Project description:  

Background

Nearly all pipes produced in the EU require one or more cycles of electrolytic treatment (‘pickling’) during the production process. Mixtures of hydrofluoric (HF) and nitric acids are traditionally used in concentrations ranging from 15 to 50 g/l at temperatures between 25°C and 55°C. The gradual introduction of processes that don’t require nitric acid has considerably improved air quality, by reducing pollutants in effluents. But these processes still require the same working temperatures and quantities of HF acid, the production and management of which raises concerns to human health and the environment. A standard pipe-producing plant needs large amounts of concentrated HF, and high transportation costs represent a significant burden for companies. Moreover, accidental HF leaks and uncontrolled emissions create further problems: HF acid and its solutions are classified as H1 (acute toxic category 1) and H2 (acute toxic category 2) in Annex I of the EU Directive 2012/82/EU on chemical accidents (Seveso III).

Objectives

The HFree Life Pickling project aimed to develop a new process of electrolytic pickling for duplex and special stainless steel, welded and seamless pipes. The process would be comparable in outputs with current chemical pickling, though not requiring HF or other acids, as well as other substances classified as less...
toxic. It would also reduce the treatment time.

The goal was to demonstrate a process that represents an industrially-viable alternative to chemical pickling. The project would identify and optimise an electrolytic process, based on applying direct current to the material to be pickled, immersed in a specially conceived electrolytic solution that contains no acids listed as toxic substances under EC Regulation 1272/2008. It planned to then identify parameters for the application of current and find the most suitable electrolyte with the lowest environmental impact, while reaching the same quality levels as the existing chemical pickling.

Results

The HFree Life Pickling project developed an electrolytic pickling processes for special steel tubes without using highly toxic substances such as HF and nitric acids. This new pickling solution, comprising mainly sulphuric and glycolic acid, was first tested on a small scale in order to allow for the process to be optimised at a reduced cost. Indeed, several unexpected technical difficulties were encountered (over-corrosion near electrodes, production of hydrogen and some defects in the internal pickling of the tubes, mainly due to gas bubble accumulation), but these were solved before the process was then tested at a larger pilot plant on an industrial scale. This plant validated the results of the lab- and small-scale demonstrations, confirming the feasibility of the process.

The process, which was also tested at high and low current density, was shown to reduce environmental impacts, reduce processing times and result in economic benefits. The high-current process achieved a very short pickling time and is easy to manage, while the low current process has a slightly higher pickling time (though still well below the traditional process), very low energy consumption, but a more complex process management. Both are non-toxic processes, owing to the complete elimination of HF acid and nitric acid, and achieving a surface finishing quality comparable with the traditional process.

The HFree Life Pickling process furthermore reduces energy consumption by 60%, related to its considerably shorter pickling time (more than 70% less time). The pickling bath can be used for longer before disposal, while less water is consumed in the tube washing after pickling. Moreover, the processing cost is lower, increasing its market attractiveness despite the initial investment cost of the new plant. A preliminary market analysis showed that the new process can be applied to about 2-3% of the total European steel market, with a possible increase in the market share if new geometries and new alloys are included in the treatable products. Several stakeholders and potential customers have shown a strong interest in the project results, and the beneficiaries say that, given the environmental and economic benefits, they intend to build on the project results after the project ends.

The project contributed to achieving the objectives of REACH regulation, the Waste Framework Directive (Hazardous Waste), the Directives on energy efficiency and accident hazards (Seveso III), and the Clean Air Policy Package.

Further information on the project can be found in the project's layman report and After-LIFE Communication Plan (see "Read more" section).
Environmental issues addressed:

Themes

Air & Noise - Air pollutants  
Environmental management - Cleaner technologies  
Industry-Production - Metal industry  
Risk management - Industrial risks - Hazardous substances  
Risk management - Pollutants reduction

Keywords

public health, coating, air pollution, metal products industry, industrial process, pollutant elimination, hazardous substance

Target EU Legislation

- Climate Change & Energy efficiency
- COM(2014)15 - Policy framework for climate and energy in the period from 2020 to 2030 (22.01.2014)
- Waste
- Air
- Directive 2008/50/EC - Ambient air quality and cleaner air for Europe (21.05.2008)
- Chemicals & Hazardous substances
- "Regulation 1907/2006 - Registration, Evaluation, Authorisation and Restriction of Chemicals (REA ...

Natura 2000 sites

Not applicable

Beneficiaries:

Coordinator: RIVIT SPA SOCIO UNICO
Type of organisation: SME Small and medium sized enterprise
Rivit manufactures pipes and fittings in stainless steel and special alloys. The company has developed particular expertise in producing thin-walled tubes and medium/heavy wall pipes up to 12 m long. The company’s markets are the specialist pipes sector, the chemical and petrochemical industries, and heavy industries in general.

**Partners**
- ProVI(PROVINCIA DI VICENZA), Italy
- Henkel(HENKEL ITALIA S.P.A.), Italy

### Administrative data:

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### Read more:

- **Poster**
  - Title: Cartello informativo del progetto
  - No of pages: 1
- **Project web site**
  - [Project's website](#)
- **Project web site** - 2
  - [Project's LinkedIn page](#)
- **Project web site** - 2
  - [Project's Twitter page](#)
- **Publication: After-LIFE Communication Plan**
  - Title: After-LIFE Communication Plan (Italian version)
  - Editor: Free Life Pickling
  - No of pages: 7
- **Publication: Layman report**
  - Title: Layman report
  - Year: 2017
  - Editor: Free Life Pickling
  - No of pages: 9
- **Publication: Technical report**
  - Title: Project's Final technical report
  - Year: 2017
  - Editor: Free Life Pickling
  - No of pages: 0