

**Presentasi Laporan Akhir  
PENELITIAN FUNDAMENTAL 2014-2015  
Universitas Mulawarman**

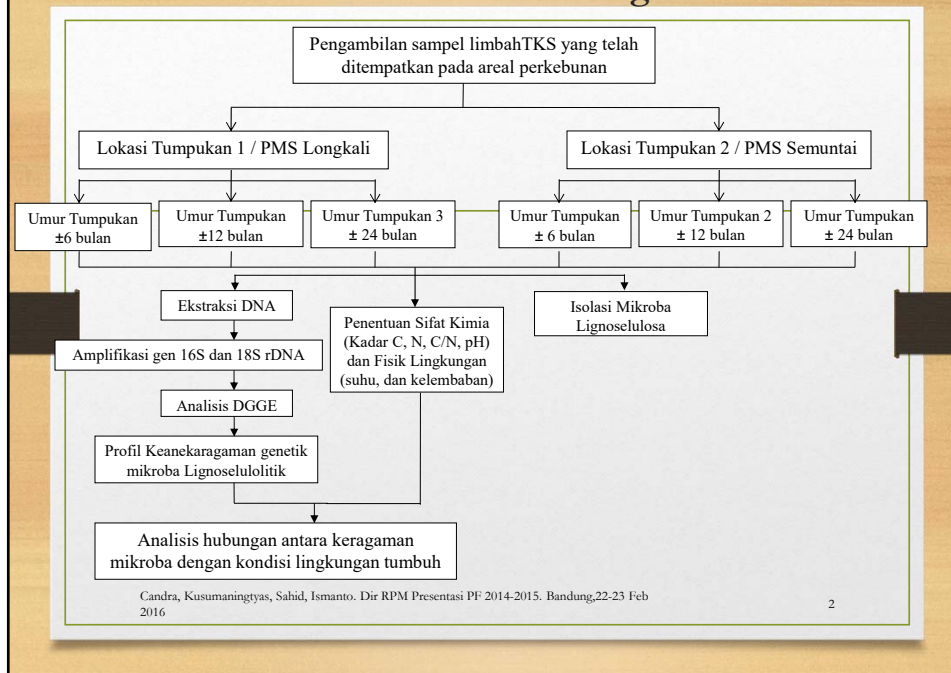
**ANALISIS KERAGAMAN DAN POTENSI MIKROBA  
PADA LIMBAH TANDAN KOSONG SAWIT  
SEBAGAI AGEN PENDEGRADASI  
LIMBAH LIGNOSELULOSA**

Krishna Purnawan Candra (*PS Teknologi Hasil Pertanian, Faperta*)  
Pintaka Kusumaningtyas (*PS Pendidikan Kimia, FKIP*)  
Abdul Sahid (*PS Ilmu Hama dan Penyakit Tumbuhan, Faperta*)  
Arif Ismanto (*PS Peternakan, Faperta*)

Direktorat Riset dan  
Pengabdian Masyarakat  
Bandung, 22-23 Februari 2016



### Bagan Alur Penelitian



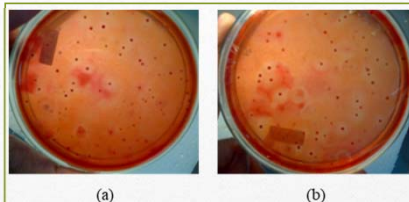
### Kondisi fisiko-kimia lingkungan dan kerapatan mikroba pada proses degradasi limbah TKS

Lokasi	Umur tumpukan TKS (kode)	Kelembaban (%)	Suhu (°C)	Kerapatan mikroba (x10 <sup>4</sup> )
PSM Longkali	± 6 bulan (A1)	(73,10±7,35)	(35,65±0,07)	(33,00±0,71)
	± 12 bulan (A2)	(78,78±2,09)	(35,90±0,14)	(39,25±7,42)
	± 24 bulan (A3)	(91,60±1,56)	(33,10±0,42)	(19,25±0,35)
PSM Semuntai	± 6 bulan (B1)	(83,40±4,38)	(35,40±0,57)	(39,50±7,07)
	± 12 bulan (B2)	(88,80±0,28)	(36,95±0,64)	(44,50±0,71)
	± 24 bulan (B3)	(94,40±1,41)	(26,00±0,85)	(39,25±1,77)

Lokasi	Umur tumpukan TKS (kode)	pH	C-organik	Nitrogen
PSM Longkali	± 6 bulan (A1)	(7,50±2,72)	(19,64±0,45)	(0,55±0,04)
	± 12 bulan (A2)	(8,45±0,21)	(19,00±0,98)	(0,53±0,05)
	± 24 bulan (A3)	(8,17±0,05)	(15,31±2,91)	(0,72±0,08)
PSM Semuntai	± 6 bulan (B1)	(8,89±0,20)	(11,53±1,29)	(0,53±0,06)
	± 12 bulan (B2)	(7,63±0,18)	(11,31±0,33)	(0,50±0,06)
	± 24 bulan (B3)	(3,45±0,03)	(10,72±0,50)	(0,36±0,03)

Candra, Kusumaningtyas, Sahid, Ismanto. Dir RPM Presentasi PF 2014-2015. Bandung, 22-23 Feb 2016

3



**Isolasi mikroba selulolitik (suhu ruang, 48 jam) dari tumpukan TKS, menggunakan media Cellulose Congo Red Agar (CCRA) dengan CMC sebagai sumber selulosanya.**

(a) Sampel dari PMS Longkali,

(b) Sampel dari PMS Semuntai.

