



SINTA 2018: Seminar Nasional Penelitian Bidang Ilmu Teknik dan Aplikasi Industri

Hotel Emersia
Bandar Lampung, Indonesia, October 19, 2018

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Poster	download
Abstract registration deadline	September 22, 2018
Submission deadline	September 28, 2018

Topics: [engineering](#) [applied science](#) [computer and informatics](#) [technologies](#)

Kami mengundang Anda semua di SINTA 2018 !...

Pendahuluan

Kegiatan penelitian di Perguruan Tinggi yang dewasa ini digalakkan Pemerintah dengan tinjauan output riset, memacu para peneliti untuk menghasilkan output yang mendapat pengakuan tinggi baik dalam bentuk artikel jurnal internasional bereputasi maupun dalam bentuk paten produk/proses yang pada akhirnya mengarah kepada hilirisasi hasil dalam bentuk bisnis produk penelitian.

Berdasarkan kepada hal tersebut, Fakultas Teknik Universitas Lampung (FT UNILA) akan menyelenggarakan kegiatan Seminar Nasional Hasil Penelitian Sains, Teknik dan Aplikasi Industri (SINTA 2018) yang bertujuan untuk meningkatkan kualitas produk penelitian Perguruan Tinggi, berdiskusi tentang perkembangan penelitian terkini dalam bidang sains dan keteknikan dan meningkatkan peluang kerjasama antar bidang bagi para peneliti.

FT UNILA mengundang para peneliti baik akademisi maupun industriawan Indonesia untuk mempresentasikan hasil-hasil penelitian pada kegiatan tersebut.

Bidang Kajian

SINTA 2018 mengakomodasi beberapa bidang kajian ilmu-ilmu Sains, Teknik dan Aplikasi Industri yang terdiri dari:

- Bidang 1, Teknik Sipil dan Arsitektur
- Bidang 2, Teknik Geofisika, Geodesi, Geologi (Kebumian)
- Bidang 3, Teknik Mesin dan Manufaktur Industri
- Bidang 4, Teknik Elektro, Elektronika, Teknologi Informasi dan Komputer
- Bidang 5, Teknik Kimia dan Ilmu Lingkungan
- Bidang 6, Sains Terapan

SERTIFIKAT

DIBERIKAN KEPADA:

ORDAS DEWANTO

SEBAGAI PEMAKALAH DENGAN JUDUL:

Effect of Clay (Illite) toward Maturation and Potential of Organic Material (Stearic Acid) as Basis to Determine the Parameter of Laboratory Test on Shale Material Processing

DALAM ACARA

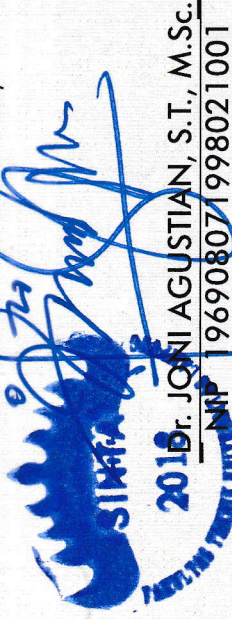
SINTA SEMINAR NASIONAL HASIL PENELITIAN SAINS,
TEKNIK, DAN APLIKASI INDUSTRI 2018
RISET PT - EKPLORASI HULU DEMI HILIRISASI PRODUK

HOTEL EMERSIA & RESORT
BANDAR LAMPUNG, 19 OKTOBER 2018

DEKAN FAKULTAS TEKNIK,
UNIVERSITAS LAMPUNG

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**SINTA**

SEMINAR NASIONAL
HASIL PENELITIAN SAINS,
TEKNIK, DAN APLIKASI
INDUSTRI - 2018

RISET PT - EKSPLORASI HULU DEMI HILIRISASI PRODUK

19 OKTOBER 2018

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SAMBUTAN KETUA PANITIA

Assalamualaikum wr wb
Alhamdulillahirobbil alamin ...
Tabikpun

Ijinkan saya selaku ketua panpel SEMINAR NASIONAL HASIL PENELITIAN SAINS, TEKNIK DAN APLIKASI INDUSTRI FT UNILA tahun 2018 untuk menyampaikan laporan singkat.

Tahun 2018 ini, Fakultas Teknik Universitas Lampung untuk ke sekian kalinya mengadakan kegiatan seminar pada level nasional yang tahun ini diberi nama SINTA 2018. Hal ini dilatar belakangi oleh kegiatan penelitian di Perguruan Tinggi yang sangat digalakkan oleh Pemerintah dengan tinjauan luaran penelitian agar memacu para peneliti untuk menghasilkan output yang mendapat pengakuan tinggi baik dalam bentuk artikel jurnal internasional bereputasi maupun dalam bentuk paten produk/proses yang pada akhirnya mengarah kepada hilirisasi hasil penelitian dalam bentuk bisnis produk riset. Semnas SINTA 2018 bertujuan untuk meningkatkan kualitas produk penelitian Perguruan Tinggi, berdiskusi tentang perkembangan penelitian terkini dalam bidang sains dan keteknikan dan meningkatkan peluang kerjasama antar bidang bagi para peneliti.

5 Pembicara utama dihadirkan pada kegiatan ini yang berasal Badan Penelitian, Pengembangan dan Inovasi Daerah pemerintah Provinsi Lampung (Balitbangnovda Lampung), Universitas Lampung, Universitas Andalas dan Universitas Sultn Ageng Tirtayasa, dan Balai Penelitian Teknologi Mineral Lembaga Ilmu Pengetahuan Indonesia (BPTM LIPI). Sekitar 80 peserta yang hadir pada kegiatan merupakan para peneliti yang tidak hanya berasal dari Perguruan Tinggi yang berada di Provinsi Lampung, melainkan juga dari daerah lain, seperti Universitas Jambi, Universitas Indonesia, Universitas Gajah Mada, dan Lembaga Ilmu Pengetahuan Indonesia. Terdapat 5 bidang utama yang diseminarkan, yaitu: Teknik Kimia dan Lingkungan, Teknik Elektro dan Informatika, Teknik Geologi dan Geofisika, Teknik Sipil dan Arsitektur dan Teknik Mesin dan Material.

Saya selaku Ketua Panitia pelaksana mengucapkan banyak terimakasih kepada Bp Walikota Bandar Lampung yang diwakili oleh Asisten II yang telah bersedia hadir untuk membuka acara ini, dan Para Undangan yang telah meluangkan waktunya untuk menghadiri acara ... teristimewa kepada Pemakalah dan Peserta yang telah hadir, sehingga acara ini dapat terselenggara.

Terimakasih yang banyak kami sampaikan kepada para sponsor: PT. Adhi KARYa, Inkindo Provinsi Lampung dan PT. Elnusa. Terimakasih kepada para rekan dosen dan mahasiswa yg sangat membantu agar acara dapat terselenggara. Terakhir kepada pihak hotel Emersia yg telah dengan baik bekerjasama agar acara ini dapat berlangsung dg sukses.

