Environmental Stewardship in the PVC sector

Innovative solutions for a cleaner, healthier future.

Theunis Post - Design Chemical Engineer

About Air Pollution

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- Passionate about Family and generational stewardship
- Chemical Engineer for the last 28years
- 15 years in the Emulsion polymer manufacturing industry
- 13 years in various ventilation and air pollution abatement technologies
- Currently lead design engineer at About Air Pollution

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❖ Group of engineers with years of experience in the dry and wet filtration industry.

❖ Fabrication house with expert quality control, gathered with ASMI IX and AWS D1.1 resources to cater towards specialist needs.

❖ Global-wide turnkey development from design, drawing, fabricating, installing and maintaining.

South Africa's Plastics Manufacturing Pollution Profile

Key Pollution Sources

- Resin production (71% of sector emissions) - coal-to-liquid process for process for plastic monomers
- Energy-intensive manufacturing using coal-fired electricity
- Open burning of plastic waste (5-8% of lifecycle emissions)
- Fine particulate matter (PM2.5) and toxic chemicals from production and disposal

South Africa's plastics sector pollution is uniquely characterized by its coal- its coal-dependent energy and feedstock base, creating significant challenges challenges for abatement technologies.

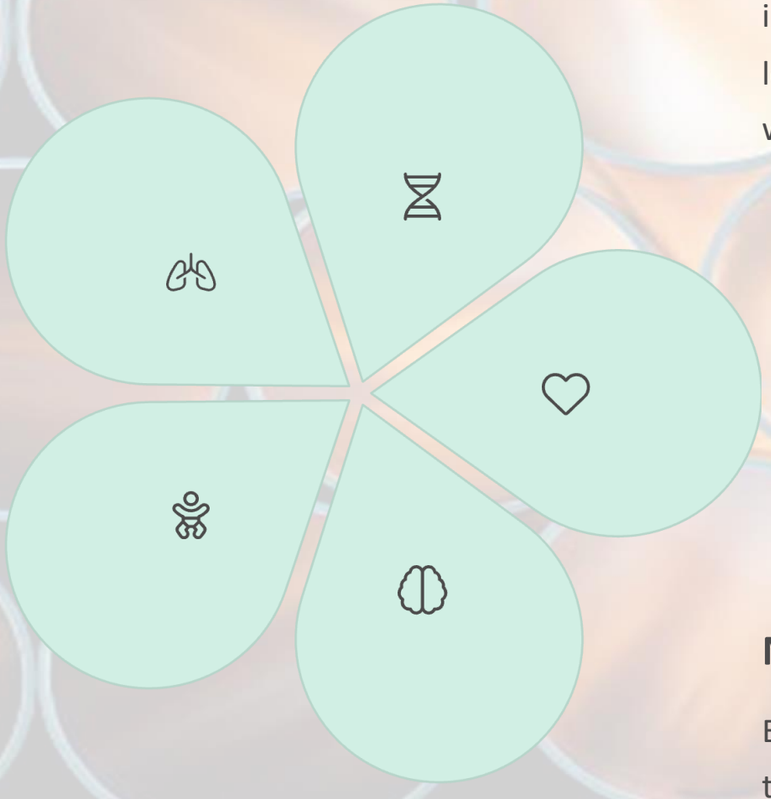
Human Health Impacts of Plastics Air Pollution

Respiratory System

Inhalation of plastic particles causes lung inflammation, impaired function, and chronic respiratory diseases. Workers exposed to plastic plastic fibers experience reduced lung capacity. capacity.

Vulnerable Populations

Children, pregnant women, industry workers, and marginalized communities face increased risks of prematurity, stillbirth, and developmental delays.



Cancer & Genetic Damage

Toxic substances from production, use, and incineration linked to increased risks of cancers, leukemia, and genetic mutations, including low birth weight and birth defects.

Cardiovascular Effects

Microplastics and plastic-associated toxins induce oxidative stress, inflammation, and immune system dysfunction, contributing to cardiovascular diseases.

Neurotoxicity

Exposure to certain plastic chemicals affects the the nervous system, causing neurological symptoms symptoms such as stress, anxiety, and cognitive cognitive decline.

