MAPPING AND WASTE MANAGEMENT ANALYSIS IN THE SPECIAL ECONOMIC ZONE (SEZ) MANDALIKA, NTB

Pemetaan dan Analisis Pengelolaan Sampah di Kawasan Ekonomi Khusus (KEK) Mandalika, NTB

Andi Tri Lestari[1✉], Hairil Anwar[1], Maiser Syaputra[1]

[1]Department of Forestry, University of Mataram
✉Corresponding author: atlestari@unram.ac.id

ABSTRACT

One of the main tourist destinations in NTB Province currently is the Mandalika area, part of the Central Lombok region. This area is designated a Special Economic Zone (SEZ) based on PP Number 52 of 2014. Tourist visits increased drastically at the 2021 World Superbike (WSBK) event, and it is assumed that this will grow at the upcoming 2022 MotoGP event. An increase in the number of tourists has a positive and negative impact on the environment, along with increasing waste production. This research analyzed waste generation, composition, and effective waste management in the Mandalika SEZ. Analysis of waste production and composition will be carried out by referring to SNI 19-3964-1994 regarding methods for collecting and measuring samples of urban waste production and composition while analyzing waste management in the Mandalika SEZ, which was carried out by interview. The research results show that the average waste production in the Mandalika SEZ is 58.16 kg/Day. The most dominant waste composition is organic waste originating from food scraps, with an average of 39.56 kg/day, followed by the amount of plastic waste with an average of 16.41 kg/day. The smallest amount of waste at the research location is paper waste, with an average of 0.48 kg/day, and other waste is used diapers, with an average of 1.71 kg/day. The Waste Management Model shows that the average waste produced at the research location is 58.16 kg in one day. As a result of the indicators of waste production, in just one month, the waste production reached 1744.80 kg/day if it was not handled at all. Based on the research results, waste management modeling was produced by increasing public awareness, organic waste management using the Anaerobic Digestion Method and inorganic waste management using the recycling method. This modeling shows that the method applied can reduce waste production by up to 0.15%, namely 263.10 kg/day.

Keywords: Mandalika SEZ; Waste management; Waste production.

ABSTRAK

Salah satu tujuan wisata utama di Provinsi NTB saat ini adalah Kawasan Mandalika yang merupakan bagian dari wilayah Lombok Tengah. Kawasan ini ditetapkan menjadi Kawasan Ekonomi Khusus (KEK) berdasarkan PP Nomor 52 Tahun 2014. Kunjungan wisatawan meningkat drastis pada gelaran Wolrd Superbike (WSBK) 2021 dan diasumsikan akan bertambah pada gelaran MotoGP 2022 mendatang. Pertambahan jumlah wisatawan tidak hanya menimbulkan dampak positif namun juga dampak negatif pada lingkungan seiring dengan bertambahnya timbulan sampah. Penelitian ini bertujuan untuk menganalisis timbulan, komposisi dan pengelolaan sampah yang efektif di KEK Mandalika. Analisis timbulan dan komposisi sampah akan dilakukan dengan mengacu pada SNI 19-3964-1994 tentang Metode pengambilan dan pengukuran contoh timbulan dan komposisi sampah perkotaan sedangkan analisis pengelolaan sampah di KEK Mandalika dilakukan dengan wawancara. Hasil penelitian menunjukkan bahwa rerata timbulan sampah di KEK Mandalika adalah 58.16 kg/Hari. Komposisi sampah yang paling mendominasi adalah sampah organik yang berasal dari sisa-sisa makanan dengan rerata 39.56 kg/hari, diikuti dengan jumlah sampah plastik dengan rerata 16.41 kg/hari. Sampah dengan jumlah terkecil di lokasi penelitian adalah sampah kertas dengan rerata 0.48 kg/hari dan sampah lainnya berupa popok bekas dengan rerata 1.71 kg/hari. Model Pengelolaan Sampah menunjukkan bahwa rerata timbulan sampah yang dihasilkan di lokasi penelitian adalah 58.16 kg dalam satu hari. Akibat indikator dari timbulan sampah maka hanya dalam kurun waktu satu bulan timbulan sampah sudah mencapai 1744.80 kg/hari jika tidak ditangani sama sekali. Berdasarkan hasil penelitian dihasilkan pemodelan pengelolaan sampah dengan peningkatan kesadaran masyarakat, pengelolaan sampah organik dengan Metode Anaerobic Digestion dan pengelolaan sampah anorganik dengan Metode daur ulang. Pemodelan ini menunjukkan bahwa metode yang diterapkan dapat menekan timbulan sampah hingga 0.15% yakni 263.10 kg/hari.

