GIS layers overlay, to complex spatial decision-making systems for study of the impact of air, water and soil pollution, ecological imbalance, and natural disasters on the environmental and human receptors.

Complex real world systems are currently developing to become a decisive instrument for IT-supported problem solving of a great number of problems posed by science, economy and society. By this, we for the first time face the chance of being able to find new solutions, visions, and strategies for sustainable development on the basis of complex, real world simulations.

Adding the computer to environmental sciences is one of possibly fruitful mergers. It is not only the technology that allows us to do things better and faster, it is new concepts and ideas, or a new paradigm, that leads us to do different things.

PREFACE

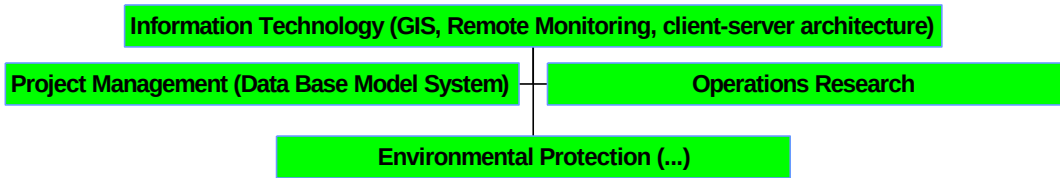
Have you ever seen a computer game, called "The Sims"? There are virtual people leaving in a virtual world, you are the master managing their life as the end user. Let's consider a scientific system able to give you the possibility to simulate the real world. Put it into the problems related to environment and you are the winner. That is actually the subject of presented thesis.

When I have met the subject of Computer Technology used in Environmental Protection problems for the first time I was delighted. I have finally found something that could be the challenge for the huge part of scientific life. I started to look for more information. I was impressed there are so much of them. I felt as if I have never been aware of so much achievements existing. Then I made small review at my University resulting in the publication I am presenting.

ENVIRONMENTAL SIMULATION

Definition

Environmental Simulation - An environmental management information system that integrates monitoring and simulation modeling for environmental decision support in any area. The project develops and demonstrates an environmental decision support system based on a modular and distributed client-server architecture using wide-area network technology and the Internet to connect clients, monitoring networks, and high-performance model servers.



WHAT IS THE AIM OF THE PRESENTATION ?

Knowledge for the Development of Sustainability Goals.

Perhaps one of today's most frequently discussed questions is how humankind is to evolve in the future without destroying the foundations of its own existence.

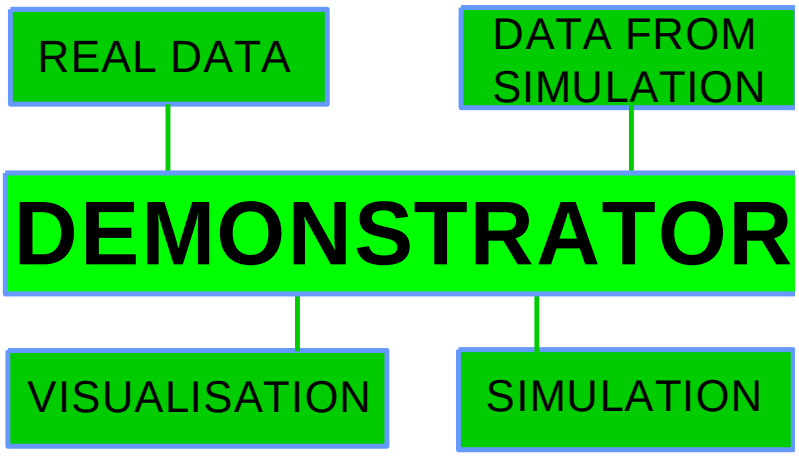
The transition into the third millennium is, above all, marked by a growing awareness of global problems that threaten the further development of mankind. For this reason, the search for criteria, concepts and strategies for a long-term and globally sustainable development has become a major topic in science, policy and society.