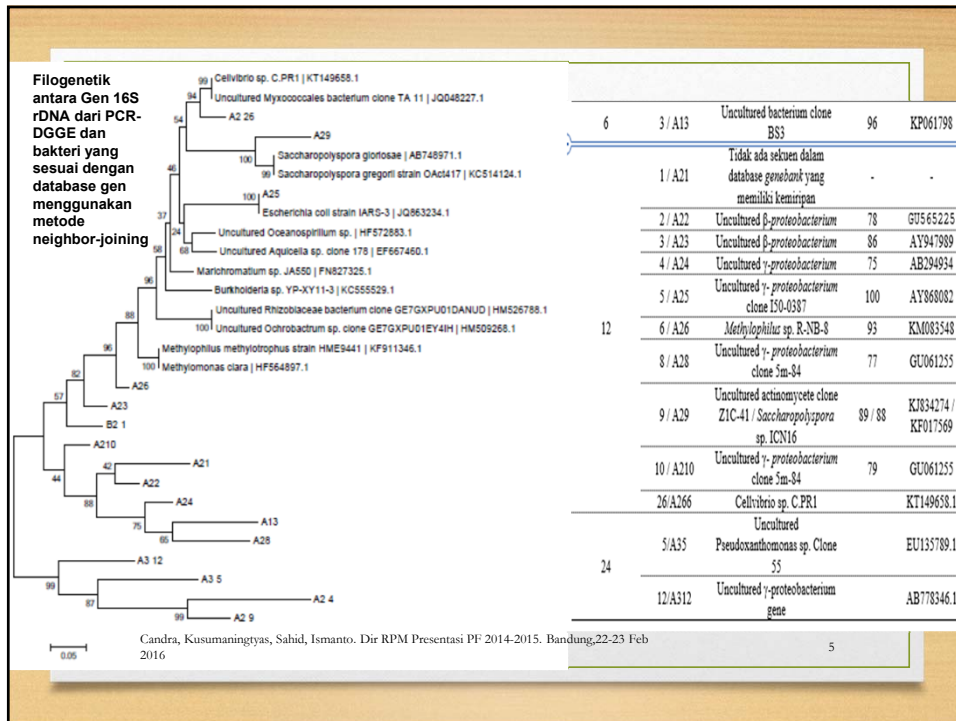
Kode isolat	Indeks selulolitik pada suhu pertumbuhan		
	25°C	37°C	55°C
A2-1	1,75	2,75	2,5
A2-2	7,50	12,5	2,5
B1-2	6,50	11,5	11,5
B2-1	6,50	9,00	2,5
B2-2	7,50	13,00	2,5

	A1	A2	A3	B1	B2	B3
A1	1,00					
A2	0,96	1,00				
A3	0,56	0,57	1,00			
B1	0,56	0,53	0,53	1,00		
B2	0,53	0,50	0,62	0,41	1,00	
B3	0,23	0,18	0,10	0,37	0,48	1,00

Keterangan: A1 (TKS 6 bulan, PMS Longkali); A2 (TKS 1 tahun, PMS Longkali); A3 (TKS 2 tahun, PMS Longkali); B1 (TKS 6 bulan, PMS Semuntai); B2 (TKS 1 tahun, PMS Semuntai); B3 (TKS 2 tahun, PMS Semuntai).

Candra, Kusumaningtyas, Sahid, Ismanto. Dir RPM Presentasi PF 2014-2015. Bandung, 22-23 Feb 2016

4



## KESIMPULAN

- Terjadi dekomposisi jaringan lignoselulosik yang signifikan untuk limbah TKS yang berumur 2 tahun.
- Proses dekomposisi TKS didominasi oleh spesies bakteri yang tidak dapat dikulturkan dan belum teridentifikasi.
- Bakteri dari filum proteobacteria, terutama  $\gamma$ -proteobakterium mendominasi komunitas populasi bakteri.
- Biodiversitas/keragaman populasi fungi selama proses dekomposisi lebih rendah daripada bakteri, namun dominasi spesies fungi tertentu pada setiap tumpukan sangat tinggi.

