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1. Lili Tahli and Tatang Wahyudi

A CHARACTERISTIC STUDY OF POPAY ZIRCON SAND USED FOR CERAMICS, REFRACTORY AND FOUNDRY RAW MATERIALS

STUDI KARAKTERISTIK PASIR ZIRKON SEBAGAI BAHAN BAKU KERAMIK, REFRAKTORI DAN PASIR CETAK

Indonesian Mining Journal, Volume 19, Number 1, February 2016, P. 1 - 17

The objective of this study is characterizing the zircon sand from Popay of Nanga Pinoh District, West Kalimantan as well as its performance when separated using physical method, i.e., tabling and magnetic separator in terms of obtaining zircon concentrate for making zircon flour. The satisfied requirement of zircon flour will be used for ceramics, refractory and foundry raw materials. Tabling followed by magnetic separator of Popay zircon sand increase zircon content from 43.54 to 65.50%. The content increases to 66.11% when reversing the process, namely started with magnetic separator and then tabling. Mineralogical analysis using optical microscope detected six minerals available within zircon sands. Those are zircon, ilmenite, magnetite, hematite, rutile and quartz while XRD analysis only identified five minerals. Hematite was not distinguished within Popay samples. Chemical analysis of the samples shows that the ZrO_2 content within zircon flour is bigger than 65%. Such a figure is categorized as premium class for zircon flour to be used for refractory, ceramics and foundry.

Keywords: Popay zircon, tabling and magnetic separator, optical microscope and XRD analysis.

2. N. Nurhadi and M. Ade A. Efendi

UTILIZATION OF COAL GASIFICATION PRODUCER GAS FOR POWER GENERATION USING 10 KW SPARK IGNITION ENGINE

PEMANFAATAN GAS PRODUSER GASIFIKASI BATUBARA UNTUK PEMBANGKIT LISTRIK MENGGUNAKAN GENSET 10 KW TIPE SPARK IGNITION

Indonesian Mining Journal, Volume 19, Number 1, February 2016, P. 19 - 26

Coal gasification is the process of converting coal into gas to ease its use and more environmentally friendly. Research and Development Center for Mineral and Coal Technology (tekMIRA) has been researching, designing, and developing a small-

capacity gasifier with the brand of GasMin. This study discusses GasMin design and utilization for power generation using internal combustion engine type spark ignition engine. The result of laboratory analysis shows that the calorific value of producer gas was 1,013 kcal/Nm³, tar content was 4.04 mg/Nm³, particulate content was 11.17 mg/Nm³ and temperature of gas was 36°C. Based on characteristic of producer gas, it can be used for fuel in internal combustion engine. The internal combustion engine generator set (genset) used in this research was 10 kW spark ignition type. To be used for gas producer, some modifications were made on genset engine by replacing the function of the carburetor into mixing chamber for air and producer gas, and placed before mixing gas entering the combustion chamber. The results of this research show that the power generated was 4.8 kW, which was about 53% of maximum power on fuel. It is in accordance with the literature which states that de-rating of the genset engine ranges from 40-50%.

Keywords: gasifier, coal, generator set (genset), internal combustion engine, spark ignition engine

3. Husaini

IMPLEMENTATION OF MATHEMATICAL EQUATION FOR CALCULATING ALUMINA EXTRACTION FROM BAUXITE TAILING DIGESTION

PENERAPAN PERSAMAAN MATEMATIKA UNTUK MENGHITUNG PERSENTASE EKSTRAKSI ALUMINA DARI PROSES EKSTRAKSI AMPAS BAUKSIT

Indonesian Mining Journal, Volume 19, Number 1, February 2016, P. 27 - 38

Research on bauxite tailing digestion using pressurized batch reactor at a feed capacity of 86.66 kg had been conducted. Bauxite with -150 mesh of particle size is reacted with 42.15 kg of caustic soda (433.49 g/l) at 140°C for 1.0 to 2.5 hours using steam as heating media. Lime added are varied from 3 to 9 kg. After processing for a certain period of time, slurry product is transferred into a mixer. To evaluate percent extraction of Al_2O_3 from this process, the height of slurry level in the mixer, densities of the slurry, filtrate, and solid residue are measured and determined. The head sample of bauxite, filtrate and residue are analysed by using wet method to obtain Al_2O_3 content of each sample taken from the mixer. There are four equations that are used for obtaining the alumina extraction, namely :

$$V_{sl} = 4.176x + 15.83$$

$$W_{sl} = (4.176x+15.83)psl$$

$$S = (psl - pl) / (ps - pl) (ps / psl) * 100\%$$

$$E = [10 (4.176x+15.83) [1 - (p_{sl} - p_i) / (p_s - p_i)] * [C_i / F_{x_F}] \%$$