The key model here is that of an environmentally compatible, sustainable development. At the environmental summit held in Rio de Janeiro in 1992, a large number of countries undertook to implement this idea of sustainable development. But how this is to be achieved in concrete terms is still a matter of contention.

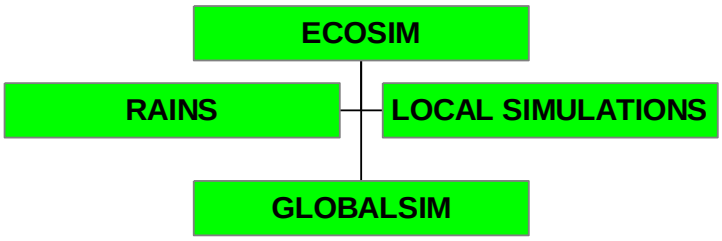
WHY DO WE NEED IT ?

- Analysis of the data and functions.
- Sources of pollution, rate of emission assessment.
- Prognosis of the quality of air, underground water and inshore waters
- Determining and understanding the causes and effects of quality of air, underground water and inshore waters.
- An effective strategy for controlling emission, traffic, waste control and environment monitoring.
- General effectiveness of action of political circles and people at posts dealing with environmental issues.
- Permanent improvement of air, underground water and inshore waters quality.
- Reaction time to environmental changes, and efficiency in planning and making decisions (their cost and duration).
- Participation in decisions planning and access information about the environment.

WHAT KIND OF METHODOLOGY IS USED ?



EXAMPLES OF SIMULATIONS IN THE WORLD (CONFERENCES, ASSOCIATIONS).



HOW IT ALL WORKS ? - PRACTICAL EXAMPLE

EXAMPLES OF ENVIRONMENTAL SIMULATION PROJECTS:

Globalsim
The objective of the M3 project is the realization of a Simulated World involving real human actors in a virtual reality environment based on multidisciplinary simulation models. The distributed design of the M3 system aims at integrated simulation of complex processes belonging to heterogeneous levels of reality, paying specific attention to real human modes of conduct.

ECOSIM - Ecological and environmental monitoring and simulation system for management decision support in urban areas

RAINS - Regional Air Pollution Information and Simulation Model

RESPONSIBILITY PROBLEMS.

a. Different points of view:
People:
- Sociological,
- Economical,
- Scientific.

b. Different approaches:
Science:
- Co-relations,
- Connections,
- Interactions.

c. Critical approaches:
- Contradictions,
- Constraints,
- Competition between concurrence.

CONCLUSIONS

Comparison of Projects presented in the presentation:
- range of the project
- number of parameters taken into account
- implementation technique
- visualisation

MY OWN CONCLUSIONS

Strategy of any simulation consists of a lot of stages as it concerns very difficult scientific approach in at least few fields of study. That is why the strategy of decision making in implementation of the project represents a huge structure.

When one makes decision in implementation of the new technologies in real environment, one should be aware of the difficulty of the project. Especially because of the fact that the decision leads to some results and the person who decides is responsible for the effects of its behavior.

During the realization of the environmental simulation one is able to avoid the situation of environmental deterioration, however it may happen in reality. The advantage of simulation application is the fact that we – as the virtual actors in a new (virtual reality) can be aware of the results of our decisions. We consider of course the effects of environmental damaging, but we would never lead to such a harmful situation. Thanks to the simulation we can understand the risk better, asses it or even recalculate the economic revenue avoiding the deterioration.

The structure of decision making and solving the proper problems can be a key to the success until one thinks reasonably, taking into account different attributes, criteria (the needs, the duties…).

Questions which arise to consider in that area are:

- Should we sacrifice one field of study to succeed in the other one ?
- What kind of relation exist between different points of view ?

In my opinion our duty is to consider all the aspects we can imagine in each important field of study or even more, when implementing environmental simulation. We should be also aware of all the limits which exist (stiff limits) or may exist (elastic limits).

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"Water Quality of the Vistula Lagoon on the base of monitoring research (1993 – 2002)".