Kata kunci: KEK Mandalika; Pengelolaan sampah; Timbulan sampah.

A. INTRODUCTION

West Nusa Tenggara (NTB) Province has enormous tourism potential. The number of tourists in NTB continues to increase (BPS NTB, 20 21). One of the main tourist destinations in NTB Province currently is the Mandalika area, part of the Central Lombok region. This area is designated as a Special Economic Zone (SEZ) based on Government Regulation Number 52 of 2014. This determination can increase the country's foreign exchange while improving the welfare of the surrounding community and opening up job opportunities (Satrio, 2021). Increase in the number of tourists This not only has a positive impact but also a negative impact. Tourist activities in this area will undoubtedly impact the environment and increase waste production (Sunaryo, 2013).

Waste production in the Mandalika SEZ at the 2021 World Superbike (WSBK) event has increased drastically (iNewsNTB, 2021). The scattered rubbish even remained until a week after the WSBK event. Based on data presented by campurlaut.id, Mandalika previously produced around 215.7 tons of waste per year (Ecorangerid, 2023). However, in the 2022 Mandalika MotoGP alone, waste production reached 60 tons (Antaranews, 2023). Waste prevention and control measures must be intensified, considering that one of the NTB Provincial Government's priority programs is the zero waste program (Kurniawati, 2020). This program targets 70% management and 30% waste reduction in 2023 (Paramita et al., 2021).

Research on Waste Management in the Mandalika SEZ is fundamental to broadening the knowledge of the community around it. Analyzing waste production and composition and its management can provide information for related agencies to make waste management in the area more effective and sustainable.

B. METHODS

Research Location and Time

This research was carried out in the Mandalika SEZ, Central Lombok Regency, NTB Province. The sampling location was Kampung Hijrah Village, where the people of Ebunut Village and Ujung Lauk Village lived. They were relocated to construct the Mandalika Circuit. The research was carried out from April to September 2022.

Research Tools and Materials

The tools and materials used consisted of 0–5 kg and 0–100 kg scales, gloves, masks, 100 x 120 cm trash bags, cameras, writing tools, and interview questionnaires. The research subject is waste taken from the research location.

Research methods

This research uses a combination of quantitative and descriptive qualitative methods. Quantitative methods are used to analyze waste production and composition data, while qualitative descriptive methods are used to analyze waste management data in the Mandalika SEZ.

Data analysis

1. Analysis of Waste production and Composition

The analysis of waste production and composition will be carried out by referring to SNI 19-3964-1994, which Concerns methods for collecting and measuring urban waste production and composition samples. An example of waste production is waste taken from the research location. The volume is then calculated, the weight is weighed, and the composition is measured. Meanwhile, the components of waste composition are the physical components of waste, such as food scraps, paper, cardboard, plastic, etc.

The collection of waste production samples was carried out following SNI 19-3964-1994, namely for eight consecutive days at the same location and carried out in random strata. The number of samples of people and heads of families (KK) was calculated based on formula one, and the number of samples of waste production from housing was calculated based on formula 2.

$$S = Cd \sqrt{Ps} \hspace{4cm} (1)$$

where S is the number of samples (people), Cd is the housing coefficient, and Ps is the population (people)

example of permanent housing = ($S \times K$) family   (2)

where S is the number of sample people, and K is the number of families (S/N; S is the number of sample people, N is the number of people per family)

Measuring and calculating examples of waste production using units in liters/unit/day for wet volume (origin) and units in kilograms/unit/day for wet weight (origin). Meanwhile, the unit used to measure waste composition is % wet/original weight.

2. Waste Management Analysis

Interviews were conducted with respondents from several groups using the Cluster Sampling technique, namely selecting samples from several clusters or small units (Nazir, 2009). The selected respondents came from the management of the Mandalika SEZ, the surrounding community, and tourists who visited the Mandalika SEZ. Interviews were conducted using a structured interview technique, namely a questionnaire (Siregar, 2017). The questionnaire prepared in this research consists of four components, namely (a) respondent identity, (b) general knowledge about waste management, (c) community attitudes in managing household waste, and (d) community attitudes towards waste in the Mandalika SEZ.

