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CHEMICAL AND SPECTROSCOPIC CHARACTERIZATION OF OFF-SPECIFICATION LIMESTONE (B3) WASTE FROM CEMENT PRODUCTION

Name : Siti Nur Khairiah Binti Julpin
Student ID : 2023502119
Program : AS245
Course code : FSG631
Mobile Phone : 017 865 8898
E-mail : khaijlpn@gmail.com

Approval by Main Supervisor :

I certify that the work conducted by the above student is completed and approve this report to be submitted for evaluation. The similarity index is less than 2%

Supervisor's name : Mohd Lias Bin Kamal
Date : 4/ 8/ 2025
Turnitin Similarity % : 2%
Signature :

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PRODUCTION**

SITI NUR KHAIRIAH BINTI JULPIN

**BACHELOR OF SCIENCE (HONS.) APPLIED
CHEMISTRY
FACULTY OF APPLIED SCIENCES
UNIVERSITI TEKNOLOGI MARA**

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ABSTRACT

CHEMICAL AND SPECTROSCOPIC CHARACTERIZATION OF OFF-SPECIFICATION LIMESTONE (B3) WASTE FROM CEMENT PRODUCTION

This study investigates the chemical and spectroscopic characteristics of B3 limestone waste generated during cement production in Malaysia with the aims of evaluating its potential in environmental or cement-based application. Elemental composition, functional groups, and thermal stability were investigated using analytical techniques, such as the Inductively Coupled Plasma Optical Emission Spectroscopy (ICP-OES), Fourier Transform Infrared Spectroscopy (FTIR), and Loss on Ignition (LOI). ICP-OES revealed high concentration of calcium and magnesium while, hazardous heavy metals such as lead, and cadmium were found in nondetectable values. Evidence of the predominance of calcite and silicate and aluminosilicate impurities were certified with the aid of FTIR frequencies. The LOI valued average at 30% indicating significant carbonate content. Furthermore, the waste exhibited a strong alkaline pH of 13.67 as measured using a digital pH meter. The results allow that B3 limestone waste has chemical characteristics for potential reuse as raw material in alkaline remediation technologies, soil stabilizers and a supplementary additive in cement materials. Overall, the study supports the feasibility of valorizing B3 limestone waste as part of a circular economy. Nevertheless, a further research effort is recommended with respect to regulatory constraints and real-world scenario and performance-based assessment.

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