Billahi taufik walhidayah
Wassalamualaikum wr wb.

Bandar Lampung, 19 Oktober 2018

Dr. Joni Agustian, S.T., M.Sc.



SUSUNAN DEWAN REDAKSI
SEMNAS NASIONAL HASIL PENELITIAN SAINS, TEKNIK DAN APLIKASI
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(SEMNAS SINTA FT UNILA 2018)

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SUSUNAN ACARA
SEMINAR NASIONAL HASIL PENELITIAN SAINS, TEKNIK DAN APLIKASI
INDUSTRI FAKULTAS TEKNIK UNIVERSITAS LAMPUNG TAHUN 2018
(Semnas SINTA FT UNILA 2018)

HOTEL EMERSIA BANDAR LAMPUNG, 19 OKTOBER 2018

07:30 – 08:30	Registrasi
08:30 – 09:00	Pembukaan
(08.30 – 08.35)	(Menyanyikan Lagu Indonesia Raya)
(08.37 – 08.42)	(Laporan Ketua Panitia Semnas Sinta FT UNILA 2018)
(08.45 – 08.55)	(Sambutan Wakil Rektor sekaligus pembukaan acara)
(08.55 – 09.00)	(----- Doa -----)
09:00 – 09:25	Keynote speaker 1: Ir. Mulyadi Irsan, M.T. (Moderator: Dr. Nandi Kheiruddin, S.Si., M.T.)
09:25 – 09:50	Keynote speaker 2: Prof. Dr. Eng. Gunawarman, S.T., M.T. (Moderator: Dr. Nandi Kheiruddin, S.Si., M.T.)
09.50 – 10.00	Break dan Foto Bersama
10.00 – 10:25	Keynote speaker 3: Dr. Eka Sari, S.T., M.T. (Moderator: Dr. Vera Agustriana N., S.T., M.T.)
10.25 – 10.50	Keynote speaker 4: Dr. Sudiby, S.T., M.Sc. (Moderator: Dr. Eng. Yul Martin, S.T., M.T.)
10.50 – 11.25	Keynote speaker 5: Prof. Dr. Ahmad Saudi Samosir, S.T., M.Sc. (Moderator: Dr. Eng. Yul Martin, S.T., M.T.)
11:30 – 13:00	Sholat dan makan siang
13.00 – 14.08	Sesi Paralel 1
14.10 – 15.18	Sesi Paralel 2
15.18 – 15.30	Break
15.30 – 16.45	Sesi Paralel 3
16.45 – 17.00	Penutupan acara: Tarian Penutup dan Foto Bersama

Sesi Paralel 1.

Waktu	Ballroom 1	Ballroom 2	Crystal 1	Crystal 2	Crystal 3
	Moderator: Pak Hanif (Yahya)	Moderator: Dr. Helmy (Ridwan)	Moderator: Pak Afri Y. (Detri)	Moderator: Dr. Vera (Jesu)	Moderator: Pak Yudi (Dedi)
Kode Artikel					
13:00 – 13:12	BR-1-2	BR-2-3	CR-1-5	CR-2-26	CR-3-32
13:14 – 13:26	BR-1-4	BR-2-14	CR-1-9	CR-2-37	CR-3-39
13:28 – 13:40	BR-1-6	BR-2-1	CR-1-10	CR-2-40	CR-3-41
13:42 – 13:54	BR-1-7	BR-2-21	CR-1-11	CR-2-43	CR-3-42
13:56 – 14:08	BR-1-24	BR-2-25	CR-1-15	CR-2-57	CR-3-45

Sesi Paralel 2.

Waktu	Ballroom 1	Ballroom 2	Crystal 1	Crystal 2	Crystal 3
	Moderator: Dr. Sudiby (Dwi)	Moderator: Dr. Khairudin (Talita)	Moderator: Pak Bagus (Detry)	Moderator: Pak Amril (Dedi)	Moderator: Pak Mona (Ulfa)
Kode Artikel					
14:10 – 14:22	BR-1-44	BR-2-29	CR-1-16	CR-2-60	CR-3-59
14:24 – 14:36	BR-1-46	BR-2-55	CR-1-34	CR-2-69	CR-3-75
14:38 – 14:50	BR-1-56	BR-2-61	CR-1-38	CR-2-71	CR-3-87
14:52 – 15:04	BR-1-58	BR-2-63	CR-1-47	CR-2-73	CR-3-8
15:06 – 15:18	BR-1-62	BR-2-64	CR-1-48	CR-2-74	CR-3-91



Sesi Paralel 3.

Waktu	Ballroom 1	Ballroom 2	Crystal 1	Crystal 2	Crystal 3
	Moderator: Pak Joni (Dwi)	Moderator: Dr. Lukmanul (Talita)	Moderator: Bu Rahmi (Yahya)	Moderator: Dr. Karami (Ridwan)	Moderator: Dr. Irsyad (Jesu)
	Kode Artikel				
15:30 – 15:48	BR-1-67	BR-2-65	CR-1-52	CR-2-80	CR-3-92
15:50 – 16:02	BR-1-68	BR-2-82	CR-1-53	CR-2-81	CR-3-86
16:04 – 16:16	BR-1-77	BR-2-84	CR-1-72	CR-2-83	CR-3-93
16:18 – 16:30	-----	BR-2-85	CR-1-79	CR-2-90	CR-3-94



