**Abstract Index**

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**Effect of the Moisture Increase in the Testings Density and Saturation Degree for Mine Soil at a Constant Specific Gravity Condition**

*Pengaruh Peningkatan Kadar Air dalam Pengujian Bobot Isi dan Jenuh Tanah Tambang pada Kondisi Berat Jenis Tetap*

The degree of density and saturation in soil sample under constant specific gravity conditions are influenced by the addition of water content. To find out its effect, it is necessary to test the samples which include compaction, moisture content, specific gravity and density testing. By recognizing the soil properties through a testing and calculation; dry density, saturation density, dry soil volume, pore volume, degree of saturation, porosity, and void ratio can be evaluated. The test shows that the optimum moisture content and dry density are 53,25% and 1.08g/cm3 respectively. The tests were conducted to five samples that have a specific gravity of 2.67. The obtained saturation degree were S-01: 79.05%, S-02: 92.40%, S-03: 95.06%, S-04: 94.64% and S-05: 93.12%. The value of water content in the five samples was S-01: 48.87%, S-02: 51.04 %, S-03: 53.25 %, S-04: 55.32 %, S-05: 57.24%. The densities in five samples were S-01: 1.50 g/cm³, S-02: 1.63 g/cm³, S-03: 1.64 g/cm³, S-04: 1.62 g/cm³, S-0 5: 1.59 g/cm³. The saturation degree will increase along with the addition of the water content and the density. However, beyond the optimum addition of the moisture content, the saturation degree will decrease in line with the density even though if the water content increase. This occurred in the constant condition of the specific gravity.

Keywords: moisture content, optimum moisture content, specific gravity, density, degree of saturation

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**Physical and Chemical Natures of Post Artisanal Gold Mine Area at Kebunlado Village of Riau Province**

*Karakter Fisika dan Kimia Lahan Pascatambang Emas Rakyat, Desa Kebunlado – Provinsi Riau*

Illegal artisanal gold mining in Kebunlado, Riau Province has damaged the smallholders estate. The use of mercury for extracting the gold is potentially pollute the soil and syrrounding water as well as threats plantation productivity and it's food chain. The purpose of this research is to study the mining impact towards the physical and chemical properties of the soil around the plantation, and measure the mercury contamination within the tailings, soil and river to be compared with the soil sample near the mine area. Sampling was carried out in 10 locations to study the properties of the land surrounding the artisanal gold mining. Physical and chemical properties of the soil were studied.The samples came from the mine sites (7 samples) and its surrounding area (3 samples). Sampling was conducted using a toposequence transect method, based on its topographical conditions and soil parent material with the purposive method. Mercury level was measured from eight soil samples that were sampled from surrounding artisanal mine area and six water samples from the surrounding rivers. The research showed that the soil characteristics had changed after mining activities. The soil properties were higher in sand, with bulk density and permeability compared to intact soil. However, there was no distinct change in pH, total nitrogen, organic carbon as well as available P, except C/N in post mine area was relatively low. Mercury content in the gold mine area was higher than that of the average mercury within the soil around the world. The Mercury in the river stream exceeds the threshold based on Indonesia Regulation. The study suggested that land reclamation is needed to develop oil palm plantation in terms of improving the soil physics, increasing C/N and remediation as well as reducing the mercury in soil and water.

Keywords: gold mine, mercury, soil physical properties, soil chemical properties, palm oil

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**The Kinetics of Indonesian Galena Concentrate Leaching in Fluorosilicic Acid and Hydrogen Peroxide as Its Oxidants**
*Kenetika Pelindian Konsentrat Galena Indonesia dalam Larutan Asam Fluorosilikat dan Hidrogen Peroksida sebagai Oksidator*

