

IAMC Toolkit

Innovative Approaches for the Sound Management
of Chemicals and Chemical Waste

CASE STUDY

Introduction of a molten metal filtration system for the cleaning of recycled zinc

1. Background information

Galvanized steel is a widely used material for applications where corrosion resistance is required. It can also help avoid the cost of stainless steel. To produce galvanized steel, the hot-dip galvanization process is implemented. This involves coating iron and steel with zinc - which alloys with the surface of the base metal - when the metal is immersed in a bath of molten zinc at a temperature of around 840 °F (449 °C). When exposed to the atmosphere, the pure zinc (Zn) reacts with oxygen to form zinc oxide, which further reacts with carbon dioxide to form zinc carbonate. This protects the steel from further corrosion in most circumstances. If obsolete technology is used, hot dip galvanization consumes high quantities of zinc and generates significant quantities of waste.

2. Introduction

MIMCO is a medium-size metal-mechanic Peruvian company with 119 employees in total. The company has more than 20 years of experience in the manufacture of metallic structures and providing galvanizing services. Their metallic structures vary from lightweight items such as telecom towers or power lines towers, to heavy structures such as bridges. The market for this type of product is domestic and regional, including countries like Guyana, Bolivia and Chile. The company also offers galvanizing services to external customers, mainly large and medium-size companies.

The company galvanizes different types of structures and which they it has classified them into three types: heavyweight structures, medium-weight structures and lightweight structures. The principal operational processes developed at MIMCO's galvanizing plant are: degreasing, pickling, rinsing, flux solution, drying, zinc bath, cooling and inspection.

In an effort to improve process efficiency by reducing material consumption and waste amounts, MIMCO joined the UNIDO IAMC project in 2015.

3. Project start

With the support of NCPC Peru, the core innovation team was set up at the very beginning of the project and was comprised of three members from NCPC Peru along with the Plant Manager and assistant plant manager as well as an Environmental Health and Safety officer from MIMCO.

Topics from the IAMC Toolkit addressed:

- Resource-efficient potential in the chemical industry
- Brainstorming on innovations to reduce chemicals use
- Change / modification of process technology



As a general trend, companies had begun searching for ways to minimize the input of raw material as well as ways to increase the recyclable parts within the process. MIMCO also followed this path by searching for technologies which would make overall production more efficient and environmentally friendly.

Using the given methodology, a number of hotspots were identified, one of them being the galvanizing process with its high zinc consumption. This hotspot is connected to environmental threats as well as high operating costs. Moreover, there is a connection to the ambitions of many companies with regard to sustainability and innovation - as well as the willingness to fulfil specific customer needs.

Taking into account the identified hotspot, the project focus was formulated as follows: to reduce the total amount of zinc and resulting wastes in order to achieve better environmental performance and improved process efficiency at lower costs.

Project focus: to reduce the amount of zinc and
resulting wastes





4. Project implementation & key changes

Within the framework of the IAMC project several steps were performed, starting with an analysis of the company value chain and the experience in operational excellence combined with a strong focus on sustainability and innovation. After an evaluation of the product life-cycle impacts and an assessment of customer needs, the project team concluded that a molten metal filtration system for cleaning the recycled zinc was the best solution. Finding a provider of a technology that is aligned with the needs and production capacity of the company represented a challenge but it was accomplished by searching for suppliers of this technology in Latin America.

The proposed equipment - Metallics Zinkoff Recovery System (MZR) - consists of a thermo-mechanical device able to separate free zinc from material mixtures and top drosses. The technology includes a highly efficient industrial in-house system able to recover non-ferrous metal from industrial process wastes and top drosses. It comprises hot dip skimming into the device's drum, which can process a nominal 750kg at a time. The device rotates the drum at a specified rotational velocity within a temperature controlled chamber. In the course of the processing time, which is around three hours, the process stratifies the dross inside the heated drum, with the zinc pooling at the bottom. An operator then decants the liquid zinc into a custom made mould. When solidified the zinc is returned to the galvanizing plant for reuse in the process.

The implementation is simple and cost effective and it has the potential to lower operational costs and logistics while simultaneously protecting the environment.

The most obvious improvements were the reduction of total waste consumption for disposal, together with decreased transportation requirements for virgin zinc and waste products of up to 90%. An additional minimization of zinc content in effluents, being very toxic to aquatic life with long lasting effects, could be achieved. Moreover, Zinc consumption could be reduced by 40% leading to total annual savings of around 350,000 US \$ after an initial investment of 90,000 US \$.

Another interesting fact is the possibility of applying three different business models for this technology and offering services to other companies:

- burning skimmings service for other companies
- sale of oxides (results from burning) to other industries (e.g. paints)
- equipment rental

The molten metal filtration system has been recognized by The European Commission Integrated Pollution Prevention and Control (IPPC) as the best available technique for dross waste management.

5. Estimation of results of the process improvement and potential benefits²

Before	After
<p>Resource use:</p> <ul style="list-style-type: none"> • Consumption of 389 t/year of zinc <p>Health and safety benefits:</p> <ul style="list-style-type: none"> • Risks accidents related to zinc exposure, which causes eye irritation and could stay as particulate matter <p>Economic impacts:</p> <ul style="list-style-type: none"> • Investments needed: 90,000 US \$ <p>Environmental benefits:</p> <ul style="list-style-type: none"> • Consumption of 389 t/year of zinc, which is very toxic to aquatic life with long lasting effects 	<p>Resource use:</p> <ul style="list-style-type: none"> • Reduction of zinc consumption of 40 % <p>Health and safety benefits:</p> <ul style="list-style-type: none"> • Reduction of accidents. • There are no relevant health and safety risks related to use of MZR systems. <p>Economic impacts:</p> <ul style="list-style-type: none"> • Annual savings: 346,000 US \$ <p>Environmental benefits:</p> <ul style="list-style-type: none"> • The European Commission Integrated Pollution Prevention and Control (IPPC) recognized MZR technology as the best available technique for dross waste management • Reduction of zinc waste generation

6. Company statement

MIMCO focuses its strategy on giving quality, good service and opportunities to the customer. They expend much effort in several important sustainability areas

including: reduction of resource consumption, improving process efficiency and reducing emissions produced by chemical reactions.