Ecological Impacts on South African Habitats

Marine Habitats

- Ingestion by sharks, fish, turtles, and and seabirds causing gut blockage
- Chemical exposure from plastic additives (phthalates, bisphenol A, POPs)
- Altered sediment conditions stressing stressing benthic communities
- Transport of invasive species and harmful "plastisphere" microbial communities

Freshwater Systems

- Microplastic pollution from stormwater runoff, waste, and atmospheric deposition
- Physical and chemical disruption of aquatic organisms
- Threats to ecosystem health and biodiversity in rivers and caves

Terrestrial Environments

- Disease vector breeding grounds in improperly disposed waste
- Toxic emissions from burning affecting soil properties
- Impacts on local biota and community health

Air Emissions Act: Chemical Industry Categories

Subcategory 6.1: Organic chemical manufacturing. This involves the manufacture or use in manufacture of hydrocarbons not specified elsewhere, such as acetylene, acetic, maleic or phthalic anhydride or their acids, carbon disulfide, pyridine, formaldehyde, acetaldehyde, acrolein and its derivatives, acrylonitrile, amines, synthetic rubber, organometallic compounds, and organic dyes

Combustion & Basic Chemicals

- Subcategory 6.1: Combustion Installations
- Subcategory 6.2: Production of Lower Olefins
- Subcategory 6.3: Production of Aromatics
- Subcategory 6.4: Production of Oxygenated Compounds

Specialized Chemicals

- Subcategory 6.5: Production of Nitrogenated Compounds
- Subcategory 6.6: Production of Halogenated Halogenated Compounds
- Subcategory 6.7: Production of Sulphur Containing Compounds
- Subcategory 6.8: Production of Organo-metallic Compounds

Polymers & Synthetic Materials

- Subcategories 6.9-6.13: Various Polymer Productions
- Subcategories 6.14-6.17: Fiber and Textile Productions
- Subcategory 6.18: Organic Pigments and Dyes
- Subcategory 6.19-6.20: Surface Agents and Carbon Disulphide

South Africa's Carbon Tax Framework

South Africa's carbon tax framework implements the polluter-pays principle to incentivize businesses and consumers to factor carbon emissions into their decisions.

Carbon Tax Timeline and Phases

June 2019

Carbon Tax Act becomes effective with initial rate of R120 per tonne CO2-equivalent

1

2019-2025

Phase 1 implementation with significant tax-free allowances (60-95%) to allow transition time

2

2026-2030

Phase 2 with substantial rate increases and gradual reduction of tax-free allowances

3

2030

Carbon tax rate projected to reach R462 per tonne CO2-CO2-equivalent

4

The carbon tax supports South Africa's Nationally Determined Contributions (NDCs) under the Paris Agreement to reduce greenhouse gas emissions, with a long-emissions, with a long-term goal of net zero carbon emissions by 2050.

Practical Example: Carbon Tax Calculation (2025)

Base Calculation

For a company emitting 10,000 tCO2e annually:

10,000 tCO2e × R236/tCO2e = R2,360,000

This represents the maximum potential tax liability before applying allowances.

With Allowances

Applying typical allowances (e.g., 60% basic + 10% process + 5% performance + 5% carbon budget + 5% offsets = 85% total):

Effective tax rate: R236 × (100% - 85%) = R35.40/tCO2e

Final tax liability: 10,000 tCO2e × R35.40/tCO2e = R354,000

Air Pollution Abatement Technologies for Plastics Manufacturing in South Africa

A comprehensive overview of specialized solutions for addressing the unique challenges of plastics-related air pollution in South Africa's manufacturing sector.

Specialist designers for your application!

Assessment and Analysis

Evaluating types and quantities of pollutants generated by facilities, facilities, including particulate matter, gases (sulfur oxides, nitrogen nitrogen oxides, volatile organic compounds), and hazardous air pollutants.

Technology Selection and Design

Choosing appropriate abatement technologies such as scrubbers, electrostatic precipitators, fabric filters, catalytic converters, biofilters, or thermal oxidizers, and designing customized systems.

Integration and Optimization

Ensuring smooth integration of pollution control systems with existing existing industrial processes to maximize efficiency, minimize costs, and costs, and maintain production performance.