C. RESULTS AND DISCUSSION

Analysis of Waste Production and Composition

Data collection on waste production in the Mandalika SEZ was carried out for eight consecutive days, September 16-23, 2022. Data collection on waste composition in the Mandalika SEZ showed four types of waste found at the research location: organic waste, plastic, paper, and other waste in diapers. Based on their nature, types of waste can be divided into organic or domestic waste and inorganic or non-domestic waste (Nugroho, 2013; Dobiki, 2018; Sejati, 2009).

Data on waste production in the Mandalika SEZ can be seen in Table 1. The average waste production in the Mandalika SEZ is 58.16 kg/Day. The most dominant waste composition is organic waste, which comes from food waste and averages 39.56 kg/day. Furthermore, the second largest waste is plastic, with an average of 16.41 kg/day. The smallest amount of waste at the research location is paper waste, with an average of 0.48 kg/day. Apart from organic, plastic, and paper waste, other waste was found in used diapers, with an average of 1.71 kg/day.

Table 1. Waste production in SEZ Mandaliika

Day	Waste type				Total
	Organic	Plastic	Paper	Other	
1	63.70	45.60	2.00	1.40	112.70
2	47.00	20.70	0.50	0.00	68.20
3	34.50	11.80	0.00	0.00	46.30
4	37.80	10.30	0.40	2.80	51.30
5	19.00	10.00	0.70	1.40	31.10
6	47.20	16.10	0.20	0.00	63.50
7	38.60	9.80	0.00	3.60	52.00
8	28.70	7.00	0.00	4.50	40.20
Average	39.56	16.41	0.48	1.71	58.16

The percentage composition of waste production in the Mandalika SEZ can be seen in Figure 1. Based on this data, it can be seen that 68% of the total waste production is organic waste. This value is higher than the research results of Prasetyo et al. (2018), which shows that the generation of organic waste in the Imogiri Pine Forest tourist area is 64%. According to Darnas et al. (2021), organic waste is the waste that has the most potential for recycling because it decomposes quickly and can be used as fertilizer.

After organic waste, the following most significant percentage of waste is plastic, namely 28%. Plastic waste can be recycled into raw materials for alternative fuels (Wahyudi et al., 2018). According to Suhartoyo (2021), plastic waste can produce fuel through oil, gas, and charcoal by pyrolysis. Plastic waste can also become creative products and services (Putra & Yuriandala, 2010) or Ecobricks (Nirmalasari et al., 2021).

As much as 1% of paper waste can be processed into bag products using the paper folding technique (Ahmad and Saftyaningsih, 2013). Paper waste can also be sold directly to small paper recycling industries or the paper industry (Wahyono, 2001). Meanwhile, other trash, such as used diapers, can be recycled into planting media (Nawawi et al., 2019).
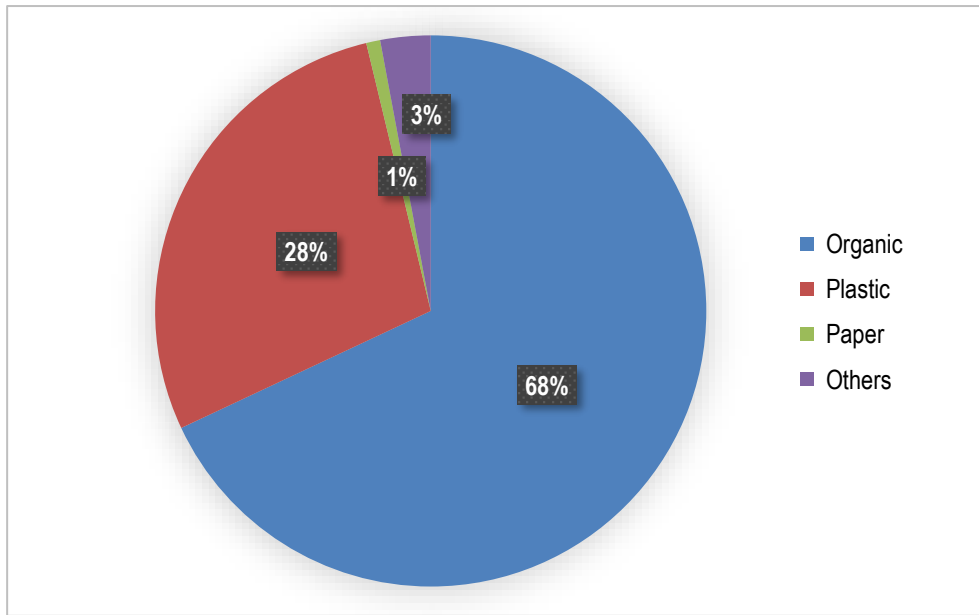
Figure 1. Percentage composition of waste production in SEZ Mandalika