The calculation results show that by increasing lime added into the slurry, percent yield of alumina extraction tend to decrease from 46.63% for 3 kg of lime to 15.84% by using 9 kg of lime. Whereas by varying reaction time between 1.0-2.5 hours, percent yield of alumina extraction are fluctuation in the range of 42.07-60.54%, and the highest result was obtained for 1,5 hours of reaction time. By implementing those four equations above for evaluating the data, we do not need to weigh the slurry in the reactor.

Keywords: bauxite tailing, digestion, alumina extraction, mathematical model, Bayer process

4. Yuhelda, Dessy Amalia and Enggan P. Nugraha

PROCESSING ZIRCONIA THROUGH ZIRCON SAND SMELTING WITH NaOH AS A FLUX
PEMBUATAN ZIRKONIA MELALUI METODE PELEBURAN PASIR ZIRKON MENGGUNAKAN NaOH SEBAGAI BAHAN IMBUH

Indonesian Mining Journal, Volume 19, Number 1, February 2016, P. 39 - 49

Zirconia had been made through smelting the zircon sand along with NaOH as a flux. The zircon sand as the smelter feed was taken from CV. Kurnia Alam Sejati mine at Palangkaraya, Middle Kalimantan. Major content of the zircon sand was 28.04% ZrO_2 and SiO_2 51.22% with several minor oxides such as 0.54% HfO_2 , 2.53% Fe_2O_3 , 10.53% TiO_2 , 3.27% Al_2O_3 and less than 1% of alkali, alkaline earth and rare earth elements. In order to economizing the process, zircon sand upgrading was conducted prior to zirconia production. The upgrading process was conducted using several comprehensive equipments, consist of shaking table, magnetic separator and high tension separator (HTS). The upgraded sand contained 65.35% of ZrO_2+HfO_2 with 73.25% recovery, which was then used for smelting process at 650°C for 2 hours using NaOH as a flux. The product was then leached with water and sulphuric acid then crystallized to get precipitated zirconium hydroxide. The precipitated product was calcined at 900°C for 1 zirconia content was 97.27% of ZrO_2+HfO_2 with 65.13% recovery.

Keywords: zirconia, zircon sand, smelting, upgrading process and concentrate.

5. Harta Haryadi and Bambang Yuniarto

ANALYSIS ON TERMS OF TRADE OF INDONESIA'S NICKEL
ANALISIS TERMS OF TRADE NIKEL INDONESIA

Indonesian Mining Journal, Volume 19, Number 1, February 2016, P. 51 - 64

The import-export trade of nickel Indonesia until 2013 was always in a less prestigious position. It is due to the entire production of nickel is exported in raw materials, while nickel is continued to be imported to meet the industrial needs of stainless steel, nickel alloys, batteries and nickel metal alloys in the country. This study aims to analyze the advantages and disadvantages of export and import of nickel with a terms of trade analysis in net barter, which measures the ratio of the nickel export price with imports price, and gross barter measures the ratio of the nickel export volume to the import volume. Net barter of the analysis results shows that in 2007, the nickel export price was only 0.0121 times than the nickel import price, while gross barter indicates that the export volume was 11044.87 times compared to the import volume. Volume and value of the exports are in nickel ore), while imports in nickel oxide sinters, product of nickel metallurgy, nickel alloys, nickel waste and scrap and nickel powders and flakes. The analysis overview of nickel gives an indication that international trade (export-import) of nickel has not provided an optimal impact on the national and regional economy.

Keywords: terms of trade, nickel, nickel matte, export-import, international trade balance.

