

ABSTRAK

KARAKTERISTIK, PEMODELAN GEOLOGI DAN ESTIMASI SUMBERDAYA BAHAN BAKU SEMEN PORTLAND (BATUGAMPING DAN BATULEMPUNG): STUDI KASUS DI DAERAH TUBAN, JAWA TIMUR

Oleh
Monika Yuliana
NIM: 212231008
(Program Studi Magister Teknik Pertambangan)

Semen portland sebagai komponen vital infrastruktur, menuntut jaminan kualitas bahan baku yang berkualitas. Kualitas semen sangat ditentukan oleh karakteristik bahan baku utamanya, yaitu batugamping (sumber CaCO_3) dan batulempung (sumber SiO_2 , Al_2O_3 , dan Fe_2O_3). Komposisi unsur-unsur tersebut menentukan parameter kualitas klinker, seperti *Lime Saturation Factor* (LSF), *Alumina Modulus* (AM), dan *Silica Modulus* (SM).

Penelitian ini menggabungkan analisis geokimia, karakterisasi mineralogi, pemodelan geologi tiga dimensi, dan estimasi sumber daya untuk mengevaluasi batugamping dan batulempung sebagai bahan baku semen. Analisis XRF digunakan untuk mengetahui kadar oksida utama, sementara identifikasi mineral dilakukan melalui XRD dan petrografi. Pemodelan geologi dibuat berdasarkan data lubang bor, dan estimasi sumber daya dilakukan menggunakan metode *Inverse Distance Weighting* (IDW).

Hasil karakterisasi menunjukkan bahwa batugamping didominasi oleh mineral kalsit dengan kadar CaO tinggi dan nilai LSF sesuai standar industri. Batulempung tersusun atas mineral lempung, kuarsa, dan felspar dengan dominasi unsur pembentuk AM dan SM sesuai standar industri. Estimasi menunjukkan bahwa dari total 2,36 miliar ton batugamping, sekitar 419,83 juta ton (17,78%) memenuhi kriteria sebagai bahan baku semen. Untuk batulempung, dari total 483,73 juta ton, sekitar 266,88 juta ton (55,17%) memenuhi kriteria sebagai bahan baku semen. Hasil ini menegaskan bahwa wilayah penelitian memiliki potensi sumberdaya yang memadai untuk digunakan sebagai bahan baku semen portland.

Kata kunci: *alumina modulus*, batulempung, batugamping, *lime saturation factor*, *silica modulus*

ABSTRACT

CHARACTERIZATION, GEOLOGICAL MODELING, AND RESOURCE ESTIMATION OF PORTLAND CEMENT RAW MATERIALS (LIMESTONE AND CLAYSTONE): A CASE STUDY IN TUBAN, EAST JAVA

By

Monika Yuliana

NIM: 212231008

(Master Program in Mining Engineering)

Portland cement as a vital component of infrastructure, demands assurance of high-quality raw materials. The quality of cement is highly determined by the characteristics of its main raw materials, namely limestone (source of CaCO_3) and claystone (source of SiO_2 , Al_2O_3 , and Fe_2O_3). The composition of these elements determines clinker quality parameters, such as Lime Saturation Factor (LSF), Alumina Modulus (AM), and Silica Modulus (SM).

This study combines geochemical analysis, mineralogical characterization, three-dimensional geological modeling, and resource estimation to evaluate limestone and claystone as raw materials for cement. XRF analysis was used to determine the content of major oxides, while mineral identification was carried out through XRD and petrography. Geological modeling was constructed based on drill hole data, and resource estimation was conducted using the Inverse Distance Weighting (IDW) method.

The characterization results indicate that the limestone is dominated by calcite minerals, with high CaO content and LSF values that meet industry standards. The claystone consists of clay minerals, quartz, and feldspar, with dominant oxide components forming AM and SM ratios in accordance with industry requirements. The resource estimation shows that out of a total of 2,36 billion tons of limestone, approximately 419,83 million tons (17.78%) meet the criteria as raw material for cement production. For claystone, out of a total of 483,73 million tons, approximately 266,88 million tons (55.17%) qualify as suitable raw material. These results confirm that the study area holds sufficient resource potential to be utilized as raw material for Portland cement.

Keywords: alumina modulus, claystone, limestone, lime saturation factor, silica modulus