Waste Management Analysis

Effective waste management is greatly influenced by the community's knowledge and attitudes (Tayeb and Daud, 2021). To determine the community's knowledge and attitudes about waste management in the Mandalika SEZ, interviews were conducted. Interview data shows that public knowledge about waste management is relatively high. The community's attitude toward household waste starts with sorting plastic and inorganic waste. However, inorganic waste has not been separated based on type, such as plastic, paper, glass, rubber, etc.

The research results show that the amount of waste produced daily fluctuates and requires handling. The waste production data was then created into a Sustainable Waste Management Model (Figure 2). Based on this model, the potential for waste production and the land required to accommodate waste increase along with population growth.
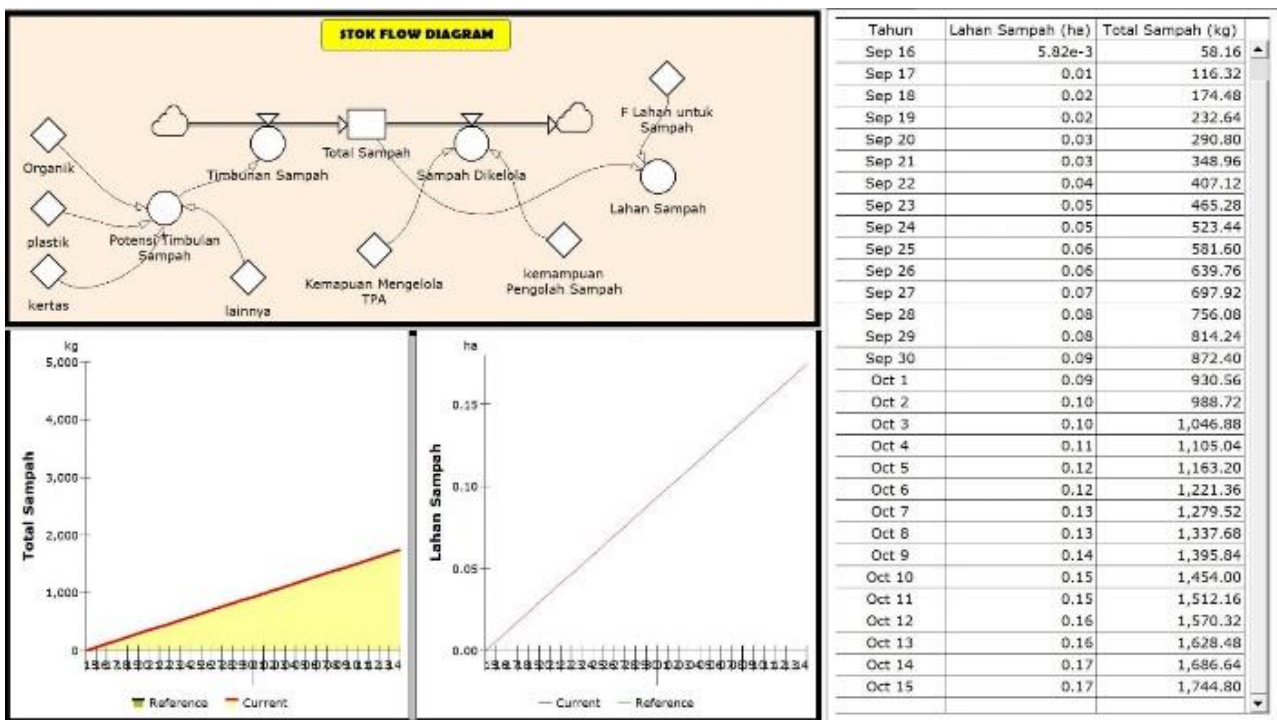

