

Norwegian University of Life Sciences



Outline

- Educational background
- Teaching and research activity today
- FOSRIN WP-5; 2006-2009

Elin Gjengedal

- PhD Environmental Chemistry (1992)
 - Mobility of metals in soil and plants
- Associate Professor since 1995
 - Responsible lecturer
 - Inorganic chemistry (10 credits)
 - Analytical Chemistry (10 credit)
 - Instrumental inorganic analysis (10 credit)
 - Quality assurance; technical assessor since 2006
 - Main research activities (2 PhD students, 6 MSc students)
 - Mobility of metals in soil and plants
 - Renewable energy (Bioenergy)
 - Waste handling (MSW)
 - Nature-based cleaning off effluent streams



Instrumental inorganic analysis

- Method development
 - Soil, sediment, water, biological samples...
 - Determine total content of metals
 - Size charge fractionation of metals (bioavailability)
 - Sequential extraction (chemical binding)
- Method validation
- Equipment
 - Sampling
 - Sample preparation
 - Detection of analytes
- Clean room facilities



MW, Ultraclave

FL-AAS, FL-AES

FIMS

ET-AAS

ICP-OES, ICP-MS

IR-MS (Isotopic ratio)

UMB - Forskning på UMB - Helse - Microsoft Internet Explorer

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OM UMB UTDANNING FORSKNING ENGLISH

Universitetet for miljø- og biovitenskap

Forskning på UMB

Hovedsiden

Store satsinger

- Akvakultur
- Bioteknologi
- Helse
- Mat
- Miljøforskning
- Næringsutvikling

For næringslivet

- Næringsutvikling

For pressen

- Pressekontakt

Administrasjonen

- Eu og EFTA
- Etikuttvalget
- FORSKDOK
- Forskerutdanning
- Mobilitetsportal
- Om avdelingen

FORSKNING YED UMB

Helse [Elin Judit Straumsvåg]

Helse ved UMB - Forebygging og rehabilitering

Mat og helse	Natur, helse og livskvalitet	Helse og utvikling
Råvarekvalitet	Gård, nærmiljø og rehabilitering	Fattigdom og mat
Ren og trygg mat	Urbane omgivelser og natur	Landbrukspolitikk
Funksjonell mat	Rekreasjon og friluftsliv	Vannkvalitet
Matglede		

• **Visjon:**
UMB skal være et nasjonalt senter for mat, natur og livskvalitet, vann og utviklingsproblematikk knyttet til helse.

• **Mål:**

GÅ DIREKTE TIL:
Velg enhet

SØK UMB:
Velg område Søk

RELASJONER TIL SAKEN

- Ledergruppe
- Forskergrupper
- Fagforum
- Helseseminarer

Last ned Studieguide
Gå til biogramgenerator
Se kurstilbud

start MightyDrive (F:) Microsoft PowerPoint ... UMB - Forskning på U... NO 18:38

Research program starting 2006 on Food security and health



Mobility of metals in soil and plants

- Micro nutrients (trace elements)
- Macro nutrients
- Heavy metals





Iodine in berries from *Vaccinium myrtillus* as infant nutrition

Eirin Færevik, Elin Gjengedal & Tore Kroghstad
 Dept. of Plant and Environmental Sciences, Norwegian University of Life Sciences, N-1432 Aas, Norway

Introduction

Iodine is an important element when it comes to human and animal health, as it is a fundamental constituent of the thyroid function, playing an important role in controlling growth and development (Haldimann et al. 2000). Iodine deficiency disorder (IDD) can be expressed in all stages of development, but especially in periods of rapid growth, such as foetus, the neonate and the infant. The most common effect of IDD is goitre (WHO 1996). This deficiency was first discovered in areas far away from the sea (Oliver 2003).



Figure 1. Plant and berries from *Vaccinium myrtillus*

Material and Method

The species selected in this work, *Vaccinium myrtillus*, has from a health aspect well documented positive effects. It contains relatively high amounts of anthocyanidins, thus the species has property as antioxidants (Haugover 2002). *Vaccinium myrtillus* is a common species in Norway, occurring i.a. in *Betula* sp. mixed forest as indicated in fig. 2.