Introduction

The Vistula Lagoon is the biggest water body of the south Baltic. It is separated from the Bay of Gdańsk by the Vistula Sandbar – narrow belt of land formed from dune sand. The Straits of Pilava connects the Vistula Lagoon with the Bay of Gdańsk. The frontier between Poland and Russia dinids the basin into two parts: southwestern Polish part and northeastern Russian one.

Table 1. The basic morphometric data of Vistula Lagoon (on the base: K. Łomniewski „Zalew Wiślany")

Specification	Total	In this	
		Poland	Russia
Area of water body	838 km^2	328 km^2	510 km^2
Length	91 km	36 km	55 km
Width max.		11 km	13 km
Width mean	9,2 km	8,9 km	9,5 km
Width min.		6,8 km	
Depth max.		4,4 m	5,1 m
Depth mean	2,6 km	2,4 km	2,8 km
Length of the coast line	270,0 km	110,km	159,0 km
Capacity	2,5 km^3	0,8 km^3	1,5 km^3

The Vistula Lagoon together with the coast is the unique area considering landscape and reach of mineral and healing waters. Fishering is one of the main sources of income for living around the Lagoon people. Herring, eel (Anguilla anguilla), bream (Abramis brama), pike perch (Lucioperca lucioperca), roach (Lenciscus rutilus) and Pelectus cultratus, carp (Cyorinus carpio), burbot (Lota lota), perch (Perca fluviatilis) and smelt sparling (Osmerus eperlanus) – they are main species of the economic importance.

Area of the Vistula Lagoon catchments is 23 870 km^2 from this 14 504 km^2 there is in Poland. The catchment area consists of a few main rivers and some smaller direct

catchments. The following major rivers are discharging into the Lagoon: Bauda, Elbląg, Nogat and Pasłęka.
There are numerous nature reserves in the Vistula Lagoon catchments:
Złota Wyspa, Zatoka Elbląska, Jezioro Drużno – water bird refuges,
Kąty Rybackie – old growth pine forest and nesting area of black cormorant (Phalacrocorax carbo),
Buki Mierzei Wiślanej – natural stand of European beech (Fagus silvatica),
Buki Wysoczyzny Elbląskiej – association of the Pomeranian beech wood,
Kadyński Las – old growth oak-beech forest,
Pióropusznikowy Jar – stand ofostrich fern (Struthiopteris germanica),
and two landscape parks: Landscape Park of Elbląg Elevators and Landscape Park of Vistula Bar.

Sources of pollution in Polish part of Vistula Lagoon

Table 1. Loads of pollutant discharged from waste water treatment plants directly to the Vistula Lagoon in 2002 (data from warmińsko-mazurskie and pomorskie provinces)

Specification	Type of sewage; Type of treatment plant	Amount of sewage (m^3/rok)	Loads of pollutants (Mg/year				
			BOD_5	COD-Cr	Total suspension	Total nitrogen	Total phosphorus
Waste water treatment plant in Tolkmicko	Municipal; mechanical-biological sewage treatment plant	268000	5,6	26,9	6,3	1,3	4,1
Water main and sewage system at Frombork	as above	330325	1,5	9,6	17,9	13,5	0,8
Enterprise of Water main and sewage system in Krynica Morska	as above	348940	17,8	68,0	18,5	14,4	2,6
Water-sewage co-operative at Piaski	as above	16252	2,5	5,1	1,2	1,2	0,1
Sum:		963517	27,4	109,6	43,9	30,4	7,6

Table 2. Pollutant loads discharged with rivers from warmińsko-mazurskei and pomorskie provinces (data from 2002).

