MIND: Microbiology in Nuclear waste Disposal
NEWSLETTER September 2016

*The **Microbiology In Nuclear waste Disposal (MIND)** programme is a unique multidisciplinary project which brings together a broad range of leading research institutions and stakeholders in the field of radioactive waste disposal to address the Euratom 2014-2015 Work Programme topic NFRP 6 – 2014: Supporting the implementation of the first-of-the-kind geological repositories.*

The aim with the project is to contribute to a more complete and realistic safety case and to communicate the effects that microbiological processes will have on the geological disposal of intermediate and high level radioactive wastes.

Content of this Newsletter:

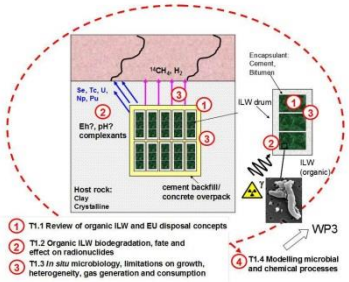
For more information please contact: mind15@skb.se
or visit our webpage: www.mind15.eu
Follow us on Twitter: @mindh2020

This project has received funding from the Euratom research and training programme 2014 - 2018 under grant agreement No. 661880

1. Work Package 1:

ILW: Organic Polymer Degradation

Long-lived intermediate level waste (ILW) requiring geological disposal can include a variety of organic wastes or encapsulants. These organics provide an energy and carbon source with the potential to fuel microbiological processes in ILW waste packages and in the repository.



http://www.mind15.eu/work-packages/wp-1/

Progress

Work is progressing well, with all **milestones and deliverables completed** as planned. There has been efficient communication between partners regarding irradiation studies and exchange of samples. There have been two exchange visits of PhD students between partners.

Following the presentation of **first results** of irradiation and biodegradation studies of polymers, ion exchange resins and cellulose together with work on radionuclide interactions at the first Project Annual Meeting (PAM) in Granada, further analyses and laboratory culture experiments and have been performed.

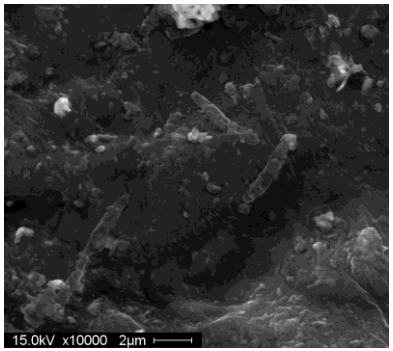


Fig. 1 ESEM image of microbes on unirradiated PVC film in the presence of nitrate

Research Highlight

Microcosm experiments are in progress studying the biodegradation of PVC polymer under alkaline conditions relevant to the conditions in cement backfilled repository for ILW. Various PVC materials and plasticiser additives have been subject to ϒ radiation to examine the effect of irradiation. Nitrate reduction is used to monitor anaerobic biodegradation, nitrate being present in some types of ILW.

At pH 10, using a microbial inoculum from a former lime works unirradiated pure PVC powder is not bioavailable, but irradiated PVC powder supports minor nitrate reduction. In contrast, PVC film (containing plasticisers and other additives) is bioavailable whether irradiated or not, but rates of nitrate reduction are higher after irradiation. It thus seems that irradiation of PVC influences its bioavailabilty, depending on the structure of the PVC and the nature of additives present.

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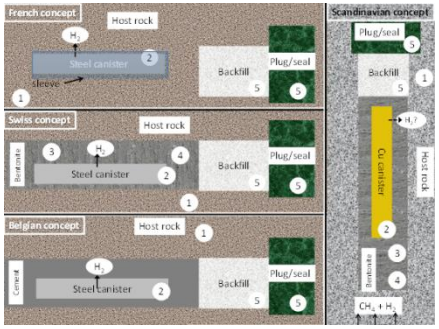
2. Work Package 2:

HLW: Waste Form Degradation

The metal, concrete and clay barriers in High Level Waste (HLW) disposal concepts are engineered barrier systems (EBS) and are susceptible to deterioration processes. Possible microbial processes are metal corrosion, illitization of smectite clay minerals and degradation of concrete.



http://www.mind15.eu/work-packages/wp-2/

Progress

Also in work package 2, work is progressing really well, with partners **reporting work as planned** and the first deliverables coming up in November. **One deliverable** will describe the inventory of reducing gasses in the geosphere, based on geochemical data from different drill holes and cores. **The second deliverable** is the laboratory design and set-up for flow experiments to assess the potential for microbial activity to accelerate the corrosion of canister materials.

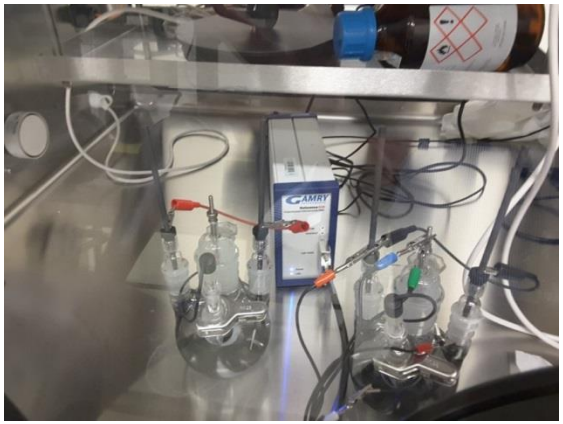


Fig. 2 Experimental arrangement of EIS measurement in the anaerobic glove box

Research Highlight

To probe for the potential of microbially induced corrosion, experimental cells (about 1 L) were designed and constructed to be suitable for the measurements of electrochemical impedance spectroscopy (EIS) and to be able to maintain stable conditions. A stainless steel (type 316L) specimen was placed into water freshly obtained from the Josef Underground facility. The experiment was held under anaerobic conditions for 111 days.