Figure 2. Sustainable waste management model

The average waste produced at the research location is 58.16 kg in one day, so in just one month, the production has reached 1744.80 kg. The waste produced requires land for storage before being transported by the Mandalika SEZ

Management, who comes once a week. When there is a delay in transporting waste and the land is sufficient to accommodate the resulting waste, residents will burn the waste to minimize the volume of garbage. Burning rubbish is very common among people because of a lack of knowledge about the impact of burning on the environment (Faridawati & Sudarti, 2021)

According to Setiawan (2018), the greater the population, the greater the waste production due to people's consumption patterns. Elyasa (2019) added that waste production is also influenced by the Human Development Index (HDI) value, where the higher the HDI value of an area, the higher the waste accumulation in the landfill. Based on the research results, the recommended method for waste management in the Mandalika SEZ is the Anaerobic Digestion Method for organic waste and the recycling method for inorganic waste.

D. CONCLUSION

The results of the research show that the average waste production in the Mandalika SEZ is 58.16 kg/day, with the most dominant waste composition being organic waste (39.56 kg/day), followed by the amount of plastic waste (16.41 kg/day), paper (0.48 kg/day) and other waste in the form of used diapers (1.71 kg/day). The Waste Management Model shows that the average waste produced at the research location is 58.16 kg/day. Based on the research results, waste management modeling was made by increasing public awareness, organic waste management using the Anaerobic Digestion Method and inorganic waste management using the recycling method. This modeling shows that the method applied can reduce waste production by up to 0.15%, namely 263.10 kg/day.

REFERENCES

Agung, K., Juita, E., & Zuriyani, E. 2021. Analisis Pengelolaan Sampah di Tempat Pembuangan Akhir (TPA) Desa Sido Makmur Kecamatan Sipora Utara. *Jurnal Pendidikan dan Ilmu Geografi*, 6 (2): 115-124.

Ahmad, A.R., & Saftyaningsih, K.A. 2013. Pemanfaatan Hasil Pengolahan Limbah Kertas pada Produk Tas dengan Teknik *Paper Folding. Jurnal Tingkat Sarjana Senirupa dan Desain,* (1): 1-6.

Antaranews. 2023. Residu sampah ajang MotoGP Mandalika 2023 menurun. https://www.antaranews.com/berita/3775320/residu-sampah-ajang-motogp-mandalika-2023-menurun diakses 27 Februari 2023.

Badan Standardisasi Nasional (BSN). 1994. *SNI 19-3964-1994 tentang Metode Pengambilan dan Pengukuran Contoh Timbulan dan Komposisi Sampah Perkotaan*. Indonesia.

Badan Pusat Statistik Provinsi Nusa Tenggara Barat (BPS NTB). 2021. *Jumlah Kunjungan Wisatawan ke Provinsi Nusa Tenggara Barat (NTB).* https://data.ntbprov.go.id/dataset/jumlah-kunjungan-wisatawan-ke-provinsi-nusa-tenggara-barat-ntb diakses 11 Januari 2022.

Chalik, A.A., Lay, B.W., Fauzy A., & Etty, R. 2011. Formulasi Kebijakan Sistem Pengolahan Sampah Perkotaan Berkelanjutan Studi Kasus: Dki Jakarta. *Jurnal Permukiman*, 6 (1): 18-30.

Damanhuri, E., & Padmi, T. 2016. *Pengelolaan Sampah Terpadu*. ITB Press, Bandung: 308 hal.

Darnas, Y., Nizar, M., & Irwand M. 2021. Kajian Potensi Daur Ulang, Timbulan dan Komposisi Sampah di Kawasan Perkantoran Kabupaten Aceh Tamiang. *Lingkar: Journal of Environmental Engineering*, (1): 41-52.

Diana, S., Marlina, M., Amalia, Z., & Amalia, A. 2018. Pemanfaatan Sampah Plastik Menjadi Produk Kerajinan Tangan Bernilai Ekonomis Bagi Remaja Putus Sekolah. *Jurnal Vokasi - Politeknik Negeri* Lhokseumawe, 1 (1): 68–73.

Dewilda, Y., & Julianto. 2019. K*ajian Timbulan, Komposisi, dan Potensi Daur Ulang Sampah Sebagai Dasar Perencanaan Pengelolaan Sampah Kawasan Kampus Universitas Putra Indonesia (UPI)*. Prosiding Seminar Nasional Pembangunan Wilayah dan Kota Berkelanjutan 2019.