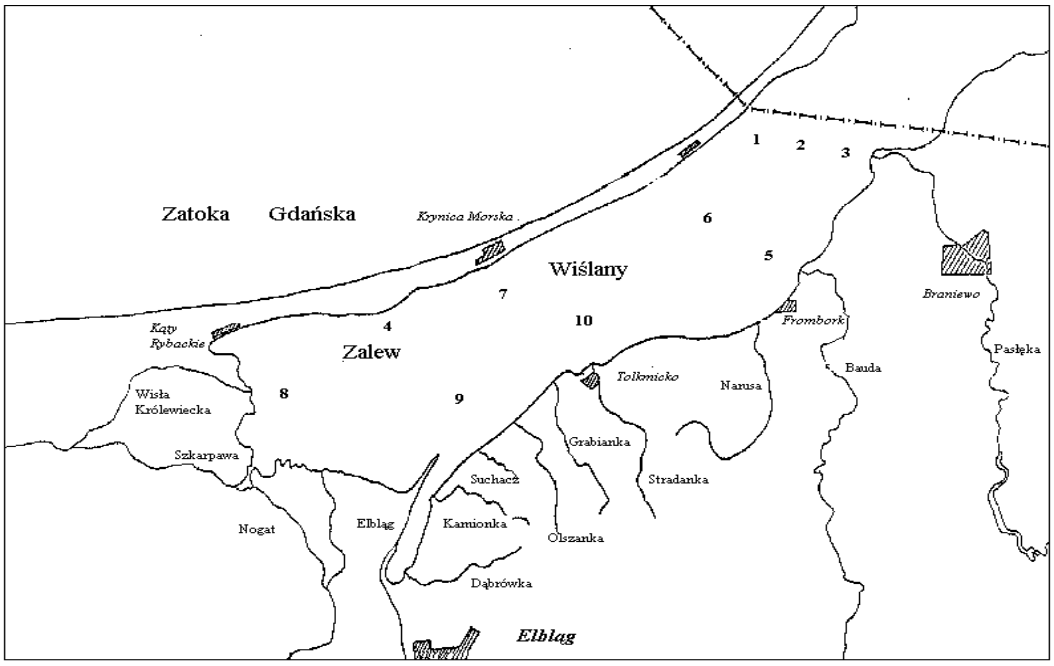
	Name of river	Flow $Q_{śr.}$ (m^3/s)	Pollutant loads (Mg/year)				
			BOD_5	COD-Cr	Total suspension	Total nitrogen	Total phosphorus
	Wisła Królewiecka*	0,8	86,0	794,4	328,9	63,8	3,8
	Szkarpawa*	2,35	178,4	2942,8	966,1	139,7	8,9
	Nogat	7,1	694,1	6493,3	2239,1	635,9	67,2
	Cieplicówka	0,75	93,2	794,9	205,8	64,6	9,6
	Elbląg	8,6	1057,7	9194	4068	802,8	94,9
	Dąbrówka	0,085	7,8	65,1	52,9	5,6	1,1
	Kamionka	0,08	6,8	43,6	40,6	3,7	1
	Suchacz	0,045	4,4	21	22,4	2,5	0,7
	Olszanka	0,06	5,4	33,3	23	3,3	0,6
	Grabianka	0,12	11,2	77,5	88,6	7,3	1,6
	Stradanka	0,22	18,9	154,3	96	16,2	2,5
	Narusa	0,3	32,2	170,3	113,5	23,5	3,3
	Bauda	2,7	195,8	1822,2	1106,9	172,9	26,4
	Pasłęka	16,75	1214,9	12149,2	3697,6	961	126,8
Sum:			3606,8	34755,9	13049,4	2902,8	348,4

Talba 3. Balance of pollutant loads discharged to the Vistula Lagoon from warmińsko-mazurskiego and pomorskie provinces. Years 2000-2002

Year	Amount of sewage	Pollutant loads from point sources Mg/year					Pollutant loads discharged with rivers Mg/year				
		BOD_5	COD-Cr	Tot. suspension	Total N	Total P	BOD_5	COD-Cr	Tot. Suspension	Total N	Total P
2000	813 897	22,0	80,9	24,4	25,4	4,7	3740,1	33 869,2	14 433,0	2701,2	310,7
2001	866 325	14,4	117,1	13,5	28,7	3,3	3274,1	34 444,5	10 694,8	3243,7	323,7
2002	963 517	27,4	109,6	43,9	30,4	7,6	3606,8	34 755,9	13 049,4	2902,8	348,4

Research methods

Voievodship Inspectorate of Environmental Protection in Olsztyn, Division in Elbląg since 1993, carries on monitoring of Vistula Lagoon water. Water sampling – once a year in the period from April till November from surface level in 10 points located in Polish part of Lagoon.