DAFTAR ISI

Kata Sambutan Ketua Panitia	ii
Susunan Dewan Redaksi Semnas SINTA FT UNILA 2018	iii
Susunan Acara Semnas SINTA FT UNILA 2018	v
Daftar Isi	vii
Abstrak Keynote Speaker-1: Prof. Dr. Eng. Ir. Gunawarman, M.T.	1
Abstrak Keynote Speaker-2: Ir. Mulyadi Irsan, M.T.	2
Abstrak Keynote Speaker-3: Prof. Dr. Ahmad Saudi Samosir, S.T., M.T.	3
Abstrak Keynote Speaker-4: Dr. Eka Sari, S.T., M.T.	4
Abstrak Keynote Speaker-5: Dr. Sudibyoy, S.T., M.Sc.	5
Kelompok Teknik Kimia, Teknik Industri dan Teknik Agroindustri	
BR-1-02 Analisis Inovasi Dan Kualitas Produk Baru Opak Biji Karet Terhadap Kepuasan Konsumen Di kota Serang (Akbar Gunawan, Dhena Ria Barleany, Romi Wiryadinata, Intan Baruna Pertiwi)	6
BR-1-04 <i>Effect of Carbonization Time for Yield and Fixed Carbon Content in Activated Charcoal of Coconut Shell Using Electrical Carbonization Furnace</i> (Enggal Nurisman, Syaiful Anang, Rahmatullah Rahmatullah)	11
BR-1-06 <i>Nickel-Cobalt Extraction Process from Low-Grade Laterite Ores Using Cyanex 272 and Versatic Acid 10</i> (Sudibyoy Sudibyoy, Lilis Hermida)	17
BR-1-07 Ekstraksi Asam Oksalat Dari Belimbing Wuluh (<i>Averrhoabilimbi L</i>) Dengan Larutan NaOH Dan HNO ₃ (David Candra Birawidha, Yosi Maya Aprilia Sari, Yusup Hendronursito, Kusno Isnugroho, Muhammad Amin, Posman Manurung)	23
BR-1-24 <i>Performance Measurement Using Balanced Scorecard, Analytical Hierarchy Process, Objective Matrix, and Traffic Light System</i> (Alina Cynthia Dewi, Akhmad Nidhomuz Zaman)	27
BR-1-44 Uji Aplikasi Berbagai Jenis Pupuk Urea Lepas Lambat Terhadap Pertumbuhan Tanaman Pakcoy (<i>Brassica rapa chinensis</i>) (Yohannes Cahya Ginting, Lilis Hermida, Rugayah Rugayah, Joni Agustian, Rizki Taufiqurrahman)	35
BR-1-46 Uji Aplikasi Berbagai Jenis Pupuk Urea Lepas Lambat (<i>Slow Release Urea</i>) Terhadap Pertumbuhan Tanaman Kailan (<i>Brassica oleraceae L.</i>) (Rugayah Rugayah, Lilis Hermida, Yohannes Cahya Ginting, Joni Agustian, Maulindra Putri Agsya)	42
BR-1-56 Rancangan Dimensi Sump Pada Tambang Terbuka Sebagai Upaya Pencegahan Kerusakan Lingkungan Yang Diakibatkan Oleh Air Asam Tambang Studi Kasus PT Manggala Alam Lestari Provinsi Sumatera Selatan (Yudha Gusti Wibowo, Hutwan Syarifuddin)	49
BR-1-58 Zeolit LTA Sintetis Berbahan Dasar <i>Coal Bottom Ash</i> Untuk Pemurnian Etanol (Simparkin Br Ginting, Wanda Gustina Utami)	54
BR-1-62 Studi Kualitas Air Sungai Cisadane Kota Tangerang Ditinjau dari Sifat Fisika dan Kimia (Desy Rosarina, Ellysa Kusuma Laksanawati)	60



BR-1-67	Pengaruh Konsentrasi SnCl_2 dan Temperatur Polimerisasi pada Sintesis Poli Laktida dengan Metode <i>Ring-Opening Polymerization</i> (Edwin Azwar, Ricky Fahlevi Sinulingga, Muhammad Hanif)	65
BR-1-68	Sifat Kimia, Fisik Dan Sensori Kerupuk Dengan Penambahan Rusip Bubuk (Dyah Koesoemawardani)	71
Kelompok Teknik Elektro, Teknik Elektronika dan Teknik Informatika		
BR-2-01	Perancangan Sistem Informasi Penugasan Dosen Berbasis Website Pada Jurusan Teknik Industri FT. Untirta (Akbar Gunawan, Nuraida Wahyuni, Bagus Kurnia Saputra)	76
BR-2-03	<i>AC Load Emulator Pada Sistem Smart Grid Berbasis Embedded System</i> (M. Mas Ruri Yusuf, Khairudin Hasan, Lukmanul Hakim)	81
BR-2-14	Prototipe Lampu Belajar Menggunakan Mini Inverter Berbasis Konservasi Energi (Fika Trisnawati, Agong Chaniago, Purwono Prasetyawan)	86
BR-2-21	Deteksi Posisi Plat Nomor Kendaraan Menggunakan Metode Transformasi Hough dan Transformasi Hit or Miss dengan Matlab (Yuda Puspito, F.X. Arinto Setyawan, Helmy Fitriawan)	91
BR-2-25	Monitoring Flicker Pada Jaringan Distribusi Tegangan Rendah (Osea Zebua, Noer Soedjarwanto)	97
BR-2-29	Rancang Bangun Alat Pendeteksi Detak Jantung Bayi Prematur Menggunakan Pulse Sensor Berbasis Mikrokontroler Yang Terintegraasi Pada Model Inkubator Bayi (Billy Mulia Wibisono, Sri Purwiyanti, Fx Arinto Setyawan, Helmy Fitriawan, Sri Ratna Sulistiyanti)	103
BR-2-55	Desain <i>Transducer Rogowski Coil</i> Untuk Pengukuran Arus Frekuensi Tinggi Dan Pulsa <i>Discharge</i> (Herman Sinaga, Hajri Trisaputra, Noer Soedjarwanto, Henry Sitorus)	109
BR-2-61	Penentuan Daya Listrik Untuk Segmentasi Rumah Tangga Dengan Algoritma Ripper Berbasis Rules (Astrie Kusuma Dewi, Dwi Normawati)	114
BR-2-64	Rancang Bangun Model Deteksi Pelanggaran Zebra <i>Cross</i> Pada Traffic Light Dengan Metode Adaptif <i>Background Substraction</i> (Pami Ruli Setiawan, F.X. Arinto Setyawan, Syaiful Alam)	118
BR-2-76	Rancang Bangun Peralatan Pengoptimal Pengecasan Baterai Dengan Sel Surya Berbasis Mikrokontroler Arduino (Budiarto Wahyono, Noer Soedjarwanto, Osea Zebua, Abdul Haris)	124
BR-2-82	Pembuatan Alat Pengering Biji Kopi Otomatis Berbasis Mikrokontroler Arduino Mega 2560 (Emir Nasrullah)	130
BR-2-84	Penentuan Sudut Datang Sumber Suara Menggunakan <i>Directional Microphone Array</i> (Annisa Firasanti, Putra Wisnu Agung Sucipto)	134