## KELUARAN (Seminar Internasional)

- Presentasi poster pada International Conference on Natural Sciences (ICONS) 2014, Batu 25-28 Sept 2014
- Presentasi oral pada 2nd International Conference on Advance Molecular Bioscience and Biomedical Engineering (ICAMBBE) 2015, Malang 13-14 Agt 2015



Candra, Kusumaningtyas, Sahid, Ismanto. Dir RPM Presentasi PF 2014-2015. Bandung, 22-23 Feb 2016

7

## KELUARAN (Publikasi ilmiah)

- Manuscript artikel ilmiah pada Jurnal Mikrobiologi Indonesia

### Isolation and Characterization of Lignocellulolytic Microbe from Oil Palm Fruit Empty Bunches (FEB) with FEB-Congo Red Agar

Krishna Purnawan Candra<sup>1,2\*</sup>, Bodhi Dharma<sup>3</sup>, Ariana<sup>1</sup>, Abdul Sahid<sup>3</sup>, and Pintaka Kusumaningtyas<sup>4</sup>

<sup>1</sup>Program Magister Ilmu Lingkungan Universitas Mulawarman, Jl. Ki Hajar Dewantara, Kampus Gunung Kelua, Samarinda 75119, Indonesia

<sup>2</sup>Jurusan Teknologi Hasil Pertanian Faperta Universitas Mulawarman, Samarinda, Indonesia

<sup>3</sup>Jurusan Biologi FMIPA Universitas Mulawarman, Samarinda, Indonesia

<sup>4</sup>Jurusan Agroteknologi Faperta Universitas Mulawarman, Samarinda, Indonesia

<sup>5</sup>Jurusan Pendidikan Kimia FKIP Universitas Mulawarman, Samarinda, Indonesia

\*candra@faperta.unmul.ac.id, kpcandra@gmail.com

#### Abstract

Oil Palm Fruit Empty Bunches (FEB) is lignocellulose biomass, which is often used as green manure in oil palm plantation. However, it constrained by the composting time of the FEB in the field. To overcome the problem we have studied the microbes, which involve in the composting process of FEB. We developed the isolation method using natural substrate derived from FEB. By modification of cellulose congo red agar (CCRA), in which the FEB powder is used instead of CMC, we have succeeded to show that TKSCRA (FEB congo red agar) could be used in determining the lignocellulolytic activity of isolates.

*Key word: Oil palm Fruit Empty Bunches, Lignocellulose*

#### PENDAHULUAN

Kalimantan Timur merupakan salah satu daerah pengembangan sawit di Indonesia yang terpusat pada 4 (empat) Kabupaten (Kab. Paser, Kab. Penajam Paser Utara, Kab. Kutai Barat

Candra, Kusumaningtyas, Sahid, Ismanto. Dir RPM Presentasi PF 2014-2015. Bandung, 22-23 Feb 2016

8

## KELUARAN (Publikasi ilmiah)

- Manuscript artikel ilmiah pada *Annals of Microbiology* (Springer)

### Physico-Chemical Characteristics of Oil Palm Empty Fruit Bunch and Microbial Succession During Its Decomposition

Krishna Purnawan Candra<sup>1</sup>, Pintaka Kusumaningtyas<sup>2</sup>, Abdul Sahid<sup>1</sup>, Arif Ismanto<sup>3</sup>

<sup>1</sup>Dept.Agricultural Product Technology, Fac.Agriculture, Mulawarman University  
<sup>2</sup>Dept. Chemistry Education, Fac. Teaching and Education, Mulawarman University  
<sup>3</sup>Dept. Animal Husbandary, Fac. Agriculture, Mulawarman University

#### Abstract

Empty Fruit Bunch (EFB) of oil palm is used by Palm Oil Mill (POM) as boiler fuel or fertilizer for oil palm plantation. Fast growing of oil palm plantation area produces huge amount of EFB, which then becomes spectacle in solid waste management. Decomposition of EFB is very slow and microbial activity on EFB decomposition also caused greenhouse, in which methane is produced. To figure out the problems, a study on physico-chemical characteristic of decomposed EFB and microbial succession in the decomposition process of EFB was conducted. Microbial diversity from 3 EFB piles (6, 12, and 24 months of age) from two different POM in Indonesia were determined using PCR-DGGE of 16S and 18S rDNA for bacteria and fungi, respectively. The result showed that decomposition of EFB is dominated by non-cultured bacteria and not reported yet. Bacteria from proteobacteria dominated the bacteria community in EFB pile of 6-24 months. The diversity of fungi community is lower than bacteria, however domination of certain fungi in each EFB pile is very high.

**Key words:** 16S rDNA, 18S rDNA, PCR-DGGE, proteobacteria

#### INTRODUCTION

Empty Fruit Bunch (EFB) of oil palm is the highest solid waste produce (22-23 % from total fruit bunch) in oil palm industri (Fauzi *et al.*, 2002). The usage of EFB for boiler fuel or as green fertilizer is not efficient anymore because of the extensification program of oil palm