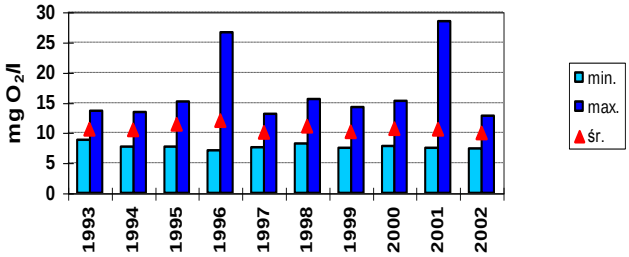
Map 1. Location of the monitoring points

temperature of water and air, salinity, concentration of dissolved oxygen and oxygen saturation and Secchi measurements are done during sampling. The remain determinations are made in Division laboratory.

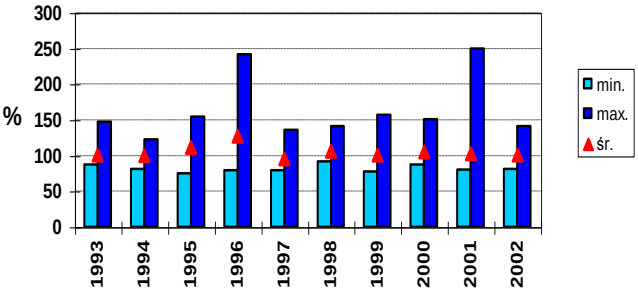
Quality of surface water in Vistula
Salinity
Water salinity was changed during seasons (it increases from April till November) and in the space (the lowest values were observed in western part of Lagoon). In spring sweet river waters affect the salinity and in autumn it is depended on flow of salt sea water (particularly during autumn storms). Chemical characteristic of water is varied and it depends on continuous water exchange between Vistula Lagoon and the Bay of Gdańsk.

Oxygenation of water in Vistula Lagoon
Concentration of oxygen dissolved in water in 2002 was ranged from 7,4 (in April) to 12,8 mg O_2/l (in November); it corresponded to water oxygenation from 81% to 141%. High values of water oxygenation in surface level are connected with high, long lasting, level of primary production.

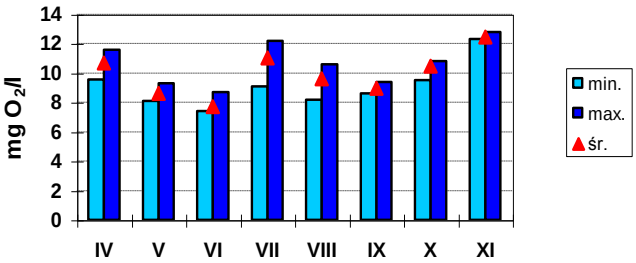
Ryc.4. Stężenie tlenu rozpuszczonego w wodach powierzchniowych Zalewu Wiślanego w latach 1993-2002 - wartości ekstremalne i średnie



Ryc.5. Natlenienie wód powierzchniowych Zalewu Wiślanego w latach 1993-2002 - wartości ekstremalne i średnie



Rys.6. Stężenie tlenu rozpuszczonego w wodach powierzchniowych Zalewu Wiślanego w 2002 roku · wartości ekstremalne i średnie



Reaction and water transparency
Small depth and limited exchange of water determinate the eutophication of the Lagoon water. Intensive phytoplancton blooms cause the increasing of the water reaction and decreasing of the water transparency. PH in 2002 ranged from 8,1 to 9,4 and value of water transparency ran from 20 to 100 cm. Decreasing of the water transparency is caused by intensive waving which rises the benthal sediments.