BR-2-85	Sintesis <i>Visual Speech</i> Bahasa Indonesia pada Beberapa Karakter Virtual 3 Dimensi Menggunakan Metode <i>Radial Basis Function</i> (RBF) Untuk Mendukung Produksi Film Animasi (Aripin, Hanny Haryanto)	141
Kelompok Teknik Geologi dan Teknik Geofisika		
CR-1-05	Studi Kualitas Batuan Reservoir Formasi Ngrayong Menggunakan Metode Petrofisik (Mohammad Al Afif, Muhammad Firsandi)	150
CR-1-08	<i>Restructuring of Mass Movement Potential Area in the middle course of Muara Emat - Kerinci (MK), Jambi</i> (Hari Wiki Utama, Yulia Morsa Said, Magdalena Ritonga, Eko Kurniantoro, Anggi Deliana Siregar and Bagus Adithya)	156
CR-1-09	Potensi Geowisata berbasis Edu-Wisata sebagai Laboratorium Alam di Daerah Panas Bumi Kerinci, Jambi (Hari Wiki Utama, Yulia Morsa Said, Magdalena Ritonga, Eko Kurniantoro, Anggi Deliana Siregar, Bagus Adithya)	162
CR-1-10	<i>Genetic of joint system Mengkarang metapelite: implication to characteristic deformation on the Muara Karing Geopark Marangin, Jambi</i> (Hari Wiki Utama, Eko Kurniantoro, Yulia Morsa Said, Rahmi Mulyasari)	168
CR-1-11	Pemetaan objek fenomena Geologi di sepanjang Sungai Mengkarang: Guna pengembangan aset Geowisata di Geopark Mengkarang Purba, Desa Bedeng Rejo, Kabupaten Marangin, Jambi (Magdalena Ritonga, Eko Kurniantoro, Yulia Morsa Said, Agus Kurniawan, Rahmi Mulyasari, Hari Wiki Utama)	173
CR-1-15	Geologi dan Studi Batuan Asal (Provenance) Batupasir Formasi Talangakar Daerah Lubuk Bernai Kecamatan Batangasam Kabupaten Tanjung Jabung Barat Provinsi Jambi (Gusmilah Iriyanti, Hari Wiki Utama, Arsyad Ar, Yulia Morsa Said)	179
CR-1-16	Karakteristik Unsur Jejak Dalam Diskriminasi Magmatisme Batuan Beku Tinggian Karangbolong Kebumen (Isyqi, Chusni Ansori, Fitriany Amalia Wardhani, Eko Puswanto)	185
CR-1-34	Zonasi Area Potensi Gerakan Massa di Sepanjang Sesar Lampung-Panjang Kota Bandar Lampung (Rahmi Mulyasari, Nandi Haerudin, Karyanto, I Gede Boy Darmawan)	190
CR-1-38	<i>Sedimentological Study of Ngrayong Sandstone at Candi and Surrounding Area, Todanan Blora, Central Java</i> (Rezky Aditiyo)	198
CR-1-47	<i>Underground Coal Gasification (UCG): The Opportunities to Increase Natural Resource Production in Indonesia</i> (Muhamad Taufik Maryudi, Ryan Aristo Nusantara, Ridwan Silalahi)	204
CR-1-48	Analisis Kerentanan Lahan Berdasarkan Tingkat Kemiringan Lereng dan Kedalaman Bidang Gelincir Menggunakan Metode Photogrammetry dan Geolistrik Di Desa Batu Keramat, Kecamatan Kota Agung Timur, Tanggamus (Muh. Sarkowi, Rahmat Catur Wibowo, Bagus Spto Mulyatno)	209
Kelompok Teknik Sipil dan Planologi		
CR-2-26	Modifikasi Penilaian pada Sistem Manajemen Jembatan di Indonesia (<i>Interurban Bridge Management System</i>) dengan Mengimplementasikan <i>Condition States</i> dari	214



	<i>Metode Bridge Health Index</i> (Ofianto Wahyudhi, Akhmad Aminullah, Andreas Triwiyono)	
CR-2-37	Pengaruh Variasi Waktu Pemeraman dan Perendaman Sampe Tanah Terhadap Nilai Daya dukungnya (Lusmeilia Afriani)	219
CR-2-40	Studi dan Analisa Pengaruh Kerusakan Jalan Terhadap Nilai Karakteristik Tanah Dan Nilai Derajat Kepadatannya (Yan Juansyah, Rani Ismiarti Ergantara, Devi Oktarina)	225
CR-2-43	Pengaruh Stabilitas Lereng Terhadap Nilai Kohesi, Sudut Geser Dalam Tanah dan Perubahan Tingkat Ketinggian Muka Air Tanah (Aryodi Widiawara, Lusmeilia Afriani, Ofik Taufik Purwadi, Setyanto)	230
CR-2-57	Kajian Kepuasan Pengguna BRT Bandar Lampung Terhadap Kualitas Layanan Menggunakan <i>Structural Equation Modeling</i> (Widodo, Aleksander Purba, Dyah Wulan Wardani)	235
CR-2-60	Studi Pengaruh El Nino dan La Nina terhadap data curah hujan dari Wilayah Lampung Timur (Ahmad Zakaria, Sumiharni, Gatot Eko Susilo, Nur Arifaini)	241
CR-2-69	Kajian Fungsi Sosial Budaya, Estetika, dan Ekologi Taman “Hutan Kota” Way Halim Kota Bandar Lampung (Citra Persada, Novia Putri, Dwi Bayu Prasetya)	246
CR-2-71	Pemanfaatan Mineral Tambahan Untuk Reduksi Ekspansi Akibat Reaksi Alkali Silika (Mohd Isneini)	251
CR-2-73	Model Tarikan Perjalanan ke Kawasan Perdagangan (Studi Kasus di Pasar Tengah – Kota Bandar Lampung) (Uun Niatika, Rahayu Sulistyorini and Muhammad Karami)	256
CR-2-74	Analisis Risiko Reaktivasi Jalur Kereta Api Menuju Pelabuhan Panjang dengan <i>Soft System Methodology</i> (SSM) (Amril Maruf Siregar, Ika Kustiani, Mauliyda Na Fanhar)	260
CR-2-80	Komparasi Pembangunan Kereta Cepat Indonesia Menggunakan Pengalaman Kereta Cepat Negara Lain dari Sudut Pandang Ekonomi (Fera Lestari, Aleksander Purba, Ahmad Zakaria)	266
CR-2-81	<i>Developing Monitoring System of Traffic Signal Using Microcontroller Device by SMS of GSM Network</i> (Aleksander Purba, Rahayu Sulistyorini, Ageng Sadnowo, Agung Ilhami)	273
CR-2-83	<i>Flexural Behavior of RC Beam Strengthened with Hybrid of GFRP and Wiremesh</i> (Fikri Alami, Mohd. Isneini, Candra Fauzan Akbar, Dedi Vernanda, Klara Nalarita, Farida Rahma Hadi Putri)	278
CR-2-90	Sistem Monitoring Lampu Lalu-Lintas Berbasis Microcontroller Dengan GSM (Aleksander Purba, I. Wayan Diana, Rahayu Sulistyorini, Sasana Putra)	283
Kelompok Teknik Mesin, Teknik Material dan Teknik Geofisika/Geologi		
CR-3-32	Kajian Eksperimental Pengaruh Parameter Pemesinan Magnesium AZ31 Terhadap Nilai Kekasaran Permukaan Pada Proses Pembubutan Menggunakan	288