The concentration of iodine in berries will be determined by inductively coupled plasma isotope dilution mass spectrometry (ICP-IDMS) after freeze-drying and nitric acid digestion. To reduce the uncertainty due to matrix effects, the long-lived radioactive isotope ¹²⁹I will be applied (Haldimann et al. 2000).

References

Haldimann, M., Esrigala, A. & Eisenreich, S. 2000. Improved measurement of iodine in food samples using inductively coupled plasma isotope dilution mass spectrometry. *Analyst* 125, pp. 1975-1982.

Haugover, S. 2002. *Wider i busten*. Available: <http://www.forbikning.no/Artikler/2002/02/01/04991/0465/02/27.06.02/>

Kabata-Pendias, A. & Pendias, H. 2001. *Trace elements in soils and plants*. 3rd edn, CRC Press LLC.

Oliver, M.A. 2003. "Soil and human health: Geomedical aspects in relation to agriculture". In: E. Stalans (ed). *Geomedical Aspects of Organic Farming*. The Norwegian Academy of Science and Letters, Oslo.

WHO 1996. *Trace Elements in Human Nutrition and Health*. World Health Organization, Geneva.

Design & Layout: Signe Dahl, IPAC UMB



Figure 2. An overview of sampling locations in Norway.

Sampling

Samples of leaves, twigs, and berries from *Vaccinium myrtillus*, in addition to samples of the soil profile have been collected from different locations as shown in fig. 2. By choosing sampling locations in three different gradients:

- North-south (Lofoten - Mojoson) (Fig. 2a)
- West-east (Selje - Sotraseteren) (Fig. 2b)
- South-north (Tvedestrand - Kittilva) (Fig. 2c)

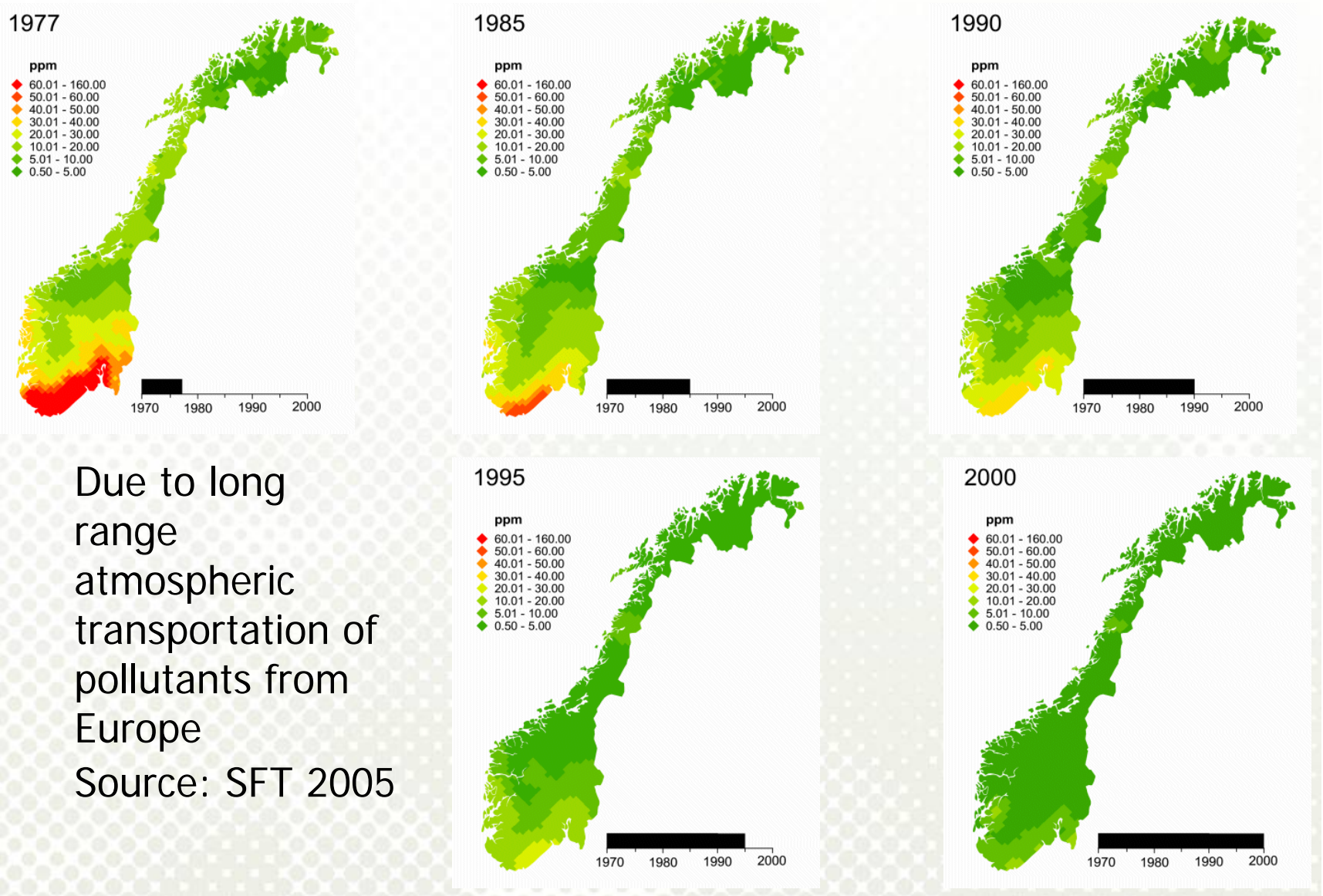
possible geographical variations in iodine concentration will be found as a function of distance from the coast.