6. Tatang Wahyudi and Erwin Faizal

MINERALOGIC CHARACTERS OF CIJULANG PHOSPHATE ROCKS RELATED TO BIOLEACHING PROCESS
KARAKTER MINERALOGIS BATUAN FOSFAT CIJULANG PADA PROSES BIOLEACHING

Indonesian Mining Journal, Volume 19, Number 2, June 2016, P. 65 - 77

Research on potency test of selected phosphate solubilizing microfungi (PSM) isolates had been conducted. The purpose was to obtain the most potential indigenous microfungi to solubilizing phosphate in bioleaching process. Identification with moist chamber showed that the selected PSM belonged to *Penicillium* genera. Bioleaching process through measuring process growth and oxalic acid production was effective on the 8th day.

Chemical analysis showed that bioleaching process using selected indigenous PSM of phosphate rock was able to increase P_2O_5 content from 38.40 to 49.70% or improve around 11.30%. Experimental condition for such a recovery was - 140+200# of sample size an 5% of percent solid. Mineralogic characters of the leached phosphate rocks showed some micro cracks as well as encapsulation by clay minerals. Not all phosphor element was leached by oxalic acid produced by microfungi.

Keywords: phosphate rocks, phosphate solubilizing microfungi (PSM), indigenous, bioleaching, Penicillium

7. Dessy Amalia, Sariman and Azhari

POTENCY OF MAKING THE CHEMICAL MANGANESE DIOXIDE (CMD) FROM EAST NUSA TENGGARA PYROLUSITE

POTENSI PEMBUATAN MANGAN DIOKSIDA DARI PIROLUSIT NUSA TENGGARA TIMUR

Indonesian Mining Journal, Volume 19, Number 2, June 2016, P. 79 - 87

Chemical manganese dioxide has not yet commercially developed in Indonesia. It is supplied by import sector. The fact that Indonesia has manganese resources as many as 60,893,820 tons is inconsistent with above condition. Research on CMD making employed pyrolusite as the raw material with size of - 100+150 mesh. The material was then reacted with sulfuric acid 6% and various concentration of molasses as reductant from 10, 20, 30, 50 and 100 %. The manganese sulfate leachate was then purified using sodium hydroxide and then filtered to have a nonferrous manganese sulfate. The Mn was precipitated from manganese sulfate using sodium bicarbonate. The precipitated manganese carbonate was then calcined at 600°C by injecting the air at various flow rates (100, 200, 300, 400 cc/minute) and different calcination time (2, 3, 4 hours) to get manganese dioxide. The best extracted Mn reached 97.58% using 50% of molasses as a reductant. The precipitation of manganese carbonate had produced sodium carbonate as an impurity. The calcination had not yet changed the manganese carbonate into manganese dioxide due to extremely high calcination temperature.

Keywords: pyrolusite, molasses, precipitation, calcination.

8. Widodo, Subari and Bagus D. Erlangga

CHARACTERIZATION OF KARANGNUNGGAL KAOLIN AS RAW MATERIALS FOR CERAMIC *KARAKTERISASI KAOLIN KARANGNUNGGAL UNTUK BAHAN BAKU KERAMIK*

Indonesian Mining Journal, Volume 19, Number 2, June 2016, P. 89 - 97

Kaolin from Karangnunggal had been characterized. This kaolin has a brownish white in color and is associated with tuff. To identify characteristics, the samples was analyzed by XRD, optical microscope, AAS, and SEM. The results showed that the kaolin consisted of kaolinite, halloysite, cristobalite, dickite, muscovite, illit and hematit while petrographic analysis describes halloysite, kaolinite, dickite, and quartz. SEM analysis showed the crystal forms such as kaolinite, halloysite and dickite; while chemical analysis confirmed that kaolin composition comprised SiO_2 = 65.78 %, Al_2O_3 = 19.55 %, Fe_2O_3 = 0.90 % and LOI = 8.29 %. Based on characterization results Karangnunggal kaolin originated from tuff alteration. Referring to such properties, this kaolin can be used as raw material for white ceramic products such as sanitary, ceramic tiles and insulation.