	Pahat Putar Dan Udara Dingin Bertekanan (Opi Sumardi, Arinal Hamni, Gusri Akhyar Ibrahim)	
CR-3-39	Perancangan Saluran Pengarah untuk Meningkatkan Unjuk Kerja Turbin Helik pada Model Sistem Pembangkit Listrik (Jorfri Boike Sinaga, Ahmad Suudi)	293
CR-3-41	Penerapan Teknologi Pompa Tanpa Motor (Hydraulic Ram Pump) Untuk Model Sistem Irigasi Persawahan Masyarakat Di Desa Wonokarto Kecamatan Gading rejo Kabupaten Pringsewu Provinsi Lampung (Jorfri Boike Sinaga, Ahmad Suudi, Panly Lumbantoruan)	300
CR-3-42	Karakteristik Perpindahan Panas Alat Penukar Kalor Berisi Material Fasa Berubah Pada Proses Pembekuan (Muhammad Irsyad, Herry Wardono, Amrizal Nalis, Mardho Akmal, Aji Muhammad Yulian)	307
CR-3-45	Inovasi Teknologi untuk Meningkatkan Kinerja dan Kualitas Produk Usaha Mikro Kecil Menengah di Desa Ulak Kerbau Baru Kecamatan Tanjung Raja Kabupaten Ogan Ilir Provinsi Sumatera Selatan (Irwin Bizzy)	312
CR-3-59	Potensi Energi Terbarukan Di Provinsi Lampung Untuk Mewujudkan Kemandirian Energi (Retno Wahyudi, Muhammad Irsyad)	317
CR-1-72	Pengaruh Meandering Sungai Lukulo Terhadap Kejadian Longsor di Perkotaan Kabupaten Kebumen, Jawa Tengah (Puguh Raharjo, Kristiawan Widiyanto, Eko Puswanto, Sueno Winduhutomo)	323
CR-3-75	Pengaruh Variasi Posisi Flow Straightener Di Dalam Cerobong Terhadap Derajat Kemiringan Aliran Gas Buang (Dewi Puspitasari, Rizki Sihombing, Ellyanie Ellyanie, Marwani Marwani, Agus Adiputra)	329
CR-1-79	<i>Effect of Clay (Illite) toward Maturation and Potential of Organic Material (Stearic Acid) as Basis to Determine the Parameter of Laboratory Test on Shale Material Processing</i> (Ordas Dewanto, Bagus Sapto Mulyanto)	334
CR-1-86	Karakterisasi Batuan Reservoir Menggunakan Metode Log-Petrofisika, Geokimia dan Termal pada Sumur I-1 dan I-2 di Daerah 'Y' Sumatera Tengah (Bagus Sapto Mulyanto, Ordas Dewanto)	340
CR-3-87	Rancang Bangun Sistem Pembangkit Listrik Tenaga Air Untuk Memanfaatkan Energi Aliran Sungai Penyungkayan Di Dusun Penyungkayan Kecamatan Balik Bukit Kabupaten Lampung Barat Provinsi Lampung (Bambang Sulistiyo, Yanuar Burhanuddin, Jorfri Boike)	348
CR-3-92	Pendekatan Metode Collaborative Filtering pada Sistem Rekomendasi Pariwisata Kota Bengkulu (Aan erlansari, Boko Susilo, Yudi Setiawan, Iit Pranata)	356
CR-3-93	Kajian Kapasitas Sungai Manjuntjo Dalam Menampung Debit Banjir Menggunakan Program HEC-RAS (Lidia Agustin, Gusta Gunawan, Besperi)	362
CR-3-94	Pemodelan Rasio Gradien Densitas Struktur Bawah Permukaan Berdasarkan Trend Surface Analysis Data Gayaberat (Suharno, I Gede Boy Darmawan, Ahmad Zaenudin, Ordas Dewanto, Martin Ridwan)	371

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- 1 Cover Prosiding
- 2 KATA PENGANTAR
- 3 Susunan Dewan Redaksi
- 4 SUSUNAN ACARA
- 5 DAFTAR ISI
- 6 Abstrak Keynote Speakers

CR-2-57

CR-2-43

CR-2-40

CR-2-37

CR-2-26

CR-1-48

CR-1-47

CR-1-38

CR-1-34

CR-1-16

CR-1-15

CR-1-11

CR-1-10

CR-1-09

CR-1-08

CR-1-05

CR-3-94

CR-3-93

CR-3-92

CR-3-87

CR-3-86

CR-3-79

CR-3-75

CR-3-72

CR-3-59

CR-3-45

CR-3-41

CR-3-42

CR-3-39

CR-3-32

CR-2-83

CR-2-90

CR-2-80

CR-2-81

CR-2-74

CR-2-71

CR-2-73

CR-2-69

CR-2-60

CR-3-94

CR-3-93

CR-3-87

CR-3-92

CR-3-86

CR-3-75

CR-3-75

CR-3-79

CR-3-59

CR-3-72

CR-3-45

CR-3-42

CR-3-41

CR-3-39

CR-3-32

CR-2-90

CR-2-83

CR-2-81

CR-2-80

CR-2-74

CR-2-73

CR-2-71

CR-2-69

CR-2-60

CR-2-57

CR-2-43

CR-2-37

CR-2-40

CR-2-26

PIMPINAN FAKULTAS TEKNIK



CR-2-26
CR-1-48
CR-1-38
CR-1-47
CR-1-34
CR-1-15
CR-1-16
CR-1-11
CR-1-10
CR-1-09
CR-1-08
CR-1-05
BR-2-29
BR-2-21
BR-2-14
BR-2-03
BR-2-01
BR-1-68
BR-1-67
BR-1-62
BR-1-58
BR-1-56
BR-1-46
BR-1-62
BR-1-58
BR-1-56
BR-1-46
BR-1-44
BR-1-24
BR-1-07
BR-1-06
BR-1-04
BR-1-02
BR-2-85
BR-2-84
BR-2-82
BR-2-76
BR-2-64
BR-2-61
BR-2-55



Effect of Clay toward Maturation and Potential of Organic Material as Basis to Determine the Parameter of Laboratory Test on Shale Material Processing

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Abstract Previous researches about clay material motivate researchers to know more about the effect of clay toward heating process of organic materials mixture. The objective of the research is to characterize clay that amalgamate with organic material stearic acid, hereinafter called as shale material. The synthesis of shale material has been successful in accordance to reference, which shows the shale material character and can be used in the conversion of oil shale into crude oil. The result of SEM and XRD analysis shows that the shale material has a very tiny pores that are not even seen, because the pores are filled by the organic material which are accumulated and strongly bound with illinite/kaolinite and other materials in small percentage. TGA test result on two sample of shale material (clay+organic) shows that the material did not experience many phase changing, so the time and temperature are relatively not high. Temperature for early maturation is $T_{max}=325^{\circ}C-430^{\circ}C$ and $T_{max}=421^{\circ}C-453^{\circ}C$. Then, at $650^{\circ}C-1000^{\circ}C$, the shale material experience constant last changing (over mature). The result of T_{max} measurement using pyrolysis is same as TGA. The pyrolysis test on clay-organic material shows a very good hidrokarbon potential ($PY=605,06-652,45$ mg/g material clay-organic and $TOC=19,94-34,38\%$). The test on both material that amalgamate with the organic shows that clay material gives a lot of influences on the heating process of the organic material.