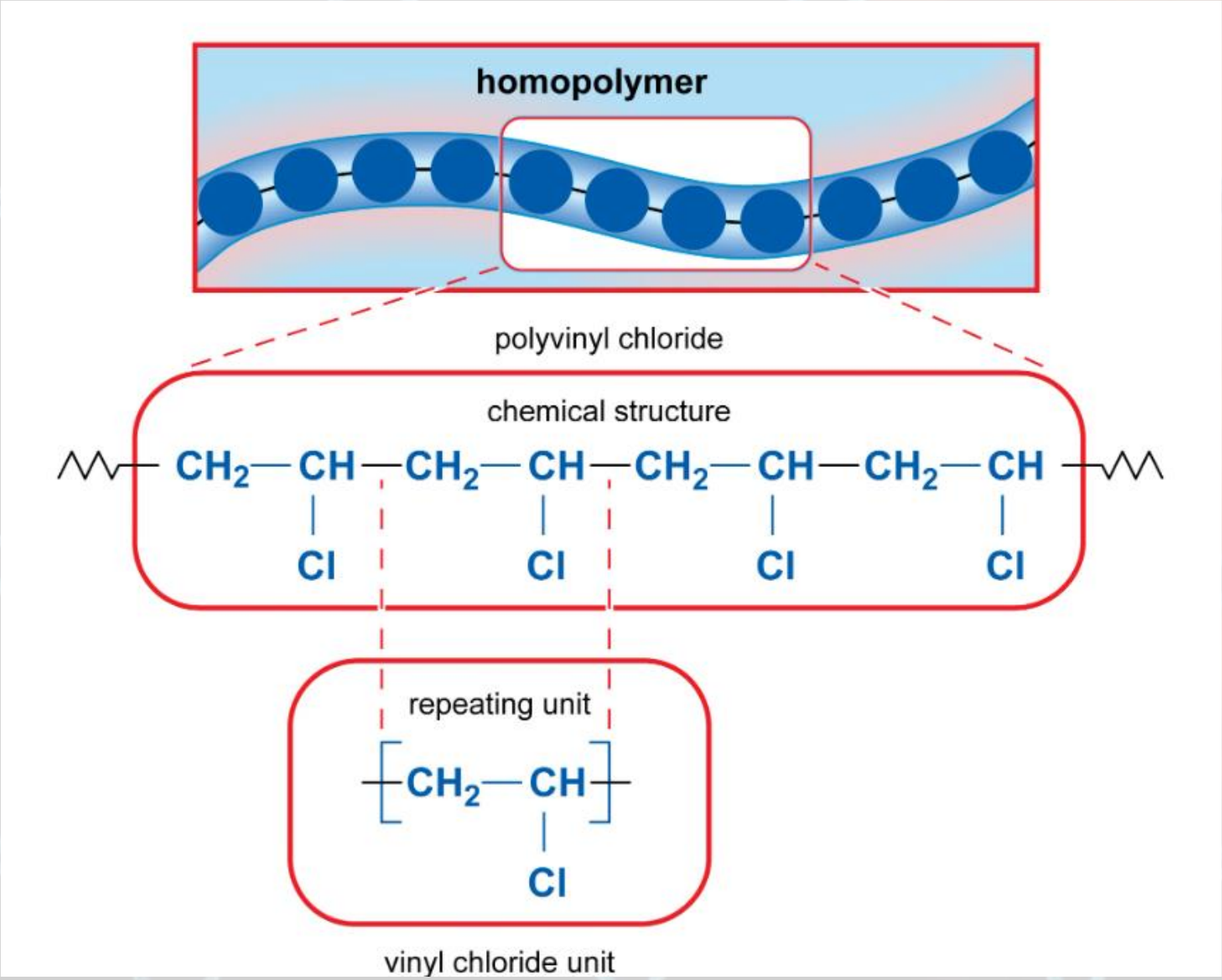
Compliance and Innovation

Helping clients comply with air quality standards while developing cutting-developing cutting-edge technologies that reduce emissions with minimal with minimal environmental footprint and energy consumption.

Specialist designers combine environmental science, engineering, and regulatory knowledge to create customized pollution control technologies tailored to specific technologies tailored to specific processes and pollutants.

Polymers-Holding Hand in the best way!

best way!



