SDG 12

RESPONSIBLE CONSUMPTION AND PRODUCTION

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

Ensure sustainable consumption and production patterns

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INDEPENDENT WASTE PROCESSING BY UNIVERSITAS PADJADJARAN

Waste is a serious problem that requires comprehensive handling, including in a busy campus environment. If not managed properly, waste will pile up in landfills and damage the environment. Universitas Padjadjaran is committed to not contributing to environmental damage caused by waste. Since the mid-1990s, Unpad has managed its waste independently as part of the

implementation of the Basic Scientific Pattern "Developing Noble Law and the Environment in National Development." According to Dr. Teguh Husodo, M.Si, Head of the Unpad Center for Safety, Security, and Environmental Order, waste on campus comes from three sectors: offices and classes, canteens, and the natural environment, and consists of two types, namely liquid waste and solid waste.

At Unpad, there is a TPS3R, which has several waste processing methods. For organic waste, especially litter, it is processed using aerobic and anaerobic methods. In the aerobic process, litter is fermented by being piled up (dumping). Some of the litter that has undergone the aerobic process is taken to be processed into the anaerobic process. In this process, litter is combined with the bokashi system, which includes additional elements as nutrients from organic waste that will be fermented. Organic fertilizer will later be used by students for the fertilization process in the laboratory or fertilizing gardens in the Jatinangor campus area. However, fertilizer production is still limited, so the stock is still limited for use on campus.

Most of the food waste is taken as maggot feed and managed by Unpad students. The rest is mixed in the bokashi process. Meanwhile, inorganic waste in the form of plastic previously also entered the TPS3R to be chopped. The results of the chopped plastic were collected and purchased by plastic pellet entrepreneurs to be used as new plastic product materials. For B3 waste, Unpad does not have a permit to process it. Therefore, Unpad has partnered with a certified B3 waste processing company.

In addition to solid waste, several activities on campus also produce liquid waste. This liquid waste is divided into two, namely waste from campus operations and laboratory waste. Operational waste from campus activities, offices, and dormitories that come out through the septic tank then enters the biofilter. Water that does not enter the biofilter then comes out and directly seeps into the ground. Meanwhile, the sediment is sucked up for further processing by a third-party service. For laboratory liquid waste, it goes to the wastewater treatment plant (WWTP). Unpad has five WWTPs to accommodate laboratory waste. The wastewater from the five WWTPs then enters and is processed into the last WWTP at Ekoriparian Leuwi Padjadjaran before finally exiting into the arboretum lake.

COMMUNITY WASTE CARE ACTION

Unpad contributes to the reduction and campaign of waste cleanliness in the ocean. In various opportunities such as community service and student Real Work Lecture (KKN) activities. In addition to beach clean-up actions, there are educational activities as an action to care about beach cleanliness with the aim of increasing awareness among tourists and tourism managers.

One of the Unpad KKNM teams, namely Group 77 with Field Supervisor Donny Nurhamsyah, S.Kep, Ners., M.Kep. conducted education in the form of distributing pamphlets, which were the results of a previous survey regarding cleanliness and safety at Pangandaran Beach. Another KKNM team, guided by Dr Sunarto, M.Si in Pangandaran, also conducted a coastal clean-up of organic, inorganic, and B3 waste types. With these various actions, it is hoped that it can be used as an example for villagers to improve the quality of the beach so that its potential can be optimally utilised to support the local economy.

Several other areas where the Unpad academic community has attempted to clean up waste are the waste clean-up activities in the Cikapundung River in four areas, namely the Cipaganti River, the Cikapundung segment, Kampung Cibarani, and Plaza Cikapundung River Spot, and Cikapundung Regol which were organised

by the Fisheries Student Association, FPIK Unpad on September 16, 2023. On another occasion, students who participated in the Think Green 8.0 activity carried out the Zero Plastic Action program, which was held in the Pasar Minggu Jatinangor area near the Unpad Jatinangor campus. From this activity, the team managed to collect 1,815 kg of plastic waste and 27,015 kg of mixed waste.

1.815KG
waste collected from beach clean up activities

ENVIRONMENTALLY FRIENDLY PLASTIC INNOVATION BY UNIVERSITAS PADJADJARAN LECTURER

A joint research team from Universitas Padjadjaran developed an environmentally friendly food packaging plastic (bio-packaging) made from shrimp shell waste and seaweed. This plastic is biodegradable, easily decomposes naturally, and is designed to reduce the accumulation of plastic food packaging waste.