Keywords: shale material, clay organic, T_{max} , over mature, TGA, TOC

INTRODUCTION

Research from Bartis *et al* (2005), exploitation of shale material are gathered and sent to be processed by directly burning the shale which then used as source of electrical energy. Bartis *et al* also did underground shale material mining using room and pillar mining method. Burhnham *et al* (2006) did ex-situ process on extraction of shale material processing result although several new technology did in-situ process (Al-Hamaiedh *et al*, 2010). This heating process separated the free organic component (shale material) from bond organic component in shale material. Barkia *et al* (2004) also did the research on on termal analysis used to determine the heating effect on shale material in Maroko, done at temperature $500^{\circ}C$. It is a significant research progress, since initially the burning is done without considering the effect. This result encourages researcher to do research development on shale material, e.g., Peters, Walters, dan Moldowan (2006). Then, Al-Hamaiedh *et al* (2010) conducted a research to know the result of exploitation on shale material combined with a large amount of ash.

Conversion technology involves heating material in the absence of oxygen to a temperature where the material breaks down into gas, condensed oil and solid residue. Commonly, it happens between temperature $450^{\circ}C$ ($842^{\circ}F$) and $500^{\circ}C$ ($932^{\circ}F$) (Youngquist dan Walter, 1998). Decomposition process is started in relatively low temperature ($300^{\circ}C/570^{\circ}F$), but the faster and more complete result is gotten on a higher temperature (Koel and Mihkel, 1999). So far, most of the research have not discussed or analyzed specifically the type of organic material associated with clay and received heating treatment. For example, $Mg_2Al_10Si_24O_{60}(OH)_{12}$ (Montmorillonite/ Smectite), $Al_2Si_2O_5(OH)_4$ (kaolinite), $K_y(AlFeMg)(Si_{2-y}Al_y)O_5(OH)$ (Illite), and $(OH)_4(SiAl)_8$ (Mg Fe) (Klorite).

Natural shale material is used by oil shale at certain depth. Meanwhile the appropriate selection and model process indicated by its high effect on shale material maturation for conversion process of oil shale into hydrocarbon in form of crude oil, will be done by creating a right shale material. The material used is, first, clay material $Al_2Si_2O_5(OH)_4$ (kaolinite) or $K_y(Al Fe Mg)(Si_{2-y}Al_y)O_5(OH)$ (Illite) with the organic (CH_3COOH or $C_7H_6O_3$). Using a careful process involving comparison method between organic material and clay/carbonat, theory of mixing and time interval before conducting the test, a good quality of shale material will be obtained which later allows the reseacher to conduct a modelling to process oil shale into hydrocarbon in form of crude oil.

is natural clay combined with organic material stearic acid that form shale material (clay-organic) with $TOC > 12\%$, which the characterization outcome will be compared with oil shale as reference material (Yoshioka and Ishiwatari, 2002). Afterward, it will be characterized using various methods until it produces information about physical and chemical properties. This outcome is crucial in the process of understanding the mechanism and active side of reaction model of oil shale into crude oil (Widjaya, 2012). Beside that, the researchers also get some lab test parameters that hopefully can be used as the basis in oil shale processing (Dewanto *et al*, 2017). This research will focus the discussion on the characterisation of shale material from natural clay compacted with organic material: stearic acid. The method in making shale material is adjusted to reference oil shale which is done by mixing/ compacting natural clay and an organic composed medium-chain aliphatic compounds (more than C_{25}) in relatively huge amount. The next is to determine some key parameters (with major impact) of lab test such as TOC, T_{start} , T_{max} , T_{end} (Tjahjono, 2004 and Tobing, 2003).

MATERIALS AND METHODS

The tools are glass tube for preparation, rock cutter, XRD, TGA, SEM, BET, pyrolysis testing tools and FTIR. The object used is natural clay that is pillarized and compacted with organic material: stearic acid, reference oil shale, oil shale that is going to be converted into crude oil.

Preparing Sample

Part of shale material, clay (illite/kaolinite), is used as organic container, prepared with petrophysical methods which then analyzed to gain the characteristic of the material. The organic material: stearic acid is prepared based on the matrix of oil shale. Cogo et al (2009) has done a research about the characteristic of sedimentary organic material using Electron Paramagnetic Resonance (EPR). Reference oil shale from the research is used as comparison and reference to the production of shale material from clay.

Characterization and Analysis

Once the organic container is ready, the shale material, clay-organic, is made. It is stirred and pressed, then kept for 48 hours, then stirred and pressed again so that it fills all the pores in the clay container. After that, the shale material is kept for two weeks so that the organic material is trapped, binded and compacted. Next, using BET, the researchers measure the size of the specific surface. Further, Thermogravimetric Analysis (TGA) is done to measure the changing on weight of the compound as the function of the temperature or even the duration. The output shows a continuous diagram record and the changing on weight and phase on the material. Differential Thermal Analysis (DTA) is a technique to compare the temperature of the sample with inert reference material during a programmed temperature change.

Pyrolysis Testing

Pyrolysis analysis is used to identify the type and the maturation of the shale material as well as detect hydrocarbon matrix of the shale material. For this analysis, the sample is destructed and dried. Pyrolysis method consists of heater (oven) on inert atmosphere temperature (helium) and 100 mg sample to determine free hydrocarbon and cracking process on the shale material.

Maximum Temperature (Tmax)

Tmax is maximum temperature to release hydrocarbon from cracking process of material mixture during the pyrolysis (peak S2). Tmax is an indication of maturation level of organic material inside shale-clay, carbonate shale and oil shale. Tmax value is one of geochemical parameter used to determine maturation level of shale-clay and oil shale. Thermal Maturation level is measured by Tmax. For example: if Tmax is $<435^{\circ}\text{C}$, it shows that shale-clay, carbonate shale and oil shale are not mature yet. If Tmax is $>470^{\circ}\text{C}$, it is over mature. Chart of pyrolysis outcome is called Pirogram and can be seen in program figure.

RESULTS AND DISCUSSIONS

X-Ray Diffraction Measurement

Figure 1 is the outcome of XRD test at high angle (10° - 80°) on clay material (OD-2) with illite mineral and an observation with software match for Illite mineral is shown in figure 2. It also shows that the compound in this illite is SiO_2 .

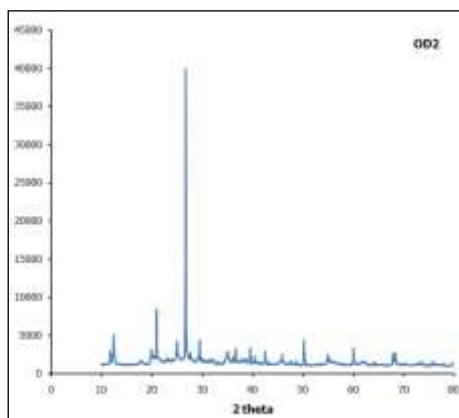


Figure 1. Chart XRD Outcome clay (OD2)

Figure 1 and 2 shows similarity between those two charts to ensure that the clay used in this research is illite. Illite or kaolinite always goes along and attach around and inside the pores which ease ion exchange to change structure and pore size, as well as catalyst in organic maturation process.