Discussion

Previous works indicate that the concentration of iodine in natural soils is mainly related to distance from the coast (Oliver 2003). Plants are able to absorb iodine directly from the atmosphere and atmospheric deposition can therefore contribute significantly to the iodine content in plants (Kabata-Pendias & Pendias 2001). Determination of low concentrations of iodine can be an analytical challenge, especially when digested in acid, due to the formation of volatile species such as HI and I₂. Therefore, sample preparation and digestion are the most critical analytical steps in iodine determination (Haldimann et al. 2000).

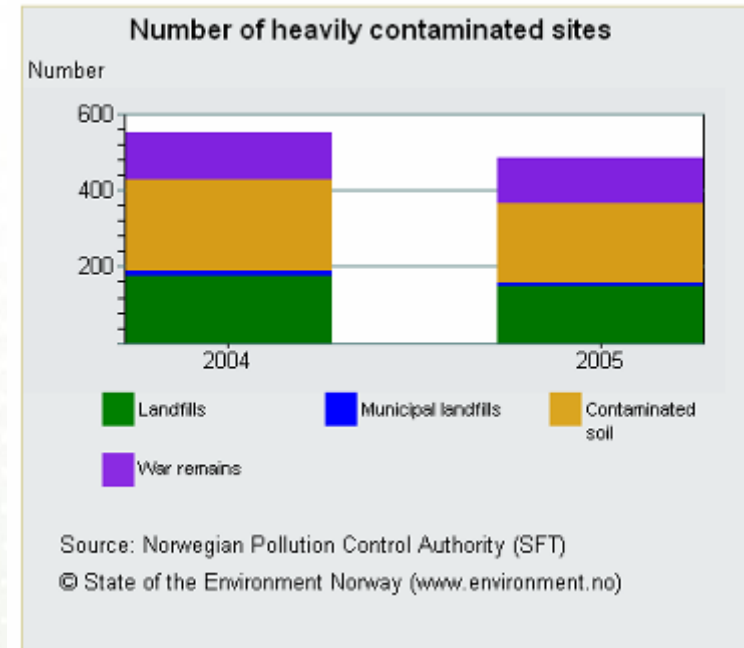
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Lead in moss (*Hylocomium splendens*)




Remediation of contaminated soil

- Diffuse sources
 - Contaminated soil, old sanitary landfills, sewage and dumping of products containing hazardous waste
 - 3000 potentially sources in Norway; 484 identifies as seriously contaminated (SFT 2005)
- Options for soil remediation include
 - Removal
 - Covering
 - Isolation
 - In situ clean-up operations
 - Deposit



Sorption of metals by naturally growing medias – Ecological engineering

- Peat
 - Is degraded plant material (*Sphagnum*)
 - Contains carbohydrates, amino acids and protein, lipid, nuclein acids, lignin and humic and fulvic acids
 - Has a high cation exchange capacity, and is an effective sorbent of heavy metals
- Sorption processes is dependent on type of peat and on concentration of metals, pH, and ion strength