Chlorophyll-a – is an indicator, which shows the intensity of photosynthesis. High values of the indicator are observed for many years. Concentration of chlorophyll-a in 2002 ran from 7,48 to 528 mg/m^3

Biogenous substances
Concentration of nitrogen and phosphorus in the Lagoon waters seasonally varied. In 2002 they ranged:
N-NH4 – from 0,05 (April) to 0,25 mg N/l (July)
N-NO3 – from 0 (May, November) to 0,97 mg N/l (July)
P-PO4 – from 0,003 (May, July) to 1,18 mg PO_4/l (October)
P-total – from 0,05 (April) to 0,64 mg P/l (October).
Seasonal changes in N and P concentration in 2002 were typical:
The highest concentration N-NH4 was in August (0,07 - 0,18 mg N/l), the lowest - in April (0,05- 0,13 mg N/l)
The highest concentration of N-NO3 were observed in July (0,2 - 0,97 mg N/l) and in November (0 - 0,82 mg N/l), the lowest – in June (0,001 - 0,61 mg N/l);
The highest concentration of P-PO4 was in September (0,64 - 1,02 mg PO_4/l), the lowest – in April (0,06 - 0,08 mg PO_4/l), in May (0,03 - 0,16 mg PO_4/l) and in June (0,054 - 0,195 mg PO_4/l)
The highest concentration of P-total was in September (0,38 - 0,54 mg P/l), the lowest – in April (0,05 - 0,09 mg P/l).

Organic substances
Indicators determinate content of organic substances: BOD_5 (easily decomposed organic substances and COD (difficultly decomposed organic substances). In 2002 values of BOD5 ran from 1,4 to 22,0 mg O_2/l and COD: from 31,9 to 132,4 mg O_2/l.

Sanitary quality of water
Water sanitation is estimated by coli test. Water quality regarding its sanitation has improved since 1997. It is an effect of realized investment according sewage management in Vistula Lagoon catchments.

Toxic substances
Twice a year concentration of chosen dissolved heavy metals and once a year – organochloric pesticides are investigated. It is not observed change in concentration of toxic substances.

CONCLUSION

Vistula Lagoon has not beneficial natural attributes (big area, small depth), which cause its high sensibility. Pollutions from point and non-point sources discharged into the Lagoon are the reason of its eutrpphication. Simultaneously benthal sediments are rised during intensive waving and they are again introduced into the pollutant circulation.
Summary: Krystyna Terlikowska; Institute for Land Reclamation and Grassland Farming, at Falenty, Research Division in Elbląg

(Summary: Krystyna Terlikowska; Institut for Land Reclamation and Grassland Farming at Falenty, Research Division in Elbląg)

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"Gas extraction techniques in environmental pollutants analysis".

Abstract:

The increase attention focused on the detection and quantitation of species in different environmental elements of our environment is mainly due to an environmental concern and the role they play in global chemical cycles. Because the ubiquitous presence of some organic compounds in different environments affects human health, it is necessary to determine them at low and very low levels (ppm-ppb). The determination of contaminants may provide useful information on their source input (spillages or natural processes, their occurrence and behaviour. The information can be also important for designing the adequate remediation strategies.

Direct analysis of some contaminants of environment, e.g. volatile organic compounds, preferred as quicker and easier to perform, is generally difficult due to their low concentrations, typically less than the ppb level. Such concentrations are frequently below the direct quantification limits for most of the current methods. Therefore, preconcentration or/and isolation procedures have to be applied before final determination.

In this work, four most popular gas extraction techniques used for the isolation of organic compounds from different matrices have been presented. The principles, advantages and disadvantages of the following techniques:

- static Headspace Analysis (HS)
- dynamic Purge and Trap (PT)
- solid phase microextraction (SPME)

These techniques are widely used in environmental analysis due to the fact that they can be considered as a proecological (solvent free) methods of isolation and enrichment. Furthermore, most versions of these techniques provide the required sensitivity (even to ppt level) and can be automated by connection with gas chromatography, the preferred method for determination of organic species.
The examples of application of all discussed techniques for determination of selected organic pollutants are also given.