Samples for qPCR analysis of SRB (*dsrA*, *apsA* genes) were collected in the beginning and in the end of the experiment. The abundance of both functional genes increased in the end of the experiment. This shows there is a potential for sulphate reduction and thus microbially induced corrosion by the microbes in the pore water.

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3. Work Package 3:

Evaluating and Sharing the Knowledge

Results obtained from work package 1 and 2 will be ensured of proper contextualization, while remaining key topics will be extracted by maintaining an active dialogue with stakeholders. The knowledge will be distributed to a broad audience, taking into account conceptualisation and perception issues.

http://www.mind15.eu/work-packages/wp-3/

Progress

With the first results of the two experimental work packages being reported, work package 3 has been busy with the first annual report, which will be published in October.

In addition, work package 3 has prepared an **exchange program** for students and professionals, for which can now be applied following the instructions on the MIND website: http://www.mind15.eu/exchange_table/

To enhance exchange of students and professionals, the coordinators together with WP3 have decided to request for the opportunity to start a **scholarship program**. If granted, this program will be up and running soon!

Regarding Education and Training, a pilot session of the **primer course module** on microbiology and disposal of radioactive waste is coming up. More info can be found at: http://micans.se/education

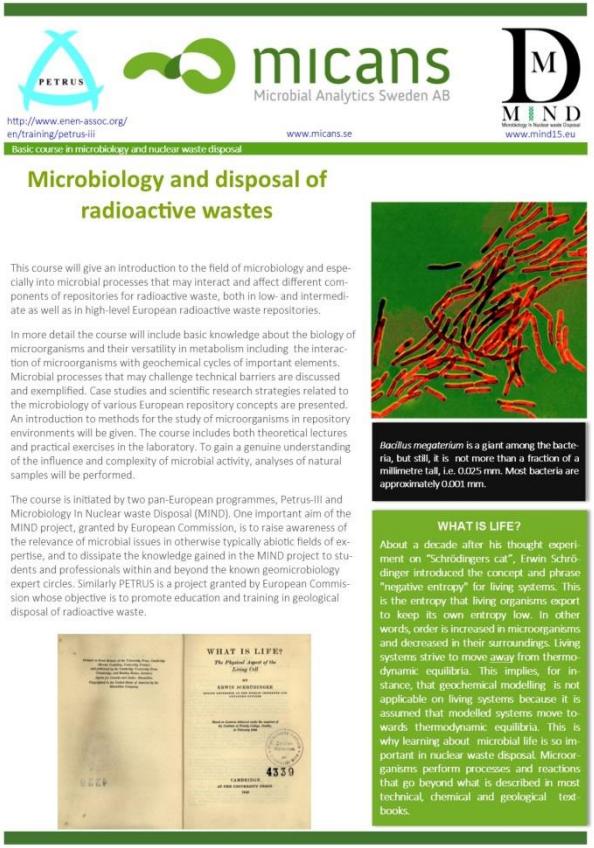

Fig. 3: Flyer of the pilot session of the primer course on microbiology and disposal of radioactive waste

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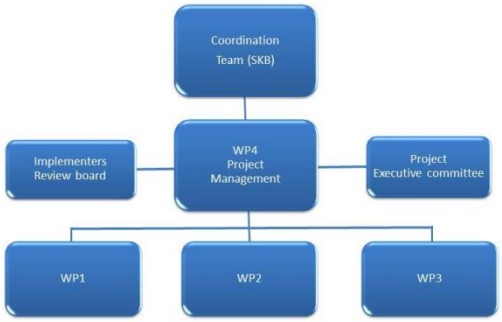
4. Work Package 4:

Project Management

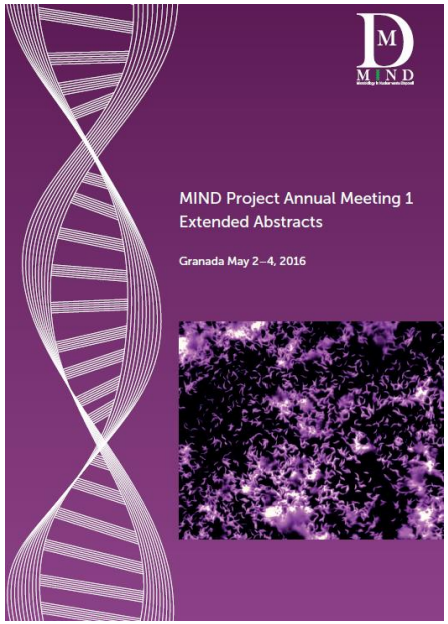
The principal task for this work package is the compliance of the project with the provisions of the European Commission (EC) as defined in the Grant Agreement and the Consortium Agreement by ensuring that the consortium complies with the rules on decision-making as defined in the Consortium Agreement.



http://www.mind15.eu/work-packages/wp-4/

Progress

After de first Project Annual Meeting (PAM), work package 4 has compiled the first abstract book, which is now available at http://www.mind15.eu/wp-content/uploads/2016/06/MIND-Abstracts_www.pdf



Save the date!

The next Project Annual Meeting will be held in the Czech Republic, from May 3rd until 5th 2017

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