

GREEN CHEMISTRY AND BEYOND MANUFACTURING WITHOUT POPs

What are POPs?

POPs – or Persistent Organic Pollutants – are organic chemical substances that have a significant impact on the environment and human health. The manufacturing industry is where much of the work to implement the Stockholm Convention on Persistent Organic Pollutants (POPs) takes place.

There are two different kinds of POPs, those which are intentionally produced, and those which are unintentionally produced. It is more difficult to phase out the use of POPs which are unintentionally produced. These POPs are often an unwanted by-product in industries where particular combustion processes occur at high temperatures. The most direct and tangible POPs reduction efforts are in industries that are intentionally producing or using POPs in their products.

Where POPs are intentionally produced, the following approaches are deployed:

1. Manufacturing alternative chemical products instead of POPs
2. Introducing alternative chemicals in the process, instead of using POPs
3. Introducing non-chemical solutions instead of POPs. This last approach is referred to as green chemistry.

In all cases, the intention is to eliminate risks to human health and the environment. In some cases both chemical and non-chemical approaches are combined. Some examples of these approaches are given below.

Tackling DDT in India

Dichlorodiphenyltrichloroethane (DDT) is an organochlorine known for its insecticidal properties and environmental impacts. DDT was used extensively in the 1940s and 1950s to control malaria and dengue fever with spectacular results. It has played an important role in eradicating malaria in areas with high socio-economic status, organized healthcare systems and less intensive or seasonal transmission of malaria. Due to poor infrastructure and the continuous life

cycle of mosquitoes, DDT has been less effective in tropical regions.

DDT is a persistent organic pollutant and its use in agriculture has been banned under the Stockholm Convention on POPs, but it is still allowed in limited amounts due to its effectiveness in reducing malaria infections. With the continued use of DDT, however, the mosquitoes have developed a resistance to it, and the recommended dose of DDT no longer remains effective to combat mosquitoes. According to a World Health Assembly resolution, member countries are urged to initiate sustainable action and reduce the use and dependency on DDT.

In India, which is the only country worldwide that produces and exports DDT, the government is enhancing its alternative vector control strategy based on Integrated Vector Pest Management (IVPM) including the following interventions: biological control, chemical control and environmental management, all of which operate in conjunction with legislative measures and alternative approaches.



Green intervention

UNIDO is currently collaborating with the United Nations Environment Programme (UNEP) and the government of India in a project approved by the Global Environment Facility (GEF) to combat mosquito vectors at different vulnerable points of the lifecycle and develop a phase out strategy on DDT in the country. Under this project, UNIDO will establish the production of alternatives through a three-pronged approach:

1. Reduction and/or elimination of the breeding of mosquitoes (larvae) in bodies of water, through application of Bacillus (Bt) based bio-pesticides, which are very effective against larvae but safe for other aquatic animals and human beings.

2. Provision of long lasting insecticide bed mosquito nets (LLIN) to prevent mosquito bites while people sleep. These nets contain green chemicals such as synthetic pyrethroid (considered green because of limited toxicity and high biodegradability).

3. The nets will be accompanied by the use of neem-based pesticides to repel mosquitos at various stages of the life cycle from larvae to fully grown, as well as regulating the mosquitoes' growth. Bio-pesticides and botanical pesticides are entirely biodegradable and environmentally friendly, and can be used as alternatives to DDT.

The project will be strongly linked to the latest strategies related to Integrated Vector Pest Management (IVPM) in India.

One of the notable socio-economic benefits of the project is the creation of job opportunities in farmer communities, particularly for women and unemployed youth. Other benefits include the low price of bio-botanical pesticides, the pesticides' very low or lack of toxicity, the biodegradability of alternatives to DDT, and take back agreements with LLIN vendors. New neem plantations will also help to mitigate climate change, land degradation and desertification.

Seeking safe solutions

In building construction, whether in cold or hot climates, proper insulation is vital for comfort and energy efficiency. In modern buildings, this insulation is made from man-made foam boards, typically from polystyrene. As polystyrene is highly combustible, flame-retardants are used when the insulation boards are manufactured. Unfortunately, the most common flame-retardant in manufacturing is Hexabromocyclododecane (HBCD), a POP listed under the Stockholm Convention.

UNIDO therefore works together with countries and their insulation manufacturing companies to introduce alternative flame-retardants in the production process. These alternatives are better for human health as well as the environment. In addition, these alternatives ensure that the relevant countries can export insulation boards to other countries that have banned HBCD.

Green chemistry

When producing high quality parts for manufacturing, particularly in machinery and vehicles, metal plating is used for both protective and decorative purposes. Chromium

plating is especially common. To achieve effective and uniform production manufacturing as well as to ensure safety in the workplace, the metal plating process uses a number of additives. One of these is a POP called perfluorooctane-sulfonic acid or –sulfonate (PFOS).

PFOS is useful as a surfactant or wetting agent in metal plating in order to achieve uniform thickness of the plating; suppress mist so as not to contaminate nearby plating baths and reduce the losses by drag-out and finally, to decrease aerosol emissions in chromium-VI plating and thus ensure a safe work environment.

The alternatives to PFOS in this instance include chemicals of a similar type which do not exhibit POPs characteristics, as well as other non-chemical alternatives.

The most interesting alternatives to PFOS are non-chemical alternatives, such as PTFE coated plastic balls, which are placed on top of metal plating baths. Another non-chemical alternative includes the introduction of mesh or blankets (Composite Mesh Pads) placed on top of metal plating vessels to avoid the release of harmful chromium.

... and beyond

These are just some of the examples of ways in which UNIDO is working to help phase out the use of POPs in the manufacturing industry. You can find out more about our work under the Stockholm Convention by visiting the resources below.

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