Keywords: kaolin, XRD, petrographic, SEM, chemical, utilization

9. Datin F. Umar and Gandhi K. Hudaya

THE USE OF 1-METHYL NAPHTHALENE AS COAL ASH REMOVAL SOLVENT

PENGUNAAN 1-METIL NAFTALEN SEBAGAI LARUTAN PENGHILANG KADAR ABU DALAM BATUBARA

Indonesian Mining Journal, Volume 19, Number 2, June 2016, P. 99 - 108

Solvent extraction method is one of the methods to reduce ash content in coal to improve the energy efficiency and reduce negative environmental impacts. The use of 1-methyl naphthalene (1-MN) as a solvent in the weight ratio of coal to solvent of 1: 3, 1: 6 and 1: 9 using three coal samples obtained from a coal washing plant, namely ROM (run of mine), DC (dirty coal) and RC (reject coal) was performed. Results show that the ash content of the extracted coals no or significantly low amount (<0.3%) ash contents. The highest extraction yield was obtained at 15.38 % (daf) at DC coal sample and coal to solvent ratio of 1:9,

while the lowest at 3.09 % (daf) at ROM coal sample and coal to solvent ratio of 1:3. In addition, the extraction process with a solution of 1-MN also able to reduce moisture content of the coals, as a result the calorific value of the coals were significantly increased.

Keywords: solvent, ash, extraction yield, moisture, calorific value.

10. M. Ade A. Efendi and Yenny Sofaety

ANALYZING CHEMICAL KINETICS OF COAL GASIFICATION IN MINI GASIFIER REACTOR

ANALISIS KINETIKA REAKSI GASIFIKASI BATUBARA PADA REAKTOR GASIFIKASI MINI

Indonesian Mining Journal, Volume 19, Number 2, June 2016, P. 109 - 119

Coal gasification is a chemical reaction that has a purpose to change the original solid coal into gaseous compounds. Converting the coal into gaseous compounds will make the combustion process easier and results in increasing combustion efficiency. The sulfur and nitrogen are also easier to be separated in order to obtain cleaner flue gas. This paper presents kinetic analysis of coal gasification reactions in mini gasifier (or known as GasMin in Bahasa) reactor. The results show that the increase of the air-coal ratio (ACR) affected the maximum temperature of the reactor, which means that an increase of the intake air flow rate will increase the amount of oxygen for combustion reaction. Meanwhile, the increase of the steam coal ratio (SCR) will increase flow rate of the mixture of air-steam feed. As a result, the ability of coal gasification has also increased. This will increase gasification efficiency around 3-5% which then will also increase the gas yield. The maximum value of SCR was 0.06, further than that of the yield gas and the q-value will slightly decrease. The simulation result showed that the producer gas was dominated by CO with 26.72% mole fraction; H₂ with 14.06% mole fraction, and N₂ with 47.88% mole fraction. Meanwhile CO₂, CH₄ and O₂ mole fraction were 5%, 0.24%, and 1.20% respectively.

Keywords: coal, gasification, mini gasifier, kinetic reactions.

11. Binarko Santoso

NEOGENE TENGGARONG COALS-KUTAI BASIN-EAST KALIMANTAN

FAKTOR-FAKTOR PENGONTROL KOMPOSISI BATUBARA TENGGARONG NEOGEN-CEKUNGAN KUTAI-KALIMANTAN TIMUR

Indonesian Mining Journal, Volume 19, Number 3, October 2016, P. 119 - 131

Petrographic composition of the Neogene Tenggarong coals in the Kutai Basin-East Kalimantan indicates its geological setting. The aim of this study is to obtain an understanding of the geologic aspects controlling the petrographic composition of the coals. Variation of type and rank in the coals was determined by petrographic examination of twenty-two samples. The coals are absolutely dominated by vitrinite, common liptinite and rare inertinite and mineral matter. Vitrinite macerals are dominated by detrovitrinite and telovitrinite. Cutinite and resinite are the dominant liptinite macerals in the coals. The inertinite macerals include semifusinite, inertodetrinite and sclerotinite. Clay and pyrite are the dominant mineral matters in the coals. The type differences largely reflect climatic influence and differences in peat conditions. Rank of the coals, in general, depends largely on the stratigraphic position. Reflectance measurements on the coals indicate that there is a slightly difference in rank. The coals are sub-bituminous rank (R_vmax of 0.40-0.47%). The change in vitrinite reflectance of the coals is due to the thicker cover/overburden on the high rank coals. Nevertheless, the vitrinite reflectance is higher in some coals in the Loa Kulu area (R_vmax of 0.48-0.57%) due to its stratigraphic position that is at the bottom of the sequence. The type and rank characteristics of the coals clearly influence the utilization. The coals are suited to utilize for direct combustion and therefore, the major utilization potential would be for power generation.