The research, led by Dr Emma Rochima, M.Si, produces plastic from chitosan (from shrimp shells) and carrageenan (from Kappaphycus alvarezii seaweed). Chitosan functions as a food protector and antibacterial, while carrageenan becomes a polymer matrix. This plastic also uses nanotechnology with the addition of silica and zinc to prevent the entry of water vapour and microbes and increase transparency.

This biodegradable plastic is used to wrap chocolate bars without changing the taste, smell, or colour of the food and is able to decompose in the soil in 28 days. This research received a Kedaireka-Matching Fund 2023 grant and involved collaboration with various universities and industries through the Marine Biomaterials Research Collaboration Center. In addition to shrimp shells and seaweed, other materials such as crab shells, cassava starch, and fish skin waste are also used to make similar products, such as nanocomposite films, to extend the shelf life of fruits.

THINK GREEN UNIVERSITAS PADJADJARAN, COMMUNITY THAT CARES ABOUT WASTE AT VARIOUS CAMPUS EVENTS

Thinkgreen Unpad is one of Universitas Padjadjaran's initiatives to increase awareness and participation of the campus community in waste management and environmental preservation. This program focuses on reducing, sorting, and processing waste in the campus environment, as well as encouraging environmentally friendly behaviour among students, lecturers, and campus staff.

The Thinkgreen Unpad program has several main activities to improve waste management in the campus environment:

Environmental Awareness Campaign: Holding various campaigns such as workshops, seminars, and clean-up actions to increase awareness of the campus community about good waste management. This activity educates participants on how to reduce, recycle, and dispose of waste properly.

Waste Sorting at Source: Unpad provides separate trash bins for organic, inorganic, and recyclable waste throughout the campus area. The goal is to facilitate the waste management process and reduce the volume of waste that goes to the final disposal site.

One of the collaborations is Think Green 8.0, which collaborates with the 2023 FPIK Development Pattern to hold a plastic waste management campaign in the Faculty of Fisheries and Marine Sciences (FPIK), Universitas Padjadjaran. This activity highlights the importance of reducing the use of single-use plastic and encourages students to be wiser in using plastic and switch to more environmentally friendly materials. As part of the campaign, Think Green 8.0 and the 2023 FPIK Development Pattern facilitate the provision of special trash bins for plastic bottles and cups at various strategic points around FPIK. This initiative aims to reduce the amount of plastic waste that is carelessly disposed of and direct plastic waste to the right recycling process. These trash bins are expected to be the first step in promoting environmentally conscious behaviour among students, especially new students who are still adjusting to the campus environment.

TIM PADJAWARA

Degradasi Limbah Tekstil Methylene Blue Menggunakan Nanokomposit TiO2-BC Berbasis Sabut Kelapa Dengan Sonofotokatalisis Sebagai Upaya Mendukung Ekosistem Lingkungan Hijau

Abstrak

Data Badan Pusat Statistik (BPS) Indonesia tahun 2022, menunjukkan jumlah limbah tekstil di Indonesia yang berhasil dikelola hanya **sebesar 13,04%**. *Methylene blue* (MB) merupakan salah satu pewarna tekstil yang sering digunakan namun sulit terurai. Penggunaan MB dalam jangka panjang akan sangat berbahaya karena bersifat karsinogenik bagi manusia maupun lingkungan. Berdasarkan hal tersebut, penulis menggagas COCOMETH berupa *biochar* (BC) berbahan dasar sabut kelapa yang diimpregnasi TiO2 untuk mendegradasi MB menggunakan metode sonofotokatalisis. Inovasi ini menerapkan green chemistry dengan prinsip ***"Solving Waste Using Waste"*** yang dapat menjadi solusi pengolahan MB. Hasil yang diharapkan adalah **nanokomposit TiO2-BC** dengan pori dan luas permukaan yang besar serta diperoleh efisiensi degradasi limbah tekstil MB yang lebih tinggi dibandingkan biochar tanpa terimpregnasi TiO2. Dalam gagasan ini juga didesain *prototype* yang dapat mengolah produk hasil pirolisis serta mendegradasi MB dari air limbah dalam skala kecil maupun industri secara efisien sebagai upaya mendukung **ekosistem lingkungan hijau** di Indonesia.