Lead smelting is known as a lead extraction technique which has negative impact to environment because it produces emissions of dust, $SO_2$ gas and lead. The leaching is conducted to reduce the smelting's weaknesses by extracting the lead without damaging the environment. This technique, often called hydrometallurgical lead extraction, uses liquid media to extract the lead and separate it from the elemental sulphur ($S^0$) by filtration. Particle size, slurry density (solid percentage) and acid concentration affect the dissolution of Indonesian galena concentrate with fluorosilicic acid and hydrogen peroxide as oxidants. By means of these reagents, it is expected that the Pb extraction process from galena concentrate resulted from flotation of sulfide ore can be carried out at low temperatures and lead recovery can be accomplished from the leach solution by electrowining. Studying galena leaching kinetics is required to perform galena leaching with high Pb extraction percentages. Two kinetics models are commonly used to study leaching kinetics, namely shrinking core model (SCM) and shrinking particle model (SPM). These models are used to determine the mechanism which controls leach reaction and reaction rate constant or diffusion constant of the reacting species. Total plotting of sulfide fraction dissolves with time adjusted to the existing mathematical model, and fitting the curve from the dummy model to the experimental data, are two techniques that are utilized to obtain the best kinetics model which is important in controlling the leaching reaction rate. Applying the Arrhenius equation, the relation between the reaction rate constant or the diffusion constant and the temperature is determined to calculate the leaching activation energy. The result from kinetics analysis showed that the leaching of Indonesian galena concentrate in fluorosilicic acid with hydrogen peroxide as oxidants followed the shrinking core model with diffusion through porous solid product layer as the reaction controller with activation energy of 45.81 kJ/mol or 10.91 kcal/mol.

Keywords: galena concentrate, leaching, fluorosilicic acid, kinetics, activation energy

Suryaputra, Saviqri; Rai, Made A.; Widodo, Nuhindro P. and Lingga, Bob A. (Mine Inspector, Ministry of Energy and Mineral Resources; Bandung Institute Technology)
**A Shear Test of Debris Rock at Laboratory Scale**
*Uji Kuat Geser Batuan Hancuran pada Skala Laboratorium*

As one of rock's mechanical properties, the shear strength is one of the most significant factors that affect rock-dump slope stability. On previous research, one of the tests that needs to be conducted for shear strength characteristic estimation is the field-scale tilt test that requires a lot of expense and material. In this research, a direct shear test was conducted to 3 different mudstone specimens for modeling the Barton and Kjaernsli shear strength at laboratory-scale, using the fragment size of coarse (50 mm - 1 mm), medium (<1 mm – 0.25 mm), and fine (<0.25mm). Then, the results was compared to the shear strength of the debris rock that was come from the value of the equivalent roughness (R) both derived from back-calculated and empirical calculation. This research delivers the estimated shear strength that is more representative because the specimens were controllable in regards to its fragment size and composition. The more predominant big rock fragment in a composition, the bigger its back-calculated R-value. The obtained crushed rock shear strength with empirical R was lower in value compared to the one with back-calculated R.

Keywords: Barton and Kjaernsli criterion, debris rock shear strength, equivalent roughness, mudstone, shear strength test

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**Economic Analysis of Mini Coal Gasifier (GasMin) Commercialization for Small and Medium Industries (SMIs)**
*Komersialisasi Gasifier Batubara Mini (GasMin) untuk Industri Kecil dan Menengah (IKM)*

The Research and Development Centre for Mineral and Coal Technology (*tek*MIRA) has conducted a research on the GasMin since 2011, and currently enters the commercialization stage with a partnership scheme (KSO). This technology is one solution to solve the problem regarding the availability of cheap, clean and sustainable energy as well as environmentally friendly which is specifically intended for SMIs. Economic

analysis is one of the activities in the commercialization process. From the analysis results, it can be seen that the Net Present Value of IDR is 808,273,705, the Internal Rate of Return 28.68% per year and the Payback Period 3 years and 8 months. The three indicators show that the project is financially feasible, with a level of sensitivity to changes in production costs is up to a 5% increase, and a level of sensitivity to a decrease in selling prices is up to -4%. This economic analysis is very important for both *tek*MIRA as a technology provider to find out the value of technology, and its potential partners as input in making decisions as a partnership with *tek*MIRA.