

IAMC Toolkit

Innovative Approaches for the Sound Management
of Chemicals and Chemical Waste

CASE STUDY

Substitution of Nonylphenol ethoxylate in biopesticide formulation

1. Background information

Biopesticides are pesticides produced by living organisms such as bacteria, animals and plants, and can be found in nature. To obtain marketable products out of extracted active substances, different types of additives are used, some of which can be highly toxic, as in the case of the emulsifier Nonylphenol ethoxylate. This poses a risk for workers during production and for the handler of the biopesticides containing the product - as well as for the environment in general.

2. Introduction

Agrocosmos Corporation S.A.C. is a Peruvian agrochemical company specialized in manufacturing green pesticides (incl. biopesticides). It is a small company located in Lambayeque Province and has 4 permanent employees along with 10 to 25 temporary employees. It is a pioneer in offering these types of pesticides in Peru.

The primary products the company offers are certified rice, corn and bean seeds. The seed market is national, and the company sells its products regionally in: Tumbes, Piura, Lambayeque, La Libertad, Cajamarca, San Martin, Amazonas and Arequipa. The secondary product - Bio Ray - is offered directly to farmers and exporters, the latter representing 70% of their customers.

In an effort to improve their green products by eliminating all potentially harmful substances the company joined the UNIDO IAMC project in 2015.

3. Project start

With the support of NCPC Peru (Grupo GEA), the core innovation team was set up at the very beginning of the project and consisted of experts from Agrocosmos, including the executive director. Using the given IOMC methodology, the project team identified all relevant hotspots within the company. One of the hotspots identified was the production of biopesticides and especially the use of Nonylphenol ethoxylate for the production of so-called "Bio Ray".

The formerly applied method was based on steam distillation technology to extract essential oils from aromatic plant material to obtain the active substance, whereas the marketable product Bio Ray was obtained

Topics from the IAMC Toolkit addressed:

- Resource-efficient potential in the chemical industry
- Risk assessment
- Substitution of hazardous chemicals



through the simple process of adding Nonylphenol ethoxylate, propylene glycol and soy lecithin. Nonylphenol ethoxylate is toxic to aquatic life with long lasting effects and causes serious eye damage. It is harmful if swallowed as well as if inhaled and it causes skin irritation. Categorized as an endocrine disruptor, it is a precursor of Nonylphenol which is a persistent and bio-accumulative substance.

Taking into account the identified hotspot the general project focus was formulated as follows: to find substitutes for the emulsifier Nonylphenol ethoxylate by safer and environmentally friendlier alternatives.

Project focus: to find substitutes for the emulsifier
Nonylphenol ethoxylate





4. Project implementation & key changes

By applying the IAMC Toolkit methodology, the chemicals used were classified, and sustainability hotspots determined. Based on the focus of the project to replace Nonylphenol ethoxylate with a substitute the team carefully studied available literature, including web information and case studies from industry, then discussed and exchanged information with suppliers.

As a result of this extensive study the project team was able to present four alternatives to Nonylphenol ethoxylate. The major challenge was to identify the alternative with the most similar emulsifying action to Nonylphenol ethoxylate.

ALKOSYNT® IT 120, with the main ingredient Isotridecanol ethoxylate, was evaluated as providing the best solution because it demonstrated the best performance with the biopesticide base formula.

This innovation allowed Agrocosmos to offer a safer pesticide to the market while also providing a safe and secure work environment for the company's workers. The new formulation of the biopesticide is free of highly toxic substances and therefore does not pose a threat to the environment or to the health of the product handlers.

Through this substantial innovation, greater potential for improving chemicals management and added value for the company was able to be achieved. However, due to The Coastal El Niño, South America has been plagued by persistent heavy rain events. Multiple countries suffered substantial losses, with Northern Peru being particularly hard-hit. This climatic phenomenon caused an increase in implementation costs and time: Current costs are US \$ 200,000, and the implementation time was extended to 24 months.

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

Before	After
<p>Resource use:</p> <ul style="list-style-type: none"> Consumption of 8,100 kg of toxic Nonylphenol ethoxylate. <p>Health and safety:</p> <ul style="list-style-type: none"> Nonylphenol ethoxylate is toxic to aquatic life with long lasting effects, causes serious eye damage, is harmful if swallowed, is harmful if inhaled and causes skin irritation. It is categorized as an endocrine disruptor. <p>Economic impacts:</p> <ul style="list-style-type: none"> The annual cost of using 8,100 kg of Nonylphenol ethoxylate is US\$ 25,272. 	<p>Resource use:</p> <ul style="list-style-type: none"> Total substitution of the toxic emulsifier with benign one in formulation. <p>Health and safety:</p> <ul style="list-style-type: none"> Reduction of customer's and workers exposure to health and safety risks. <p>Economic impacts:</p> <ul style="list-style-type: none"> The annual cost of using 8,505¹ kg of ALKOSYNT® IT 120 is US\$ 29,597.

6. Company statement

The owner of "Agrocosmos" is committed to offering the domestic and international market a biopesticide that can be used in organic farming and which complies with all safety requirements and quality standards of the European Union.



1. The annual cost of using 8,505 kg of ALKOSYNT® IT 120 is US\$ 29,597.