

CAPTURING AND UTILIZING CO₂ AND ASH FROM A MUNICIPAL SOLID WASTE INCINERATION PLANT



TEAM: 36 Abdurrahman Fairaq (CEE) Bassam Albassam (CEE) Naif Alqahtani (CHE) Turki Alhamal (CHE)

INTRODUCTION

Municipal Solid Waste (MSW) **incineration plant** that utilizes **carbon capture technology** allows Saudi Arabia to reduce its reliance on landfills by incinerating the MSW and utilizing its wastes and emissions to produce valuable products that could be utilized in different industries such as construction, Oil and gas, and petrochemicals. Motivated by the goal of achieving **net-zero carbon emissions by 2060**, this initiative aligns with sustainable and resilient practices for the future.

MSW Incineration: brings a way to reduce the need for landfills in the kingdom by incinerating MSW with minimal environmental harm. Captured CO₂ and the MSW ashes are utilized to produce highly durable concrete with optimized proportions, while profiting from the extra CO₂ as a product, reducing waste and increasing profitability.

Project Statement: Develop an environmentally sustainable process that recycles MSW while capturing CO₂ and utilizing it in the production of durable concrete, effectively transforming waste into marketable products while minimizing environmental impact.

OBJECTIVES



ENVIRONMENT FRIENDLY WASTE DISPOSAL



HIGH-DURABILITY CONCRETE



REPURPOSE THE WASTE GENERATED



CONTINUOUS CO₂ PRODUCTION

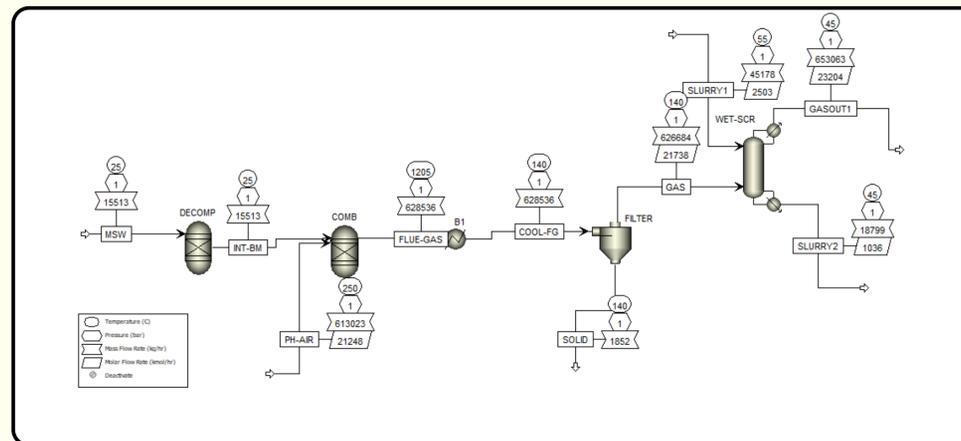
IDENTIFICATION OF CONSTRAINTS:



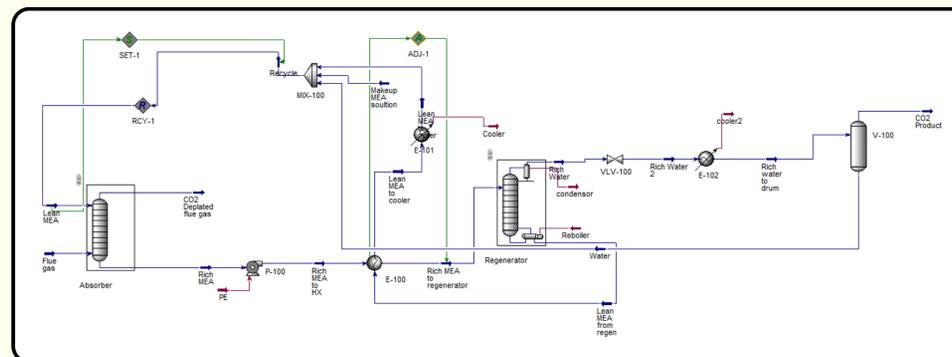
IDENTIFICATION OF SPECIFICATIONS:

