e-ISBN: 978-93-6252-974-9 | Year of Publication 2024
DOI: https://www.doi.org/10.58532/nbennuriach2

2

Eco-Conscious Choices by Process Chemist for a Sustainable World

Dr. D. Mayuri* **Ms. Talari Sreevidya***

Abstract

"Chemistry is not just about test tubes and beakers; it's about the World we live in"

Chemistry Plays a Vital role in addressing Global Challenges and in Conserving the Mother Earth in various ways. Chemists develop sustainable sources such as Carbon Capture technologies, and Climate resilient materials. They also design eco-friendly materials, reducing waste and promotes recycling. Process Chemist has a professional responsible for developing, optimizing and improving business processes for the production of chemicals, pharmaceuticals, or other products. Process Chemist protects the environment by developing sustainable processes which reduces the emissions, such as air and water pollution. Process Chemists can significantly reduce the environmental

* *Assistant Professor, Department of Commerce and Business Management, Veeranari Chakali Ilamma Women's University (Formerly University College for Women), Koti, Hyderabad, Telangana, India.*

* M.Sc Student, *Department of Chemistry, Veeranari Chakali Ilamma Women's University (Formerly University College for Women), Koti, Hyderabad, Telangana, India.*

e-ISBN: 978-93-6252-974-9 | Year of Publication 2024
DOI: https://www.doi.org/10.58532/nbennuriach2

footprint and promote sustainable practices. This Chapter highlights the role of Process Chemist in saving the Earth. It also lime-lights the job description of Process chemist and their role in saving the Planet.

Keywords: *Process Chemists, Environmental footprint, Job description, Sustainable source*

Introduction

Research on Chemistry and its role in Earth's Sustainability includes but not limited to, technologies to achieve responsible consumption and production of chemical products such as the elimination of hazardous substances in the production and use of chemical products, their reuse and recycling. Process chemistry is a branch of science dealing with chemical transformations that occur in large-scale manufacturing operations. A process chemist applies scientific principles and techniques to develop, optimise and scale up chemical processes to create high-quality products The role of a Process Chemist is crucial in **ensuring the efficient and cost-effective production of high-quality chemical products.** They work closely with other members of the research and development team, including chemical engineers and production personnel, to optimize the production process and improve product yield.

Review of Literature

An editorial paper titled "Role of Chemistry in Earth's Climate" by A R Ravishankara, Yinon Rudich and John A.

e-ISBN: 978-93-6252-974-9 | Year of Publication 2024
DOI: https://www.doi.org/10.58532/nbennuriach2

Pyle in American Chemical Society Publication in the year 2015. The Paper highlighted the solutions to climate change are intimately connected with air quality issues. It also mentioned that carbon dioxide has very complex and long lifetime in the atmosphere. This paper also throws light on the role aerosol in the climate system via interaction with incoming sunlight. Thus, the paper explains that understanding of chemical changes will continue to play a major role in better understanding and predicting of climate change, and providing solutions to anthropogenic climate change.

In an editorial paper titled "Green Chemistry: A Framework for a Sustainable Future" Krishna N. Ganesh et. al., in the ACS Publications in the year 2021. The Paper highlighted the Minimizing dependence on fossil fuel, minimizing the impact of chemical synthesis and manufacturing, designing chemical with minimal hazard and sustainable water resources.

Job Description of Process Chemist

Process Chemist typically falls into the middle level management, specifically:

1. **Technical Lead:** Leading a team of process chemists or technicians. They have to ensure proper equipment maintenance, reduce the risks of leaks and spills or other environmental hazardous.

2. **Senior Process Chemist:** Overseeing process development and Scale-up. They can design and implement chemical

e-ISBN: 978-93-6252-974-9 | Year of Publication 2024
DOI: https://www.doi.org/10.58532/nbennuriach2

processes that minimize waste, reduce energy consumption, and use environmentally friendly materials. They must develop and enforce safety protocols for handling hazardous chemicals and materials.

3. **Process Development Manager:** Managing Process Development projects and teams. They can apply Green Chemistry principles to reduce the environmental impact of chemical processes and identify areas for improvement and implement changes to enhance environmental safety.

