Open Cycle Atmospheric Purification System

This document contains a technical overview and component list for building a prototype of the Open Cycle Atmospheric Purification System.

SYSTEM OVERVIEW:

A modular, closed-loop vertical tower that burns waste and purifies gas emissions through ionization, chemical reactions, and condensation. Output is clean air and reusable byproducts.

CORE MODULES:

1. Combustion Core

- Function: Burns waste material (solid, liquid, or gas)

- Materials: Ceramic-lined stainless steel chamber, induction or arc heater, pressure-sealed waste feeder

- Components: Ceramic insulation (alumina), heat sensors, thermal controller

2. Ionization Chamber

- Function: Charges particles for better reaction/filtration

- Materials: Cold plasma emitter or corona discharge grid, electrostatic plates

- Components: High-voltage power supply, charged metal mesh, insulation housing

3. Reactive Chemistry Stack

- Function: Converts toxins into stable compounds

- Layers:

  a) Activated Carbon (VOCs)

  b) Zeolite (Ammonia, moisture)

c) Potassium Permanganate (Oxidation)

d) Calcium Hydroxide (Acid gases)

e) Copper Oxide (Carbon monoxide)

- Replaceable trays or cartridges with reagent sensors

4. Condensation & Quench Layer

- Function: Rapid gas cooling, water and salt capture

- Materials: Metal fins or mesh, nano-mesh film, liquid-cooled tubing

- Components: Condensation tank, air-to-water separator, exhaust draft fan

5. Output Verification Chamber

- Function: Final air polishing and validation

- Materials: HEPA filter, UV-C emitter, optical gas sensor (FTIR, PID)

- Output: Only releases air matching safe thresholds

6. Byproduct Collection Tanks

- Function: Store solids and liquids safely

- Types: Water tank, salt/mineral catch, carbon black collector

CONTROL SYSTEM:

- Microcontroller: Raspberry Pi 5 or NVIDIA Jetson Nano

- Sensors: Gas composition, heat, pressure, flow rate

- Software: Real-time feedback loop, layer-by-layer saturation analysis, emergency shutoff

BUILD NOTES:

- Frame: Steel, titanium, or fire-resistant polymer housing

- Height: Prototype (1.5m-2m), Full system (up to 8m)

- Power: Renewable (solar array + battery) or grid-connected

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