Kata Kunci: *Biochar, methylene blue*, sonofotokatalisis

Latar Belakang

- Produksi MB di industri tekstil **mencapai 50%** dari total limbah warna (Ariyanto, 2016)
- Pengolahan tekstil seperti adsorpsi dan lumpur aktif **masih kurang efektif** (Ernawati *et al.*, 2020)
- Limbah sabut kelapa sebanyak 6.500 ton **belum terolah dengan baik** (Anugrah *et al.*, 2020)
- Potensi sonofotokatalis sebagai metode degradasi senyawa organik yang **lebih efektif** (Wang & Cheng, 2023)

Tujuan

- Menganalisis **proses pembuatan nanokomposit TiO2-BC** menggunakan *biochar* berbasis limbah sabut kelapa.
- Menganalisis **pengaruh impregnasi TiO2** terhadap kualitas *Biochar* sebagai katalis.
- Menganalisis **variabel optimum** dalam mendegradasi MB metode sonofotokatalisis serta variabel pembuatan nanokomposit TiO2-BC.

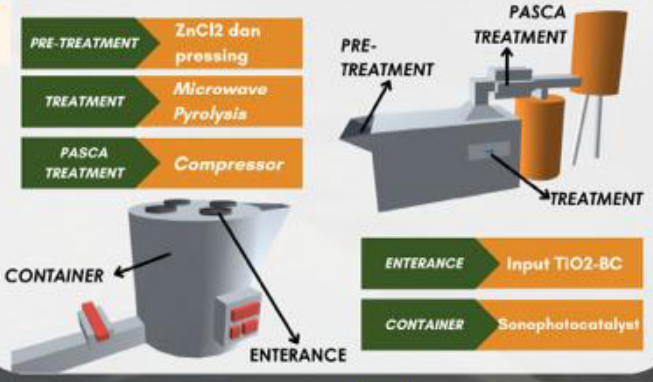
Metode Penulisan

Identifikasi masalah → **Studi Literatur** → **Pengolahan data** → **Penyajian Data** → **Perancangan *Prototype***

Kesimpulan

- Rendemen **94%** ***biochar*** menggunakan *microwave pyrolisis*
- Impregnasi TiO2 pada BC (1:2) meningkatkan kemampuan degradasi hingga **99%**
- Kondisi optimum sonofotokatalisis yakni **pH 3, 300 W , 60 menit**

Prototype



Hasil dan Pembahasan

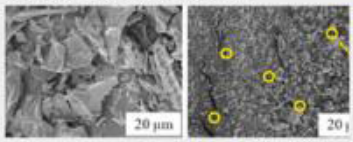
A. Komposisi Sabut Kelapa

83,7% Total Karbon · **8%** Total Air · **0,5%** Total Abu

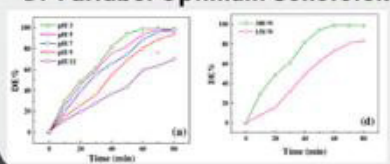
B. Standar SNI *Biochar*

Jenis Parameter	Nilai
Kadar Air	Maksimal 10%
Kadar Abu	Maksimal 15%
Kadar zat menguap	Maksimal 25%
Kadar karbon terikat	Minimal 65%
Daya serap terhadap iodium	Minimal 750 mg/g
Daya serap terhadap benzene	Minimal 25%

C. SEM BC vs TiO2-BC



D. Variabel Optimum Sonofotokatalisis



300 W Daya · **3** pH · **99%** Degradasi · **80** Menit

TEAM MEMBER
Raisya Fakhira Khairani
Luluatul Fuadatin Nafisah R
Fahmi Nur Alim
Uji Pratomo (Dosen Pendamping)

SCAN ME!

DEGRADATION OF METHYLENE BLUE TEXTILE WASTE USING COCONUT FIBER-BASED TIO2-BC NANOCOMPOSITE WITH SONY PHOTOCATALYST AS AN EFFORT TO SUPPORT GREEN ENVIRONMENTAL ECOSYSTEM

Padjawara Team from Universitas Padjadjaran won first place in the 2023 Chemistry Innovation Project (CIP) competition with the Cocometh innovation, a coconut fibre-based biochar (BC) impregnated with TiO2 to degrade methylene blue (MB), a carcinogenic textile dye. This innovation applies the green chemistry principle of "Solving Waste Using Waste" and is designed to increase the efficiency of MB textile waste degradation. Cocometh uses the sono photocatalysis method to efficiently process MB from water, both on a small and industrial scale. The prototype developed can process pyrolysis products and degrade MB with large pores and surface areas, offering a more effective textile waste processing solution.