4. **Operations Manager:** Overseeing Production Operations and Process implementation. They must track the environmental performance and report incidents or near misses and implement emergency response plans for environment.

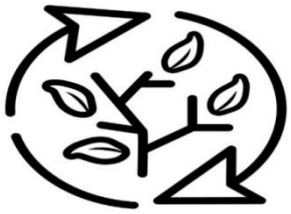
5. **Technical Specialist:** Focusing on specific technical areas, like process optimization safety. They can provide technical expertise to identify and mitigate environmental hazards. They also develop and implement corrective actions to prevent future environmental incidents.

6. **Team Lead:** Leading a team of Process Chemists or Technicians. Process Chemist as a team leader can prioritize environmental safety and it more core value for the team and allocate the resources to support environment safety initiatives.

e-ISBN: 978-93-6252-974-9 | Year of Publication 2024
DOI: https://www.doi.org/10.58532/nbennuriach2

Role of Process Chemist in Protecting the Environment by:

1. **Developing Sustainable Processes:** As a process Analyst one has to



Sustainable

- **Design the Processes that Minimize Waste** i.e While in the past traditional waste management strategies focused only on the disposal of toxic byproducts, today efforts have shifted to eliminating waste from the outset by making chemical reactions more efficient. Process Chemist can develop creative solutions to complex, intractable problems

- **Reduce Energy Consumption:** Most industrial energy consumption occurs in the manufacture of bulk chemicals and petrochemicals, iron and steel, nonmetallic minerals, and nonferrous metals. The chemical and petrochemical industries are among the largest energy consumers in the last decade. Process chemist has options such as fuel substitution (change the fuel used to provide energy to the chemical process and include options such as biomass fuel and/or use low-

e-ISBN: 978-93-6252-974-9 | Year of Publication 2024
DOI: https://www.doi.org/10.58532/nbennuriach2

carbon methane) and Combined Heat and Power (CHP) generators (reduce emissions by using CHP generators to provide energy and thereby, reducing emissions from the fuel used) are alternatives worth considering.

- **Use Renewable Resources:** The renewable resources are A renewable resource (also known as a flow resource i.e., it is a natural resource which will replenish to replace the portion depleted by usage and consumption. Renewable resources are a part of Earth's natural environment and the largest components of its ecosphere. A positive life-cycle assessment is a key indicator of a resource's sustainability. One of the renewable resources is Water. It can be considered a *renewable* material when carefully controlled usage and temperature, treatment, and release are followed. If not, it would become a non-renewable resource at that location which leads to Water Pollution. It is estimated that 22% of worldwide water is used in industry. Major industrial users include hydroelectric dams, thermoelectric power plants (which use water for cooling), ore and oil refineries (which use water in chemical processes) and manufacturing plants (which use

e-ISBN: 978-93-6252-974-9 | Year of Publication 2024
DOI: https://www.doi.org/10.58532/nbennuriach2

water as a solvent), it is also used for dumping garbage. The Process Chemist can opt for the integrations of energies, convert valuable chemicals and fuels through various processes that reduces the reliance on non-renewable resources.

2. **Environmental Monitoring:** Process Chemist has to Monitor and analyze the environmental impact of Chemical Processes. Monitoring the impact of chemical processes is crucial for ensuring the safety, efficiency and environmental compliance.

- Process Chemist can develop the use of Sensors and automated systems to continuously monitor parameters such as Temperatures, Pressures and Flow rates. This

e-ISBN: 978-93-6252-974-9 | Year of Publication 2024
DOI: https://www.doi.org/10.58532/nbennuriach2

aids in maintaining optimal operating conditions and detecting any deviations at the earliest.

- They have to regularly sample and analyze Air, Water and Soil around the facility to detect Pollutants. Process chemist has to monitor emissions, effluents and waste to ensure they meet regular standards.
- Process Chemist can implement air sampling and analysis to monitor chemical exposure levels for workers as this assists in identifying and mitigating potential health risks.

