



INIVERSITY OF TECHNOLOGY

FRIST kompetenscentrum

Forum for Risk Investigation and Sustainable Technology





European Regional Development Fund

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Treatment and Management of Organotin and Metal Contaminated Sediment



FORMAS

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Interreg North Sea Region

IMMERSE



Why this research?













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Previous research

Acidic leaching and chemical precipitation for metal recovery

Waste ash, 3% Zn

•70% Zn recovery

•Product with 50% Zn

•Full-scale plant under construction

Ash from contaminated bark, 2% Cu •>80% Cu recovery •Product with 40% Cu

Soil 0,2% Cu •50% Cu recovery •Product with 10% Cu









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Can similar approach be used on sediment?

- Extra challenges
- Organic compounds and metals
- Lower metal content
- Potentials

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- Decreased landfilling
- Decreased transports
- Saves natural resources
- Metal recovery
- Circular economy

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Aim and goal

- Environmental adaptable methods for sustainable treatment of OTs and metal contaminated sediments
- Less disposal and landfilling
- Higher utilization of resources (material and metals)







The sediment research team in IMMERSE:

- + PhD student Anna Norén Chalmers
- + Associate Professor Karin Karlfeldt Fedje Renova/Chalmers
- + Professor Ann-Margret Strömvall Chalmers
- + Professor Yvonne Andersson Sköld VTI/Chalmers
- + Professor Sebastien Rauch Chalmers
- + Associate Professor Oskar Modin Chalmers
- + MSc Anna Wilhelmsson COWI
- + MSc Kristina Bernstén COWI







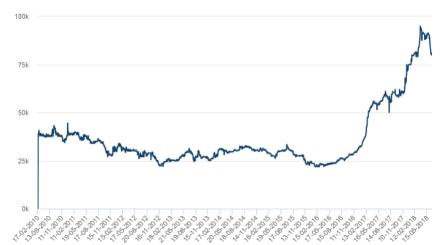


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Metal prices

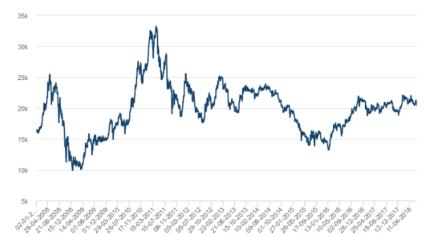
<u>Cobalt</u>

HISTORICAL PRICES GRAPH





LME TIN HISTORICAL PRICE GRAPH





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iunnebostrano Linkoping Vadstena Kungshamn Malmsla Uddevalla Vänersborg Skara Skov Skänning ingsta Grastorp Vargön Mantorp Mjölby rollhättan Vara Valdemars alköping Boxholm 13 Atvidaberg Tidahoim Μ2 Hålavede Rimforsa Heriljunga Tranås inna Vårgårda Kisa Alvänger Alingsås Nödinge Mullel Kungalv Gamleby IT Gråbo Bankeryd M1 Jönköping rum Hindàs Ulricehamn Borås Dalsjöfors Västervik Göteborg Odens Tenhultorserum Eksjö Taberg. Vimr Mölnlycke iskafors Nāssjö Bildal Pritsla Svenljunga Kinna Valida Fjärås Vaggeryd Huitsfred Onsala Skillingarvd Vetlanda Sävsjö Fringsas Læsø Gislaved Anderstorp Ringhals Veddige Bua Värnamo Smålands-Varberg Tvååk Monsterås Hyltebruk Rottne Blom stermåla Kattegatt W Växjö Falkenb Borgholi Alvesta Ljungby Oskarstrom Hovmantorp Nybro Anholt Öland indsdal Halmstad Kalmar Smedby aboda Stromsnäsbru Tingsry Amhult Mellbystrand Alvaret Grenaa Bastad Markaryo Torsås Os For Bjärnum Ängel-Bodeby Ronneby Karlskrona Höganäs Hassle Nättraby Jamjo Gilleleie Tyringe







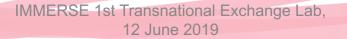




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Sediment characterization

- + TBT is the main problem
- + Cu, Zn, As
- + Determines possible management alternatives













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Summary

- + Useful approach for deciding management options, assessing environmental and economical aspects
- + Need for metal and organotin extraction technology Treat specific particle size or metall (Cu, Zn...)
- + Other treatment methods then leaching



Photoelectrocatalytic degradation of TBT, organic pollutants, microplastics, and simultaneous metal recovery?

