Green Inhibitors: Screening of tropically natural or (agro)-biotechnology products as sources for new eco-friendly materials protection agents - BL/01/V13

Context and objectives

The use of heavy metal compounds (i.e. hexavalent chromium species) as a corrosion inhibitor (e.g. in paints), or the use of biocides in anti-fouling paints has shown to be a significant environmental problem worldwide, endangering biodiversity in many –especially aqueous– environments. Several countries have already introduced restrictions on the use of some of the most harmful heavy metal coumpounds and biocides and more strict regulations on their use are under completion both at the EU-level and the international level.

The current project wants to discover new, environmentally-friendly *corrosion inhibitors*, i.e. materials protection compounds, based on tropically natural or cultivated/modified (agro-)biotechnology products harmless to nature but still effective to protect metals, metal compounds. Among the whole "world" of unexplored traditional species, we want to examine and explore possibly/probably more efficient, compounds and species around. If some success is achieved, the current project is probably only going to be the first in a row, aiming at screening a series of "high-potential" (based on current scientific insights) organic derivatives.

Methodology

- **Exhaustive world-wide computerized literature survey on the subject and creation of reference information database**

The Long-list and Short-list of candidate natural products were selected/created by the Belgian and Vietnamese partners.

- **Screening and selection of candidate (tropical) natural or other raw material 'source-products' and Extraction and/or production of active biological substances.**

The Screening-process was done by VAST based on the short-list created/agreed by both sides.

- **Electrochemical tests on standardized metal surfaces (AISI 304, carbon steel, Brass), both in static lab set-ups at KUL lab in different environments (acidic, alkaline and saline) at different temperatures (room & heated) at short- and long-term times, in the 1st year on 4 types of Tropical extracts have been done as pioneer to latter guide the Vietnamese partners.**

A methodology to perform tests is defined by the Belgiian partner (KUL). From these results, interesting results observation and analysis procedures were setup for further guide/assistance to VAST researchers at KUL

- **Seminars was given at VAST for strengthening their know-how in the field, and setup further long-term test in Hanoi**

Seminar was performed by VUB partner at VAST, and tests performed by VAST

Results

- **Literature survey**

A "long-list" of more than 190 tropical plants was developed by KUL (with input from VAST), each with photo as illustration, description, distribution, chemical components, parts used and of 130 plants by VAST were developed. From this long-list, a short-list of 10 to 20 plants to be used as corrosion inhibitors were screened.

- **Screening and selection of candidate natural products**

More than 20 types of tropical plants have been screened and extracted by VAST. 10 plants were selected for further investigation.

- **Electrochemical tests at KULeuven by KULeuven staff and by 4 VAST secondees**

Totally more than 235 tests of 10 extracts were performed, measured and evaluated at KULeuven Lab by both sides on short- and long-term conditions; at both room temperature and heated one (40-65°C), in 3 environments (in acidic, alkaline and chloride-bearing solutions), *with* and *without* inhibitors.

- **International Research exchange/cooperation**

For this purpose, the Belgian Partners have welcomed 3 Vietnamese Leader's visits (2 VAST Chairman Delegation visits, 1 Project Leaders Delegation visit and 4 VAST secondees), and the Vietnamese partners have welcomed 2 Belgian Delegations visits (KUL + Cebelcor/ULB). Also KUL has provided VAST with 2 CD-ROMs on corrosion expertise and know-how (Active Library on Corrosion and NACE Basic Corrosion Course).

Products and services

Peer-reviewed articles :

* V.T. Thuy, W. Bogaerts, A. Rauf, Le Quoc Hung. *Recent advances in Green Chemistry Research & Development - New eco-friendly Materials Protection Agents.*
Plenerary Talk, 12th Annual Green Chemistry & Engineering Conference, Washington DC (USA), June 21-28, 2008.

* Vu Thi Thuy, W.F. Bogaerts, Abdul Rauf (*), Do Chi Linh, Pham Hong Phong, Pham Hong Hanh. *Evaluation of Use of different natural Extracts from Tropical plants as Green Inhibitors for Metals*. 19th International Corrosion Congress, Las Vegas (USA), October 6-10, 2008

Submitted

* Use of different natural Extracts from Tropical plants as Green Corrosion Inhibitors for Metals.
to: Clean Technology 2009 Conference (May 3-7th, 2009).

* Idem: *Journal of Corrosion Engineering, Science and Technology*.

"Products"

- Corrosion inhibiting natural compounds/products (*patent submission* being investigated);
- CD-ROM data sources;
- Project website: http://www.mtm.kuleuven.be/Research/GreenChemistr

Execution

Period: 01/11/2006-31/05/2009

Laboratory/network :

Flemish partner:
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Discipline

Chemistry
Environment
Materials (bio- etc.)
Freshwater resources
Forest & natural vegetation