Comparison of heavy metal removal from water by peat and algae treated peat

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 Norwegian University of Life Sciences, Department of Plant and Environmental Sciences

Goal of experiment:

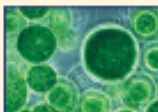
- define range of use for peat as a sorbent for heavy metals;
- study kinetic of the sorption process;
- evaluate the influence of Ca²⁺ on metal sorption by peat;
- assess the effect of microalgae on metal sorption by peat;

Characteristics of microalgae making possible to use it for metal sorption:



Humic and fulvic acids, plant residuals with different degree of degradation, lignin, bearing polar functional groups can be in charge of chemical bonding, complexation, ion-exchange and adsorption of heavy metals on peat.

Characteristics of peat making possible to use it for metal sorption:




Biosorption in algae has been mainly connected to the cell wall properties. Both electrostatic interaction and complexation can be involved in metal sorption mechanisms. Alginate polymer, present in a cell wall, has a tendency to absorb metal cations.


Metal solution* used for sorption experiment, mg·l ⁻¹							Characteristics of microalgae used in study			
Element	Cu	Zn	Cd	Ni	Pb	Co	Class	Genus	Fresh/Marine	Strain
Solution1**	30	15	0.3	3	3	15	Phycochlorophyceae	<i>Isoclysis galbana</i>	Marine	NVA-451
Solution2	300	150	3	30	30	150	Phycochlorophyceae	<i>Porosira lutheri</i>	Marine	NVA-451
							Chlorophyceae	<i>Pseudochlorella subcapitata</i>	Fresh	CHL1
							Eustigmatophyceae	<i>Nannochloropsis</i> sp.	Marine	–
							Eustigmatophyceae	<i>Chlorella</i> sp.	Marine	–

*To evaluate influence of Ca, its concentration was taken 10 (Ca1) and 100 (Ca2) mg·l⁻¹ for each metal solution.
 ** Corresponds to the limit for leachate from landfills with disposed inert waste. Commission of European Union, 2002.


Scheme of experiment



Incubation of granulated peat with algae on a shaker at 75 rpm



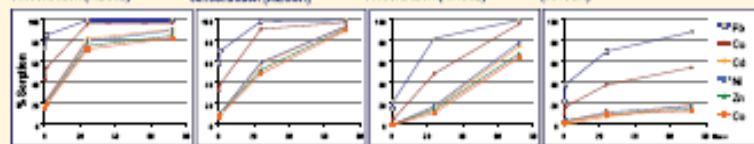
Sorption experiment: 1g peat/ 50 mL of metal solution at room temperature (20 °C)



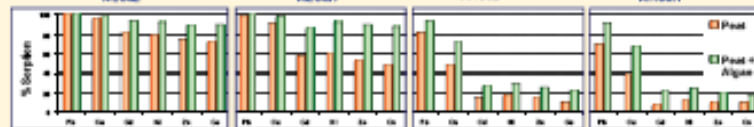
Determination of metal concentrations in supernatant by ICP-OES

Results

Kinetic of sorption by peat from solution with: low metal and low Ca-concentration (MLCa1), low metal and high Ca-concentration (MLCa2), high metal and low Ca-concentration (MHCa1), high metal and Ca concentration (MHCa2)



Comparison of metal sorption by peat and microalgae treated peat, sorption from 1 day, 1 g/50 mL:



Conclusions

1. 80-85% of all the metals in solution with low metal concentrations (solution 1) were taken up by peat
2. Pb and Cu showed the highest affinity to the sorbent
3. Ca had a rather strong influence on uptake of all the metals by pure peat, especially Ni, Cd, Co and Zn
4. The rate of metal sorption decreased with increasing content of Ca in metal solution
5. Treatment by microalgae improved metal uptake by peat and reduced the influence by Ca

Design & layout: Zilwa Daik, PhD UMB

FOSRIN – WP 5

- Interlaboratory comparison on analytical methods
- Standard reference material
- Essential mineral content of ricebean crops produced with improved methods; e.g. B, Zn, Mo
 - Screening
 - Detail work on selected material
- Tolerance to heavy metals (acid soil)
- Micro nutrient content in ricebeans vs prepared food



Bioavailability and uptake of metals in ricebean growing on acid soils

MSc thesis



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