Keywords: Neogene coal, petrography, type, rank, geologic aspects.

12. Ika Monika

POTENTIAL STUDY OF INDONESIA COAL FOR ADSORBED NATURAL GAS
STUDI POTENSI BATUBARA INDONESIA UNTUK ADSORBED NATURAL GAS

Indonesian Mining Journal, Volume 19, Number 3, October 2016, P. 133 - 142

Low rank coal was used as a precursor for the preparation of adsorbed natural gas by chemical activation with KOH-NaOH mixtures. Chemical activation process is commonly used and involves two major steps, which are heating process and chemical treatment process. The experiments were used in the various of temperatures, contact times, and ratio of sample and chemical compound. The result of process was obtained of the iodine number around of 1004 mg/g and 1198 mg/g. Based on the other study, the iodine number at 1004 mg/g and 1198 mg/g have surface area between 1000 mg/g up to 1200 mg/g. These surface area provide a methane capacity between 75 mg/g up to 80 mg/g.

Keywords: activated carbon, adsorbed natural gas, surface area, iodine number.

13. Sri Handayani and Suratman

BIOLEACHING OF LOW GRADE NICKEL ORE USING INDIGENOUS FUNGI
PELINDIAN BIJIH NIKEL KADAR RENDAH MENGGUNAKAN JAMUR INDIGENOS

Indonesian Mining Journal, Volume 19, Number 3, October 2016, P. 143 - 152

In this research, the biological leaching of nickel by indigenous fungi isolated from Indonesian limonite was studied to develop a feasible technique for microbial recovery of nickel from low grade nickel ore. XRD analyses indicated that goethite, alumina and quartz were major mineral composition of the ore. In the present study, isolated fungal strains having potential to solubilize nickel were characterized. that were identified as *Aspergillus sp* and *Penicillium sp* depending upon their colony morphology and microscopic studies. All microorganisms found were tested for organic acid production and leaching capabilities of nickel. Leaching experiments were performed in 250 ml Erlenmeyer flask at room temperature and 150 rpm agitation under aseptic conditions. It was

observed that the *Aspergillus sp* substantially leached more nickel from limonite compared to the *Penicillium sp*. Nickel solubilization was related to pH decrease and organic acid excreted caused by growth of fungi in medium containing glucose as carbon source. The mechanisms of nickel extraction had been examined either directly or indirectly related to fungal activity. The presence of fungal cells seems to improve the leaching process. However, the use of higher pulp density resulted in a decrease of nickel solubilization. The maximum nickel recovery was 57% at 5% pulp density after 20 days of direct leaching by *Aspergillus sp*.

Keywords: bioleaching, low grade nickel ore, indigenous fungi, *Aspergillus sp*, *Penicillium sp*.

14. Suratman

GOLD RECOVERY OF REFRACTORY SULFIDE CONCENTRATES USING DIRECT CYANIDE LEACHING WITH NITRITE AS AN OXIDANT
PEROLEHAN EMAS DARI KONSENTRAT REFRAKTORI SULFIDA DENGAN SIANIDASI LANGSUNG MENGGUNAKAN OKSIDAN NITRIT

Indonesian Mining Journal, Volume 19, Number 3, October 2016, P. 153 - 165

The problem of refractory sulfide gold ore that has a gold recovery less than 50% when direct cyanidation applied, still exists until now. It needs oxidative pretreatment for cyanidation to be effective in gold recovery the objective of this study is figuring out the effect of sodium nitrite as an oxidizing reagent on cyanidation of refractory gold ore. Cyanide leaching of the concentrate was performed at 20%-w/w of solid (500 gram of refractory sulfide gold ore concentrate) in a 2.5-liter glass reactor with aeration and stirred at 250 rpm. Leach solutions were prepared using deionized-distilled water at the prescribed concentration of reagents. Recovery of gold increased gradually to its maximum value of 93.05% as the value of cyanide strength increased from 0.8 to 1.2% and the addition of sodium nitrite raise to 1.2 M. No improvement for further addition of nitrites. This introduction of new hydrometallurgical pre-treatment process has given more option for treating refractory ores.