Dobiki, J. 2018. Analisis Ketersedian Prasarana Persampahan di Pulau Kumo dan Pulau Kakara di Kabupaten Halmahera Utara. *Jurnal Spasial*, 5 (2): 220-228.

Ecorangerid. 2023. Dinobatkan Jadi Kawasan Ekonomi Khusus Pariwisata Siapkah Mandalika Tanggulangi Sampah Wisatawan?. https://ecoranger.id/?press-release=dinobatkan-jadi-kawasan-ekonomi-khusus-pariwisata-siapkah-mandalika-tanggulangi-sampah-wisatawan

Faridawati, D., & Sudarti. 2021. Pengetahuan Masyarakat Tentang Dampak Pembakaran Terhadap Lingkungan Kabupaten Jember. *Jurnal Sanitasi Lingkungan*, 1 (2): 50-55.

Hasbullah., Ashar, T., & Nurmaini. 2019. Analisis Pengelolaan Sampah di Kota Subulussalam Tahun 2017. *Jurnal Ilmiah Penelitian Kesehatan*, 4 (2):135-146).

Hendrawan D. 2005. Kualitas Air Sungai dan Situ Di DKI Jakarta. *Makara Journal of Technology*, Vol. 9 (1): 13- 19.

Hidayatullah, F., & Mulasari, S.A. 2020. Literature Review: Gangguan Saluran Penapasan Akibat Pencemaran Udara di Lingkungan Tempat Pembuangan Akhir (TPA). *Jurnal Kesehatan*, Vol. 13 (2): 119-130.

Indonesia Tourism Development Corporation (ITDC). 2022. Persiapkan Motogp 2022, ITDC Terima Kunjungan Presiden RI Joko Widodo di The Mandalika. *https://www.itdc.co.id/press-release/persiapkan-motogp-2022-itdc-terima-kunjungan-presiden-ri-joko-widodo-di-the-mandalika-20220114033244* diakses 15 Januari 2022.

iNewsNTB. 2021. Ajang WSBK di Sirkuit Mandalika Sisakan Sampah, DLH: Sudah Ditangani. *https://ntb.inews.id/berita/ajang-wsbk-di-sirkuit-mandalika-sisakan-sampah-dlh-sudah-ditangani* diakses 11 Januari 2022.

Kardono, K. 2016. Environmental Performance Test of Hazard Waste Incinerator In Indonesia. *KMUTNB International Journal: Applied Science and Engineering Progress*, 9 (2): 79–90.

Kementrian Lingkungan Hidup. 2015. Data Nasional Sampah. Rangkaian Hari Lingkungan hidup. Dialog Penanganan Sampah Plastik 10 Juni 2015. *https://kanalkomunikasi.pskl.menlhk.go.id/rangkaian-hlh-2015-dialog-penanganan-sampah-plastik/* diakses 11 Januari 2022.

Kospa, H.S.D., & Rahmadi. 2019. Pengaruh Perilaku Masyarakat Terhadap Kualitas Air Di Sungai Sekanak Kota Palembang. *Jurnal Ilmu Lingkungan,* 17 (2): 212-221.

Kurniawati, R. 2020. Sosialisasi NTB *Zero Waste* Melalui Literasi Digital. *JUPITER*, 17 (1): 46-61.

Mamahit, C., Najoan, H., Monintja, D. 2021. Evaluasi Kebijakan Pengelolaan Persampahan di Kota Manado. *Jurnal Governance*, 1 (2): 1-9.

Marantika, M.Y., Subiyanto, S., & Hani'ah. 2014. Analisis Geospasial Persebaran TPS dan TPA di Kabupaten Batang Menggunakan Sistem Informasi Geografis. *Jurnal Geodesi Undip*, 3 (1): 228-241.

Marliani, N. 2014. Pemanfaatan Limbah Rumah Tangga (Sampah Anorganik) sebagai Bentuk Implementasi dari Pendidikan Lingkungan Hidup. *Jurnal Formatif*, 4(2): 124-132.

Menteri PU RI. 2013. Peraturan Menteri Pekerjaan Umum Republik Indonesia Nomor 03/PRT/M/2013 tentang Penyelenggaraan Prasarana dan Sarana Persampahan dalam Penanganan Sampah Rumah Tangga dan Sampah Sejenis Sampah Rumah Tangga.