Chemical or thermal degradation causes:

Hydrochloric Acid (HCL)

Carbon Dioxide (CO2)

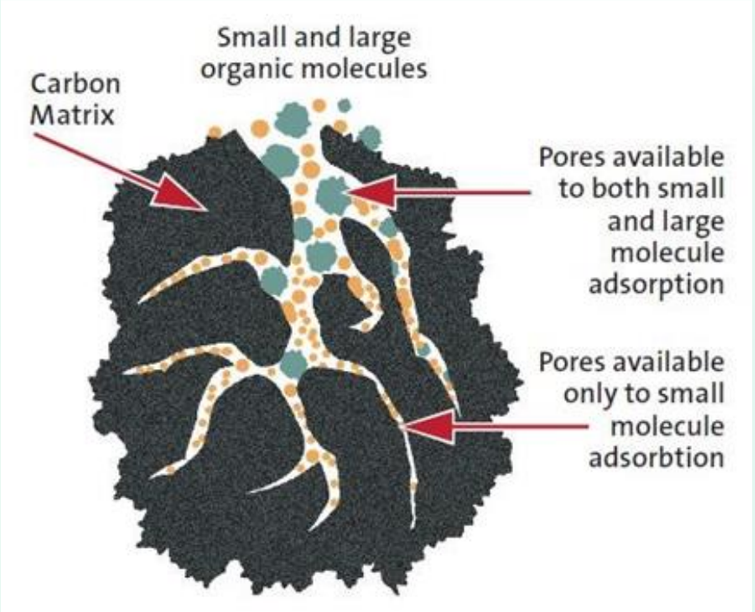
Chlorine gas (CL2)

Wet or Dry Scrubbing

Wet Scrubbing

	Venturi	Packed Bed	Spray	Tray
Max Efficiency (%)	Better than 99%	Better than 99.9%	Better than 98%	Better than 99.9%
L/G (L/m3)	0.5 -25	0.4 - 2	0.15 - 1	0.01 - 0.25
Gas Flowrate (Am^3/s)	0.1 -30	0.1 - 25	0.2 - 40	0.4 - 35
Max Temp (C°)	250	80	150	100
PM Capture	✓✓✓	✗	✓	✓✓
Gas Capture	✗	✓	✓	✓
Material of Construction	Mild Steel, Stainless Steel, GRP, Various lastic			

Dry Scrubbing



Circular Economy: From Waste to Resource

Turning PVC Abatement Abatement into Agricultural Assets

The byproducts from PVC emissions abatement, particularly calcium carbonate and sodium carbonate, can be repurposed as valuable agricultural inputs, creating a circular economy solution that transforms industrial waste into resources.

Calcium Carbonate as Agricultural Input

Benefits in Agriculture

- Neutralizes acidic soils by raising pH to levels favorable for plant growth growth
- Provides calcium, an essential nutrient for plant development
- Supports formation of strong cell walls
- Reduces disorders like blossom-end rot in fruits
- Promotes healthy root and shoot growth
- Improves soil structure through particle aggregation
- Binds heavy metals, making them less bioavailable

Calcium carbonate from PVC abatement can be applied before planting planting perennial crops or during winter months. While it works slower than slower than highly soluble compounds, it provides effective, lasting soil pH soil pH control.

Recycling Plastics

Collecting and sorting

Plastics are gathered and sorted by polymer type and color using manual or automated techniques to ensure purity.

Washing

Contaminants such as food residue, labels, and dirt are removed

Shredding

Plastics are broken into smaller flakes or pellets to facilitate processing.

Melt processing and extrusion

The flakes are melted and filtered, then extruded into uniform pellets (regranulation) that can be used to manufacture new products.

However, with each recycling loop, a gradual loss in quality usually occurs unless special additives or blending techniques are used to restore properties.

