I[st] Young Scientist Conference

World Water Day

THREATS, PROTECTION AND MANAGMENT OF WATER RESOURCES

March 22-23, 2012
Poznań, Poland

Collegium Biologicum UAM
ul. Umultowska 89
61-614 Poznań

www.hydrokonferencja.amu.edu.pl
h2okonf@amu.edu.pl

1[ST] YOUNG SCIENTIST CONFERENCE

WORLD WATER DAY

MARCH 22-23, 2012

ADAM MICKIEWICZ UNIVERSITY, POZNAŃ, POLAND

BOOK OF ABSTRACTS

FRESHWATER ULVA (CHLOROPHYTA) AS A BIOACCUMULATOR OF HEAVY METALS POLLUTION IN NIELBA RIVER (WIELKOPOLSKA REGION)

BEATA MESSYASZ, ANDRZEJ RYBAK, MARTA PIKOSZ *

DEPARTMENT OF HYDROBIOLOGY, FACULTY OF BIOLOGY,
ADAM MICKIEWICZ UNIVERSITY, UL. UMULTOWSKA 89, 61-614 POZNAN, POLAND
**corresponding author: marta_pikosz@wp.pl*

Water pollution, whose source are pesticides and chemical fertilizers from catchment areas, in result enrich the aquatic environment in heavy metals. These water contamination is accumulated in tissues of living organisms. A high degree of accumulation of dissolved metals is noticeable in macroalgae. To the one of the most tolerant group to high levels of water contaminations belong both marine and freshwater green algae from *Ulva* genera.

The main aim of these study was to show contamination levels of heavy metals (Cd, Ni and Pb) in the freshwater *Ulva* growing in polluted water in Nielba River.

Studies were carried out at six sampling stations of the Nielba River in Wągrowiec (north-east of Wielkoposka Region), between Janowiecka Street (E17°12'59.6"N52°48'27.3") and the crossing Nielba River with Wełna River (E17°12'35.6"N52°48'11.3"). Samples of freshwater *Ulva* thalli and water samples were collected from Nielba River three times during the summer seasons in 2010. Analysis included measurement of physical and chemical parameters of water and cadmium, nickel and lead concentration in biota.

Results show that metals content in the thalli depend on location and time of sampling. However, in the water, values of examined heavy metals show low content, definitely lower values than in the thalli. Cadmium (Cd) was below detection limit in the water in contrast to thalli, where in dry weight were from 0.09 $\mu g \cdot g^{-1}$ to 0.27 $\mu g \cdot g^{-1}$. In the water detect small amounts of Pb - lead (0.00 – 0.02 $\mu g \cdot ml^{-1}$), whose one time exceed, in the *Ulva* 13.0 $\mu g \cdot g^{-1}$d.w. Among the analyzed metals, nickel (Ni) have the highest content in the thalli, which generally were above 20 $\mu g \cdot g^{-1}$d.w, when the maximum value was 55.9 $\mu g \cdot g^{-1}$d.w.

FRESHWATER *ULVA* (*CHLOROPHYTA*) AS A BIOACCUMULATOR OF HEAVY METALS POLLUTION IN NIELBA RIVER (WIELKOPOLSKA REGION)

BEATA MESSYASZ, ANDRZEJ RYBAK, MARTA PIKOSZ

Department of Hydrobiology, Institute of Environmental Biology, Adam Mickiewicz University Umultowska 89, 61 – 614 Poznań, Poland

INTRODUCTION and AIM

Human activities still increase and causes negative impact to environment and consequently lead to ecological degradation. Water pollution, whose source are pesticides and chemical fertilizers from catchment areas, in result enrich the aquatic environment in heavy metals. These water contamination is accumulated in tissues of living organisms. A high degree of accumulation of dissolved metals is noticeable in macroalgae. To the one of the most tolerant group to high levels of water contaminations belong both marine and freshwater green algae from Ulva genera. The main aim of these study was to show contamination levels of heavy metals (Cd, Ni and Pb) in the freshwater Ulva growing in polluted water in Nielba River.

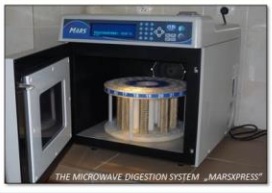
STUDY AREA

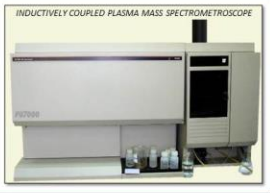
Studies were carried out at six sampling stations (1-6) of the **Nielba River in Wągrowiec** (north-east of Wielkoposka Region), between Janowicka Street (E17°12'59.6''N52°48'27.3'') and the crossing Nielba River with Wełna River (E17°12'35.6''N52°48'11.3'').

Samples of freshwater *Ulva* thalli and water samples were collected from Nielba River three times during the summer seasons in 2010.

METHODS

The content of Ni, Cd and Pb ions in the investigated samples were determined, after previous mineralization in a microwave oven Mars Xpress, on an inductively-coupled plasma emission spectrometer VISTA-MPX produced by VARIAN ICP. Calibration was performed using aqueous standard solutions. After the mineralization, the samples were quantitatively transferred into 10 ml flasks, filled up with redistilled water and then, the content of Ni, Cd and Pb ions were determined.