Hypothesis: If combining techniques for chemical oxidation, photocatalytic oxidation, and electrolysis it will be possible to degrade organic pollutants, microplastics and TBT; and simultaneously recover metals as for example tin, copper and zinc.

This method can also be useful for sustainable and innovative treatment of, for example, highly polluted street dust and sand, road runoff, urban stormwater sediment, contaminated soil.









Photoelectrocatalytic experiments for degradation TBT and recovery of tin:

Step 1. Fentons reagens (oxidation, degradation)

Step 2. Electrochemical oxidation with metal recovery (oxidation, degradation, metal recovery)

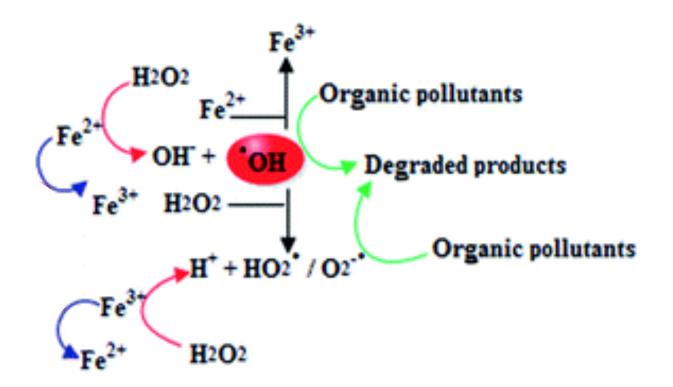
Step 3. Photocatalytic degradation (photoxidation, photodegradation)

Step 4. Combine 2 - 3 and 1 - 3



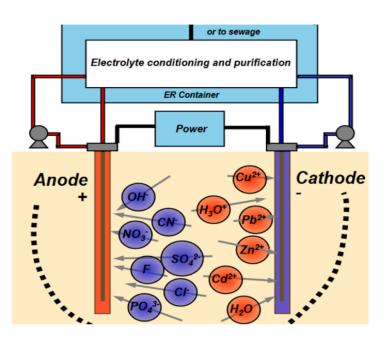


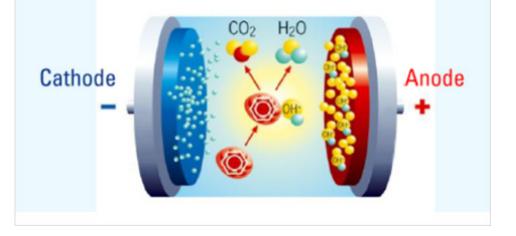
Step 1. Fenton's reagent







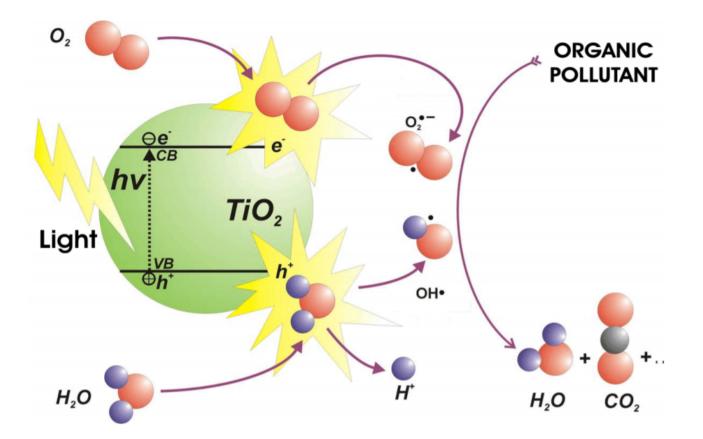








Step 3. Photocatalytic degradation









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Phytoremediation

- Hypothesis
- OTs are degraded and/or enriched in the plant.
- Metals are enriched in the plant.
- Incineration of the plant enhances recovery of the metals.
- Challenge...
- Salt water sediments

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Growth









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Just planted...

After 1 month...







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