Nawawi, M.I., Azizah, M.N., & Andini, T. 2019. Pelipob: Pemanfaatan Limbah Popok Bayi sebagai Alternatif Media Tanam. DOI:10.31219/osf.io/2whqp.

Nazir, M. (2009). *Metode Penelitian*. Ghalia Indonesia. Jakarta. Indonesia.

Nugraha, A., Sutjahjo, S.H., & Amin, A.A. 2018. Persepsi dan Partisipasi Masyarakat Terhadap Pengelolaan Sampah Rumah Tangga Melalui Bank Sampah di Jakarta Selatan. *Jurnal Pengelolaan Sumberdaya Alam dan Lingkungan*, 8 (1): 7-14.

Nirmalasari, R., Khomsani, A.A., Rahayu, D.N, dkk. 2021. Pemanfaatan Limbah Sampah Plastik Menggunakan Metode Ecobrick di Desa Luwuk Kanan. *Jurnal SOLMA*, 10 (03): 469-477.

Nugroho, P. 2013. *Panduan Membuat Pupuk Kompos Cair*. Pustaka Baru Press. ISBN : 978-602-781-942-1. hal. 204.

Nurhayati, A.D., Suharjo, B.H., Sundawati, L., Syartinilia, & Vetrita, Y. 2020. Perilaku dan persepsi masyarakat terhadap terjadinya kebakaran gambut di Kabupaten Ogan Komering Ilir Provinsi Sumatera Selatan. *Journal of Natural Resources and Environmental Management*,10 (4): 568-583.

Paramita, E.P., Suadnya, I.W., Miharja, D.L., & Khusnia, H.N. 2021. Strategi Komunikasi dalam Program *Zero Waste* Menuju NTB Lestari Oleh Dinas Lingkungan Hidup Dan Kehutanan Provinsi Nusa Tenggara Barat. *Prosiding SAINTEK LPPM Universitas Mataram* Vol. 3: 83-93.

Permadi, A. 2011. *Menyulap Sampah Jadi Rupiah*. Mumtaz Media. Surabaya. Indonesia.

Prasetyo, M.H., Juliani, A., & Yuriandala, Y. 2018. *Studi Analisis Pengelolaan Sampah di Kawasan Hutan Pinus Mangunan Bantul, Yogyakarta.* [Skripsi]. Program Studi Teknik Lingkungan, Universitas Islam Inonesia. Yogyakarta. Indonesia.

Presiden Republik Indonesia. 2014. *Peraturan Pemerintah Republik Indonesia Nomor 52 Tahun 2014 tentang Kawasan Ekonomi Khusus Mandalika*. Indonesia.

Presiden Republik Indonesia. 2012. Peraturan Pemerintah Republik Indonesia Nomor 81 Tahun 2012 Tentang Pengelolaan Sampah Rumah Tangga Dan Sampah Sejenis Sampah Rumah Tangga. Jakarta. Indonesia.

Priatna, L., Hariadi, W., & Purwendah E.K. 2019. *Pengelolaan Sampah di Tempat Pembuangan Akhir (TPA) Gunung Tugel, Desa Kedungrandu, Kecamatan Patikraja, Kabupaten Banyumas*. Prosiding Seminar Nasional "Pengembangan Sumber Daya Perdesaan dan Kearifan Lokal Berkelanjutan IX". Purwokerto, 19-20 November 2019.

Putra, H.P., & Yuriandala, Y. 2010. Studi Pemanfaatan Sampah Plastik Menjadi Produk dan Jasa Kreatif. *Jurnal Sains dan Teknologi Lingkungan*, 2 (1): 21-31.

Rahardjo, P.N. 2014. 7 Penyebab Banjir di Wilayah Perkotaan yang Padat Penduduknya. *JAI,* 7 (2): 205-213.

Rachmawaty, A., & Nasution, S.M. 2019. Penerapan Teknologi Pengomposan pada Pengelolaan Sampah Rumah Tangga di Kabupaten Garut. J*urnal Teknologi Informasi dan Komunikasi*, 6 (1): 55-64.

Rangkuti, F. 2017. *Analisis SWOT Teknik Membedah Kasus Bisnis.* Gramedia Pustaka Utama. Jakarta. Indonesia.