3. **Regulatory Compliance:** Process Chemist must ensure the processes in the industry meets the environmental regulations and standards. Regulatory Compliance refers to adhering laws, regulations, guidelines and specifications relevant to the manufacturing and control of Chemical Products. This ensure that products are safe, effective and of premium quality. Crucial aspect of this is Chemistry, Manufacturing and Controls (CMC). This involves the monitoring of Chemical Compositions, Manufacturing Processes and Quality Control measures of a Product. Process Chemist must scrutinize the compliance for:

e-ISBN: 978-93-6252-974-9 | Year of Publication 2024
DOI: https://www.doi.org/10.58532/nbennuriach2

- **Product Safety:** To avoid disasters, to protect human health and the environment from negative impacts resulting from the use of chemical products through out a product's life cycle, Process Chemist must maintain the Product safety. International Standards such as ISO standards, ANSI/ASQC standards provide a set of specifications that a product need to meet and ensures that products are safe and reliable. Process Chemist must comply with local and regional Laws too, as different markets gave their unique set of regulations and standards that products need to comply with before they can be sold. These can be related to safety, environmental impact, labelling, packaging and more.

Skills of Process Chemist: Process chemists need

- **Strong communication** and
- **People management skills**.

1. **Strong Communication:** Communication is the essential part of changing societies towards sustainability. The crucial skill of Process chemist is Communication. Process Chemist must place environmental communication in a context of Chemical Processing. One of has to critically analyse along the lines of three dimensions: which form of Communication to be used, how is communication different in influencing the behaviour of employees, and identify the difference in verbal and non-verbal communication. These three dimensions must be practiced by Process Chemist as these changes the employees' way of conserving the

e-ISBN: 978-93-6252-974-9 | Year of Publication 2024
DOI: https://www.doi.org/10.58532/nbennuriach2

environment often leads to binding element between firm and the Sustainability.

2. **People Management Skills:** Process Chemist must possess, abilities and attributes necessary to lead, motivate and support employees to meet organizational goals. They must have the ability to enhance the performance of the employee, zone to present their innovations in the work activities, build and inspire trust, provide feedback on regular intervals, enable and empower the employees towards the sustainability.

Responsibilities of Process Chemist towards Sustainability of Environment

The Responsibilities of Process Chemist is crucial in the Chemical Industry and in sustainability of Environment.
It includes:

- Designing, Developing and Optimizing Chemical Processes to improve efficiency, yield and product quality, including simulation software. While developing any chemical process, Process chemist must ensure the process is developed without releasing the hazardous gases into the environment.
- The responsibility of Process Chemist includes conducting experiments to understand chemical reactions and improve process conditions. As many experiments leads to release of hazardous waste that contaminates the soil and water impacting the environment. Hence Process chemist must check the amount of water and energy used

e-ISBN: 978-93-6252-974-9 | Year of Publication 2024
DOI: https://www.doi.org/10.58532/nbennuriach2

during the lab experiments and maintain the standards taking utmost care of eradicating the soil erosion, water and air pollution.

- Process Chemist responsibility includes collaboration with other professionals, such as production managers, engineers and quality control personnel to ensure chemical process meets the product specifications and standards. During collaboration Process chemist must ensure all the collaborations are made on the terms of environment safety.
- Responsibility of implementing new technologies and process improvements is with the Process Chemist. One must make sure technology and process improvements leads to reduce of the costs and increase in the productivity. Environment safety must be the major concern of the process chemist while using the technology and process improvements.

Conclusion

Chemistry has a big role to play in saving the Planet. Through scientific research and science of sustainability, chemists not only clean up the planet but, keep pollution from happening in the first place. As every responsible entity is striving towards a better world, chemistry's contribution must be realized. Chemists are developing tools and techniques to make sure that everyone can measure and analyse the air, water and soil pollutions. Process Chemists can aid us in monitoring, understanding, protecting and improving the environment.

e-ISBN: 978-93-6252-974-9 | Year of Publication 2024
DOI: https://www.doi.org/10.58532/nbennuriach2

References

[1] What does a process chemist do? (And how to become one) | Indeed.com UK
[2] Role of Chemistry in Earth's Climate | Chemical Reviews (acs.org)
[3] Green chemistry is key to reducing waste and improving sustainability (theconversation.com)
[4] Energy and CO2 management for chemical and related industries: issues, opportunities and challenges | BMC Chemical Engineering | Full Text (biomedcentral.com)
[5] Product Inspection: What It Is, Why It's Important & How It Works (marsquality.com)