THE MICROWAVE DIGESTION SYSTEM „MARSXPRESS"


INDUCTIVELY COUPLED PLASMA MASS SPECTROMETROSCOPE

RESULTS

PHYSICAL AND CHEMICAL PARAMETERS

MEAN CONCENTRATION OF MEASURED CHEMICAL PARAMETERS OF THE WATER FOR EXAMINED SITES FROM NIELBA RIVER IN 2010

Factors / Sites	$N\text{-}NO_3^-$ (mg L^{-1})	$N\text{-}NH_4^+$ (mg L^{-1})	$N\text{-}NH_4^+$ (mg L^{-1})	Fe_{total} (mg L^{-1})	$P\text{-}PO_4^{3-}$ (mg L^{-1})	NaCl (mg L^{-1})
1	1.23	0.62	0.80	0.12	0.11	130.76
2	1.27	0.47	0.61	0.03	0.10	106.29
3	1.23	0.25	0.32	0.06	0.33	107.53
4	1.27	0.50	0.65	0.02	0.16	101.34
5	1.17	0.25	0.32	0.01	0.19	99.96
6	1.03	0.64	0.83	0.10	0.19	97.90

MEAN CONCENTRATION OF MEASURED PHYSICAL PARAMETERS OF THE WATER FOR EXAMINED SITES FROM NIELBA RIVER IN 2010

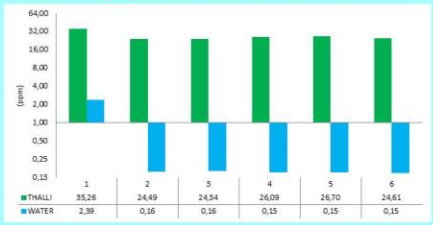
Factors / Sites	Temp (°C)	DO (%)	DO (mg L^{-1})	pH	TDS (mg L^{-1})	Cond.(µS·cm^{-1})
1	20.40	96.77	8.83	7.76-8.39	529.00	765.33
2	20.36	98.17	8.97	7.83-8.31	529.00	764.33
3	20.13	92.17	8.25	7.79-8.28	529.67	764.67
4	19.81	93.00	8.50	7.80-8.16	529.33	762.67
5	20.77	102.40	9.29	7.85-8.46	525.17	770.33
6	20.81	107.93	9.64	7.86-8.56	525.17	770.00

DO – dissolved oxygen TDS – total dissolved solids Cond. - conductivity

WATER CONDITIONS FOR *ULVA* DEVELOPMENT

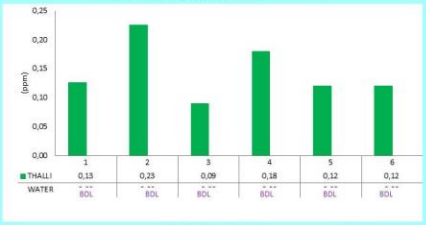
- HIGH NUTRIENT CONTENT
- TEMPERATURE ABOUT 20°C
- PERIODICALLY INCREASED LEVEL OF CHLORIDES
- ALKALINE pH (7.78 – 8.46)

NICKEL (Ni) IN THE WATER & IN THE THALLI



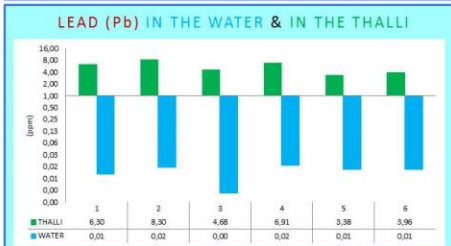
1-6 RESEARCH STANDS

CADMIUM (Cd) IN THE THALLI



BDL – BELOW DETECTION LIMIT 1-6 RESEARCH STANDS

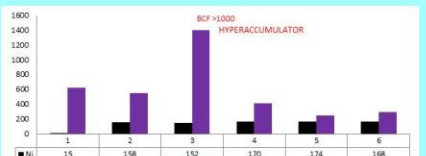
LEAD (Pb) IN THE WATER & IN THE THALLI



1-6 RESEARCH STANDS

BIOCONCENTRATION FACTOR (BCF)

BCF = mean concentration of metal in plant tissue (µg g^{-1} dry wt) / mean concentration of metal in the water (µg ml^{-1})



1-6 RESEARCH STANDS

CONCLUSION

The results of physico-chemical analyses show that water in Nielba river is polluted and enrich in heavy metals. Concentration of accumulated heavy metals (Ni, Cd and Pb) in the thalli of green algae could be even thousand times higher than in the water from the *Ulva* sites. Metals accumulation by freshwater *Ulva* thalli decrease in order: **Ni > Pb > Cd**. *Ulva* is accumulator of heavy metals and it is able to be a hyperaccumulator for Pb, because recorded higher value of BCF than 1000.

The study was supported by the Polish Ministry of Education Science grant No. N N304 0134 37 and by Dean of the Faculty of Biology, AMU Poznan, Poland; project: GDWB-07/2011