Keywords: refractory gold ore, leaching, cyanide, nitrite, oxidant.

15. Harta Haryadi

ANALYSIS OF THE VALUE-ADDED FOR TAYAN BAUXITE ORE AND CHEMICAL GRADE ALUMINA

ANALISIS PENINGKATAN NILAI TAMBAH PENJUALAN BIJIH BAUKSIT DAN CHEMICAL GRADE ALUMINA TAYAN

Indonesian Mining Journal, Volume 19, Number 3, October 2016, P. 167 - 178

Research conducted at PT. ANTAM and PT. ICA (Indonesia Chemical Alumina) Tayan, West Kalimantan was aimed to compare the amount of company value-added from selling the bauxite ore as a raw material and the chemical grade alumina as a processed goods. This research showed that company value added from selling 850.000 tons raw material US \$ 8.92 million it consisted of salary and wages of US \$ 692.42 thousand, royalties, CSR and insurance US \$ 473.87 thousand, surveyor services US \$ 150.00 thousand, other services \$ 45.00 thousand, corporate income tax of US \$ 1.64 million, Bank interest US \$ 191.77 thousand. The company profits obtained the US \$ 5, 73 million was. Of the US\$ 8.92 million added value and 850.000 bauxite selling, the increase of total added value was US\$ 10.49 per ton. Selling the chemical grade alumina up to 300,000 tons or equivalent to 850,000 tons provided the value -added to the US \$ 57.24 million that consisted of an increase in revenue salaries and wages to US\$ 3.85 million. 50.75 billion, royalties, CSR and insurance of US \$ 2.49 million, surveyor services and other services US \$ 16.50 million, corporate income tax \$ 10.39 million, Bank interest US \$ 1.21 million and corporate profits to the US \$ 22.00 million. The overall value added from selling the processed goods was US\$ 190.44 per ton. It is indicated that selling the chemical grade alumina provides a greater profit than that of selling the raw material.

Keywords: analysis, value-added, processing, bauxite, chemical grade alumina.

16. Retno Damayanti and Herni Khaerunissa

COMPOSITION AND CHARACTERISTICS OF RED MUD: A CASE STUDY ON TAYAN BAUXITE RESIDUE FROM ALUMINA PROCESSING PLANT AT WEST KALIMANTAN
KOMPOSISI DAN KARAKTERISTIK RED MUD: STUDI KASUS RESIDU BAUKSIT TAYAN PABRIK PENGOLAHAN ALUMINA DI KALIMANTAN BARAT

Indonesian Mining Journal, Volume 19, Number 3, October 2016, P. 179 - 190

Bauxite residue emerges as the major waste material during production of alumina from bauxite by the Bayer's process. An alumina refinery built in Tayan, West Kalimantan has a aproduction capacity of 300 thousands tons per year. It means that it will produce red mud or bauxite residue approximately 300 – 350 thousands tons per year and washing residue around 200 thousand tons per year. Right now, it is stored in a nearby disposal area. This paper focuses on the characteristic study of the bauxite residue to evaluate the potential pollution risk to the surrounding environment. This experimental-based study is conducted to get appraisal and description of the residue regarding its utilization. Some characterization tests were conducted in the laboratory to find the properties of bauxite residue coupled with the previous study. It is found from the study that bauxite residue shows radioactivity elements. It comprises of oxides of iron, titanium, aluminum and silica along with some other minor constituents in the form of heavy metals and rare earth elements. Hazardous elements such as As, Pb, Cr and Hg were found in bauxite residue samples. But, the toxicity test showed that bauxite residue samples were not classified as hazardous material. Some rare earth elements such as Ga, Ce, Sc, Pr, Gd, Tb etc., were also detected in the samples.

Keywords: bauxite residue, red mud, Bayer process, alumina, heavy metals.

PEER REVIEWERS

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Thomas, L. (2002) *Coal geology*. John Wiley & Sons Ltd., the Atrium, Southern Gate, Chichester, West Sussex, England. 384 p.

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