Satrio, M.A. 2021. Upaya Pemerintah Indonesia dalam Meningkatkan Pariwisata Mandalika Melalui Kerangka *Branding* 'Wonderful Indonesia'. *Indonesian Perspective*, 6 (1): 65-85.

Sejati, K. 2009. *Pengelolaan Sampah Terpadu Dengan Sistem Node, Sub Point, Centre Point*. Yogyakarta: Kanisius.

Setiawan, I. 2018. Strategi Peningkatan Pengelolaan Persampahan di Kecamatan Ngaliyan Kota Semarang. *Economics Development Analysis Journal*, 7 (2): 111-119.

Siregar, S. 2017. M*etode Penelitian Kuantitatif Kualitatif dan R&D*. Alfabet. Bandung. Indonesia.

Sucipto, C.D. 2012. *Teknologi Pengolahan Daur Ulang Sampah*. Gosyen Publishing. Yogyakarta. Indonesia.

Suhartoyo. 2021. Pemanfaatan Sampah Plastik Menjadi Bahan Bakar. *Jurnal Ilmiah Teknik Mesin*, 7 (2): 90-96.

Sukamta., Wiranata., A, & Thoharuddin. 2017. Pembuatan Alat *Incinerator* Limbah Padat Medis Skala Kecil. *Jurnal Ilmiah Semesta Teknika*, 20 (2): 147-153.

Sukrorini, T., Budiastuti, S., Ramelan, A.H., & Kafiar, F.P. 2014. Kajian Dampak Timbunan Sampah Terhadap Lingkungan di Tempat Pembuangan Akhir (TPA) Putri Cempo Surakarta. *Jurnal EKOSAINS*, 6 (3): 56-70.

Sunaryo. 2013. *Kebijakan Pembangunan Destinasi Pariwisata: Konsep dan Aplikasinya di Indonesia*. Yogyakarta: Gava Media: 41.

Tayeb, M., & Daud, F. 2021. Hubungan Pengetahuan dan Sikap Dengan Pengelolaan Sampah Masyarakat di Kecamatan Manggala Kota Makassar. Prosiding Seminar Nasional Hasil Penelitian 2021: "Penguatan Riset, Inovasi, dan Kreativitas Peneliti di Era Pandemi Covid-19". ISBN: 978-623-387-014-6.

Tim Penyusun RIP LPPM Universitas Mataram. 2021. *Rencana Induk Penelitian Universitas Mataram Tahun 2020 – 2024*. Mataram, Indonesia.

Tobing, S.L., & Imran. 2005. *Dampak Sampah Terhadap Kesehatan Lingkungan dan Manusia.* Makalah pada Lokakarya "Aspek Lingkungan dan Legalitas Pembuangan Sampah serta Sosialisasi Pemanfaatan Sampah Organik sebagai Bahan Baku Pembuatan Kompos Kerjasama Universitas Nasional dan Dikmenti DKI Jakarta.

Ula, R.A., Prasetya, A., & Haryanto, I. 2021. *Life Cycle Assessment (LCA)* Pengelolaan Sampah di TPA Gunung Panggung Kabupaten Tuban, Jawa Timur. *Jurnal Teknologi Lingkungan,* 22 (2): 147-161.

UU RI. 2008. Undang-Undang Republik Indonesia No. 18 Tahun 2008 Tentang Pengelolaan Sampah

Wahyono S. 2001. Pengelolaan Sampah Kertas di Indonesia. Jurnal Teknologi Lingkungan, Vol. 2 (3): 276 - 280.

Wahyudi, J., Prayitno, H.T., & Astuti, A.D. 2018. Pemanfaatan Limbah Plastik Sebagai Bahan Baku Pembuatan Bahan Bakar Alternatif. *Jurnal Litbang,* 14 (1): 58-67.

Widiyanto, A.F., Yuniarno, S., dan & Kuswanto. 2015. Polusi Air Tanah Akibat Limbah Industri dan Limbah Rumah Tangga. *Jurnal Kesehatan Masyarakat*, 10 (2): 246-254.

Wilkie, A.C. 2005. *Anaerobic digestion: biology and benefits*. Dairy Manure Management: Treatment, Handling, and Community Relations, 63–72.

Wiryono, B., Muliatiningsih., & Dewi E.S. 2020. Pengelolaan Sampah Organik di Lingkungan Bebidas. *Jurnal Agro Dedikasi Masyarakat*, 1 (1): 15-21.