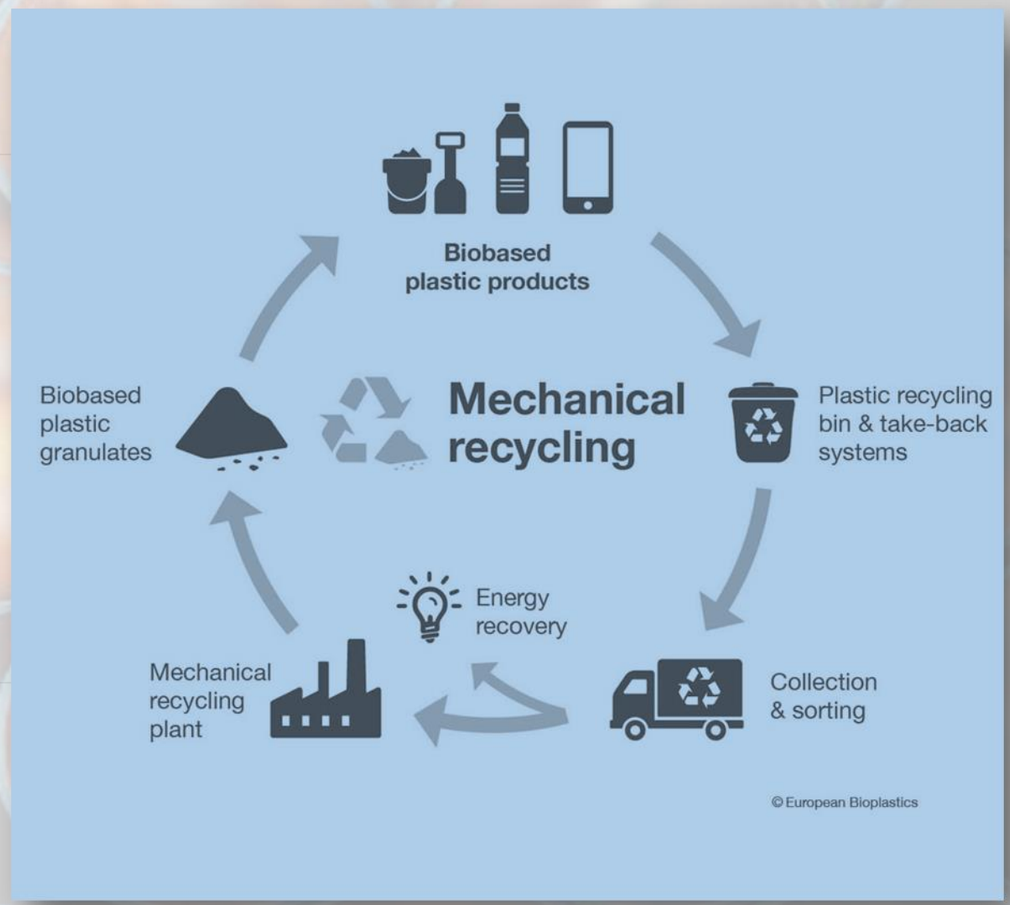
Bio-Recycling of Plastics

Key Points:

Biologically degrade plastic polymers into their fundamental units, allowing repolymerization into virgin-quality plastics

Bio-recycling includes processes such as enzymatic recycling and composting. Enzymatic recycling cleaves polymers into monomers with high chemical selectivity, resulting in purer output compared to traditional recycling.

Benefits include conserving natural resources, lowering greenhouse gas emissions, and reducing pollution caused by plastic waste that traditionally takes hundreds of years to degrade.



Reactive Scrubbing Process For PVC

Flue Gas Intake

CO_2-containing gas from PVC production enters the scrubber system system

Chemical Absorption

Gas contacts alkaline solution ($Ca(OH)_2$ or amines) forming stable compounds

Desorption

Rich solution is heated to reverse reaction and release high-purity CO_2 CO_2

Regeneration

Absorbent is regenerated and recycled back into the system

Reactive scrubbing offers high selectivity for CO_2, works effectively at low partial pressures, and can achieve high capture rates. In PVC plants, calcium-based calcium-based solutions can simultaneously capture CO_2 and neutralize acid gases like HCl.

Toward a Cleaner Tomorrow

Mitigating plastic-related air pollution requires a multi-faceted approach.

- **Shift to Cleaner Energy:** Reducing reliance on coal-based processes for resin production and electricity.
- **Improved Waste Management:** Implementing advanced recycling and proper and proper disposal methods to eliminate open burning.
- **Policy Enforcement:** Strengthening regulations and carbon tax frameworks to drive industry compliance and innovation.
- **Technological Advancement:** Continuous development of cutting-edge edge abatement solutions.

Together, we can achieve sustainable industrial growth and protect public health and the environment.

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Thank you !

Q&A