

Development of an Improved Packing Material Using Perlite from Albay, Bicol, Philippines and the Design of a Packed-Column for the Absorption of SO₂ Gas

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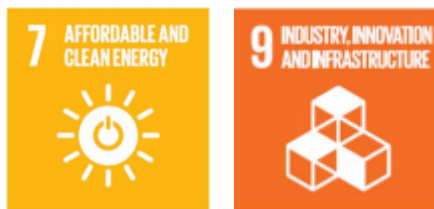
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Submission Category: “B”

Indicators to measure the impact of chemical engineering on the SDGs:



SDGs Targets/Indicators:

This Research Proposal addresses the following SDG Targets/Indicators:

- ❑ the 7th Sustainable Development Goal: “Affordable and Clean Energy” Gas absorption uses high amount of energy, large volumes of solvent and packing materials, which are expensive. All these result to the high cost of the process of the treatment of gas wastes. Due to this, there is a need for cheaper alternatives for the packing materials to be used in the industry that can maximize the efficiency of the process. Perlite is a mineral that is adaptable to different applications and holds the ideal characteristics of a packing material when it is expanded. If the gathered results are favorable, this research can contribute to a reduced amount of both solvent and energy requirements to pump the liquid in the gas absorption tower that results to a decrease in the cost of the gas absorption process.
- ❑ The 9th Sustainable Development Goal: “Industry, Innovation and Infrastructure” The design and development of a packing material for packed columns using perlite, a low-cost adsorbent medium to absorb hazardous gas wastes from refineries and other chemical industries. Globally, this research can make a huge impact to most chemical plant industries that use packed column as their gas absorbers in view of the fact that an inexpensive and effective packing material will be utilized.

Abstract:

For refineries and other chemical industries, hazardous gas wastes are treated through the process of absorption (McCabe et. Al, 2005). Absorption refers to the disposition of hazardous gas pollutants from a stream where they are dissolved by a liquid. In gas absorption, soluble components of a gas mixture are dissolved in liquid solvent. Packing materials which play a vital role in this separation process provide surface area for gas and liquid contact. This research study proposes to utilize perlite, an amorphous volcanic glass from Albay, Bicol, Philippines in the production of packing materials. The study aims to develop and characterize a packing material making use of a geopolymer derived from perlite. The design of a packed column for the absorption of SO_2 gas will be carried out. Different formulations of perlite- Na_2SiO_3 concentrations (45%, 60%, 75% wt. Na_2SiO_3) will be prepared, moulded into Rachig rings and will be cured in a dry oven at 150°C for 24 hours. The Rachig rings from geopolymerized perlite samples will be subjected to various tests such as thermal stability, chemical resistance, and compressive strength. Gas absorption experiments will be carried out using the fabricated packed column made of chemical grade fiberglass utilizing the most ideal geopolymerized perlite formulation as the packing material and SO_2 - H_2O as the feed. Based on the results of the gas absorption experiments, a packed column will be designed for the absorption of SO_2 gas.

Graphical Abstract:

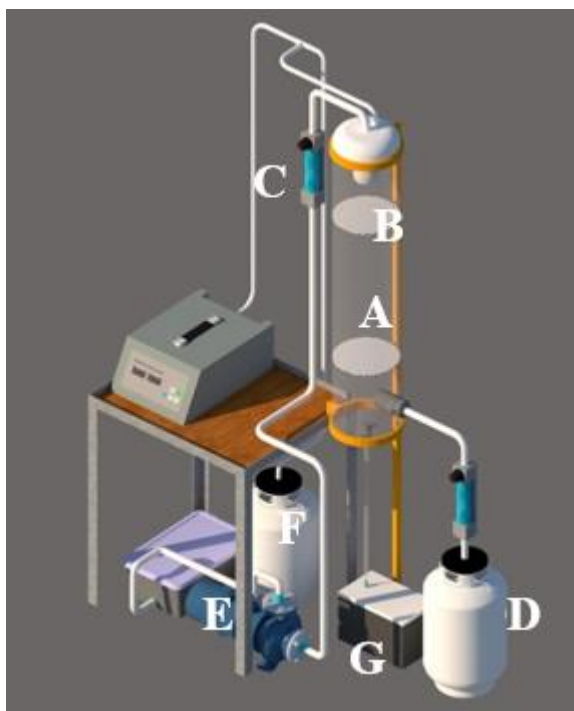


Figure 1. The proposed experimental set-up of the gas absorber with its properly labeled parts.

- A. Packing Column - A pressure vessel that has a packed section.
- B. Wire Mesh – Used to hold the packings.
- C. Flow Meter - A device used to measure the quantity of water flowing into the column.
- D. Gas Cylinder – Stores the SO_2 gas.
- E. Pump – A device that assists in moving the water from the source to the column.
- F. Distilled Water Tank – Stores the distilled water to be used.
- G. Sump Tank - Stores the outflow of liquid from the column.