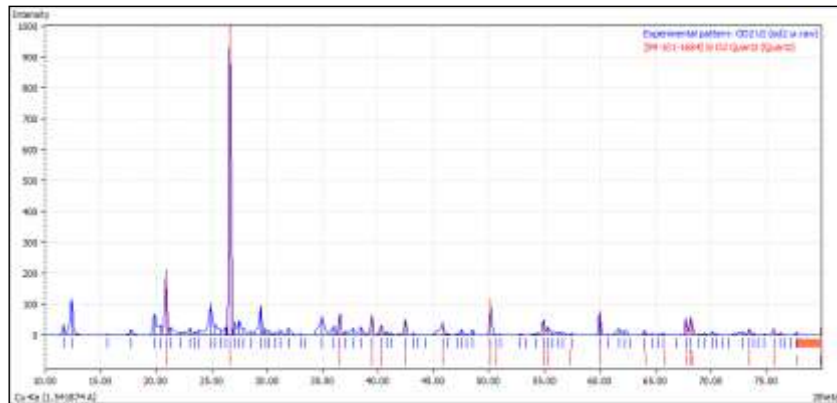


Figure 2. Graph clay (illite) from Match Software

If we take a look closer, the highest peak happens on 2theta angle between 10° to 30° (precisely 27°), because clay experiences changing on d001 basal space, beside that a peak also appears on 2theta angle between 10° and 50° , in detail 11° , 21° , 27° (The highest peak), and 50.5° . Comparison can also be done with Figure 3 which shows clay material OD2 filled and bound with organic material Ast1, and become clay shale with $\text{TOC} > 12\%$. The chart shows the peaks on 2theta angle which is different from Figure 4.

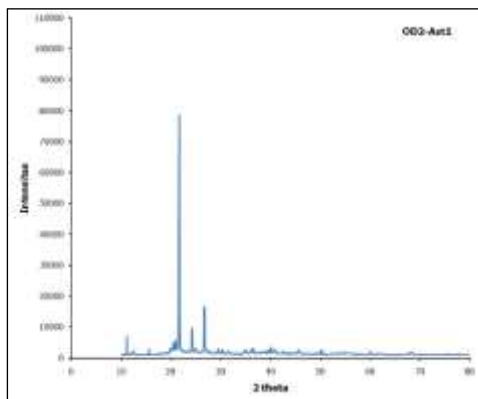


Figure 3. Chart XRD Outcome clay shale (OD2-Ast1)

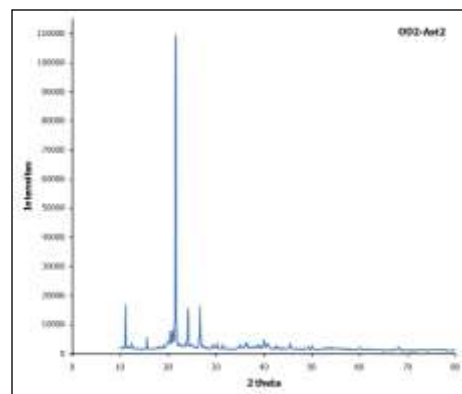


Figure 4. Chart XRD Outcome clay shale (OD2-Ast2)

Figure 4 shows XRD test on high temperature (10° - 80°) on clay shale OD2-Ast2, the result can be compared to figure 3 which is the same clay shale with different organic volume. The chart shows peaks of the 2theta angle is not different from figure 3. No change on several new peaks of 2theta indicating the same condition in which the pores space on clay shale if filled and bound with organic material, and new material has increased to form bond on clay that contains SiO_2 , hence fit to clay shale theory with $\text{TOC} > 12\%$.

SEM Analysis on Clay Shale

The dwindling pores that is filled by organic material and evenly closed by illite/kaolinite can be seen clearly in SEM analysis outcome, or XRD as supporting analysis that shows narrowing angle.

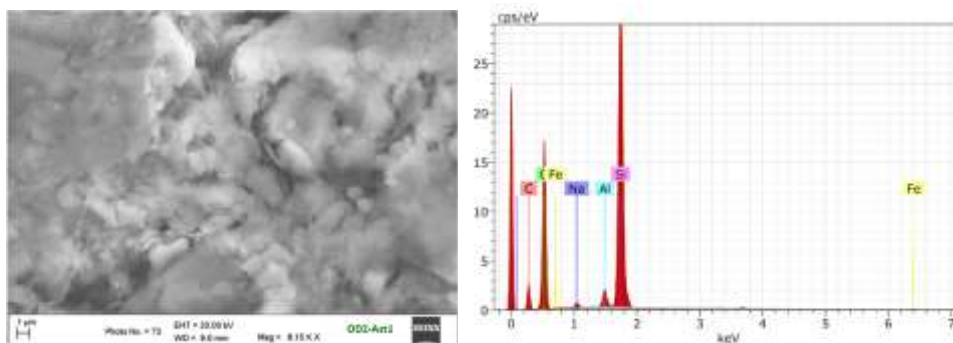


Figure 5. SEM analysis clay shale (OD2-Ast1)

Figure 5 shows the outcome of synthetic method discussed above. The formed clay shale shows that it has a very small pores which is unseen, because all the pores are filled by organic material, accumulated and bound with illite/kaolinite and some other materials in small percentage.

From Edax SEM on clay shale OD2-Ast1, it contains several elements with (wt,%) as follow: Carbon (21.77%), Oxygen (57.10%), Sodium (0.90%), Aluminium (1.89%), Silicon (27.40%) and Iron (0.43%). Figure 6 shows the same shale material OD2-Ast2. The difference is that it has 2 times amount of OD2-Ast1 organic material. The formation method of clay shale OD2-Ast2 is the same as OD2-Ast1. Clay shale is stirred and pressed slowly, then kept for 48 hours. The stirring and pressing is then conducted for the second time so that the organic material filled evenly the pores of the clay container. After kept for another 48 hours, the organic material is expected to trap (filled) all pores more tightly and compact. Specific surface measurement using BET shows that the surface of the shale has been filled by smaller organic, indicating that the clay container is successfully filled/bound by organic as the pores are dwindling. Figure 6 shows SEM analysis outcome on clay shale OD2-Ast2 with good quality supported by TOC 12% as indicators of the nature of good oil shale in accordance to reference.