CO ₂ PURITY	CO ₂ CAPTURING EFFICIENCY	SLUMP OF CONCRETE	COMPRESSIVE STRENGTH OF CONCRETE
95%	90%	100-200mm	25MPa

MSW INCINERATION



CO₂ CAPTURE UNIT

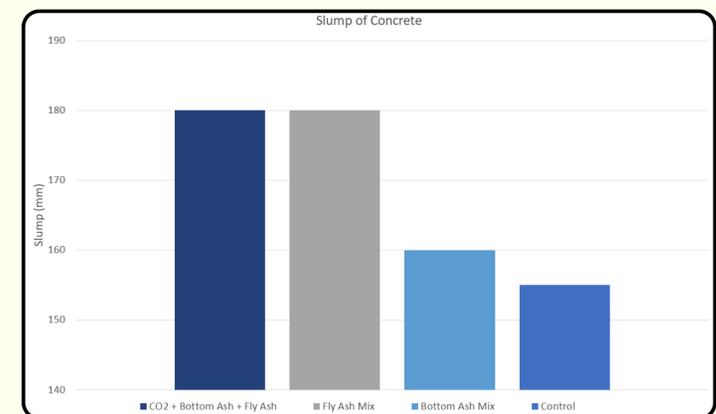
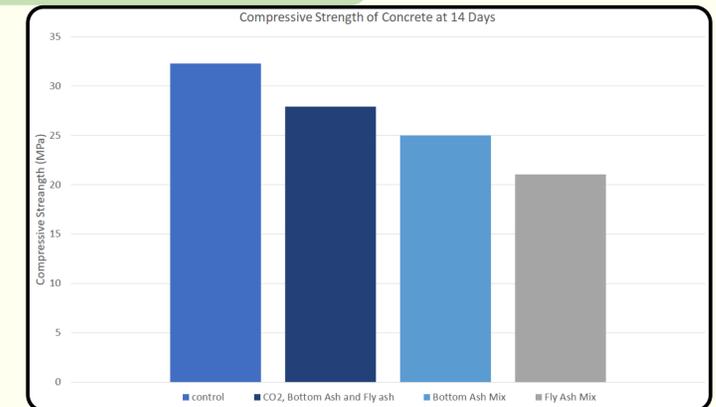


An Amine scrubbing absorption unit operates with a lean amine of 30% Monoethanolamine and 70% water that captures sour gas from the plant's flue gas and produces **99.28%wt CO₂ purity with a CO₂ capturing efficiency of 96.5%**.

CONCLUSION

In conclusion, This project demonstrates an effective method for integrating CO₂ capture and **MSW by-products** into sustainable concrete production. The results confirm that this approach not only reduces carbon emissions and landfill waste but also produces durable concrete with desirable mechanical properties. This process has significant potential for scaling in the construction industry, contributing to global sustainability efforts and aligning with **net-zero carbon emission goals by 2060**.

MSW AND CO₂ IN CONCRETE



the **CO₂**, **fly ash**, and **bottom ash** produced from the plant is incorporated into **concrete**. Fly ash was used as a replacement of cement, and bottom ash as a replacement of fine aggregates. Different mixes were made to determine the optimum amounts of fly ash and bottom ash. The concrete was cured using CO₂ for 48 hours at 60 psi

RESULTS

Constraints	Results
Gas Treatment	MET
CO ₂ Emission Limit	MET
Properties of Concrete	MET
Flue Gas Temperature	MET
Specifications	Results
CO ₂ Purity	99.28% MET
CO ₂ Capturing Efficiency	96.5% MET
Slump of Concrete	180mm MET
Compressive Strength of Concrete	31MPa MET