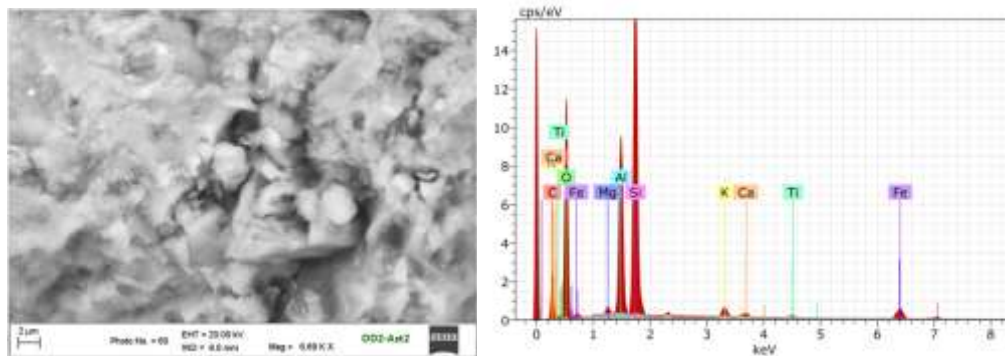


Figure 6. SEM analysis on clay shale (OD2-Ast2)

As shown in Figure 5, it is an expected condition where the clay shale can represent oil shale for basis in the processing of oil shale into crude oil (STM). Edax SEM on Clay shale OD2-Ast2 contains some elements with (wt,%) as follow: Carbon (30.85%), Oxygen (50.19%), Magnesium (0.31%), Aluminium (6.49%), Silicon (10.44%), Potassium (0.41%), Calcium (0.17%), Titanium (0.12%) and Iron (1.03%).

Outcome of TGA Analysis

Thermal analysis is defined as the process of measuring physical and chemical natures of a material as function of temperature. Firstly, TGA is conducted to oil shale as reference shale material as comparison. The result of this test can be seen at Figure 7. TGA is conducted to this natural shale material in order to know the destruction of structure suffered by the material as effect of high temperature heating (more than 400°C), since it gives description on the process of mass change on a material. Figure 7 shows that the deflation of weight percentage of the oil shale happens at temperature $\pm 148^{\circ}\text{C}$, indicating the condition when water molecules detached from crystal structure of oil shale. Another deflation happens as a perfect phase change on temperature $\pm 305^{\circ}\text{C}$.

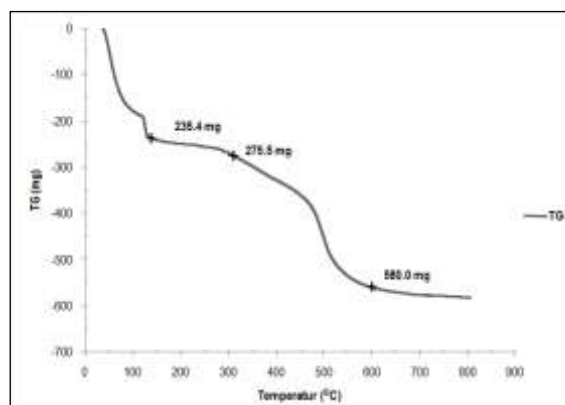


Figure 7. Chart Thermogravimetry Analysis (TGA) outcome for reference oil shale

The first weight loss is caused by water evaporation in the crystal structure. Meanwhile, the second significant weight loss happens by the changing of structure of oil shale material and the evaporation of water molecules

chemically. The weight loss that happens before the last temperature deflation indicates maximum temperature needed by clay molecules to start turning into oil shale. Further, when calcination is done from the beginning of the last loss to the constant weight (on temperature 600°C), many molecules in the oil shale are detached, causing some part of shale in the pores also detached, as seen in XRD analysis outcome. This condition is called over mature, where the chart line tend to stay horizontal along with the increase of temperature up to 800°C. Therefore, the required temperature in a process of oil shale conversion into crude oil is between $\pm 305^{\circ}\text{C}$ - 430°C .

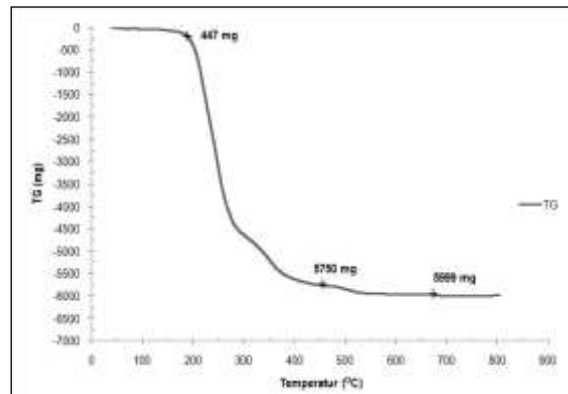


Figure 8. Chart Thermogravimetry Analysis (TGA) outcome on serpih clay (OD2-Ast1)

The first weight loss is caused the evaporation of water molecules in the crystal structure. The second weight loss is significant and indicates the change on the structure of clay shale and the evaporation of water molecules, chemically. Weight loss before the last temperature deflation indicating the maximum temperature required by clay shale to begin changing into oil shale. Over mature happens at temperature 800°C, indicating the structure of material has been broken and cannot be used as reference shale material anymore. Therefore, the required temperature in a process of oil shale conversion into crude oil is between $\pm (325^{\circ}\text{C}$ - $430^{\circ}\text{C})$.

TOC and Pyrolysis Analysis

TOC and Pyrolysis analysis on clay-organic material is shown in Table 1. Two clay-organic-material (sample 1 and 2) shows potential of good quality hydrocarbon $\text{PY}=605,06$ - $652,45$ mg/g and $\text{TOC}=19,94$ - $34,38\%$.

TABLE 1. TOC Analysis Outcome

No	TOC (%)	PY (mg/g)	PI	PC
1	19,94	605,06	0,90	50,22
2	34,38	652,45	0,88	54,15

TABLE 2. Potential of clay shale material based on HI dan OI values

No	Tmax (°C)	HI	OI	Main Products
1	323	308	87	Oil
2	322	227	57	Oil and Gas

Table 2 shows the potential of clay material based on HI and OI. HI is the outcome of $(S_2 \times 100)/\text{TOC}$ and OI for $(S_3 \times 100)/\text{TOC}$. The value of these two parameters will decrease along with the increase of maturation level. A high HI shows clay material is dominated by organic material or oil prone.. Beside, Tmax value as maturation indicator also has some limitations, such as cannot be used on materials with low TOC ($<0,5$) and $\text{HI} < 50$. The basis on choosing the potential of shale material based on previous research from Wales (1985) is used to know the potential of oil shale material (Table 3).

TABLE 3. Potential of clay shale material based on HI dan OI values (by Waples, 1985)

HI	Main Products	Relative quantity
<150	Gas	Small
150 – 300	Oil & Gas	Small
300 – 450	Oil	Medium
450 – 600	Oil	Many
> 600	Oil	Very Much

CONCLUSION

The use of clay material (OD2-Ast1, OD2-Ast2) is fit with the characteristic of good quality oil shale, which have good porosity value as place for material to accumulate. The synthetic of the clay material is successful. It fits the oil shale with $\text{TOC} \square 12\%$ (pyrolysis outcome). Value of oil shale Tmax is 421°C - 453°C . TGA testing outcome shows clay material has a huge influence during organic maturation process. The appropriate temperature in the initial



maturations is $T_{max}=325^{\circ}C-430^{\circ}C$ and over mature at temperature $650^{\circ}C-1000^{\circ}C$. Pyrolysis outcome shows that oil shale has high potential on shale material that contains clay ($PY=605.06-652.45$). OI and HI analysis outcome indicates that clay material is dominated by organic material with oil and gas feature.

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