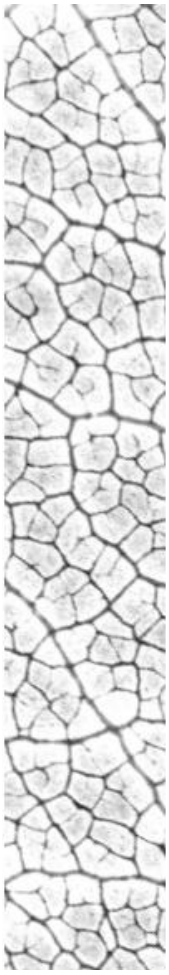

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Greening the environment in living a new lifestyle in the COVID-19 era

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Abstract
The essential health protocol for living in the COVID-19 era requires antiseptic and disinfecting agents, as well as clean water for personal washing and objects related to the conditions of human activity. The results of personal hygiene measures and the cleanliness of objects are additional wastewater discharges, and increased peak discharges of wastewater, compared to conditions without the protocol. In addition, the quality of wastewater is compounded by enrichment of toxic substances for microbes. As a consequence, the wastewater needs to be treated from the source to the disposal to the environment. Various studies that have been carried out previously indicate the potential of plants in eliminating antiseptic and disinfectant substances contained in wastewater. Therefore, this paper discusses specifically the contribution of greening the environment in treating wastewater rich in these toxic substances.

Keywords: wastewater, treatment, greening, environment

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INTRODUCTION

The COVID-19 era began in 2019 and it is difficult to predict when it will end. This world pandemic era requires everyone to adapt to new life, with the goal of being free from COVID-19. This new life is related to compliance with health protocol in every activity. In essence, everyone must obey to keep the distance between people, wear masks, and maintain personal hygiene and the surrounding objects. This essential requirement is the World Health Organization operational instructions (World Health Organization, 2020a,b,c). The rest of the protocols are certainly adjusted to the safety needs of each activity.

Compliance with the health protocol requires environmental support, which is the focus of this paper, which is greening. Greening the environment is to handle the results of these essential health protocol activities. This approach is different from the need for greening based on aesthetics (Subiza-Pérez et al., 2019; Tyrväinen et al., 2003), population (Gupta et al., 2016), social and economic aspects (Lewis et al., 2018; Ordóñez-Barona, 2017), carbon absorption (Peng & Jim, 2015; Reynolds et al., 2017), and others.

INCREASED WASTEWATER

Keeping distance certainly limits the number of people in any place outside the place of residence. If in each place of activity, the site capacity is limited to 50% of its full capacity, then the activity results in a carbon footprint reduction of at least 50% to the environment. Decreasing the carbon footprint of the air certainly improves air quality. These results were confirmed in several countries, for example China (Bao & Zhang, 2020), India (Mahato et al., 2020), and Brazil (Nakada & Urban, 2020). Therefore, our compliance with keeping distance leads to improved air quality.

However, a decrease in the number of people in a place is predicted to result in an increase in water use fluctuations in that place. Fluctuations in water use typically vary with the number of users. The fewer water users, the shorter the time to use it, moreover it is added to the activity time limit, which results in an increase in peak fluctuations. An increase in peak fluctuations in water use results in an increase in peak factor (Omaghomi et al., 2020; Scheepers, 2012; Balacco, et al., 2017; Mandi, 2020; Parvin et al., 2019; Wireko-Manu, & Amamoo, 2017). Typically the condition of Indonesia, a 50% reduction in the number of people results in an increase of about 170% of the peak factor of fluctuations in water use (Mangkoedihardjo, 2010). This is a significant number at the level of water drainage, which then becomes an increase in fluctuations in wastewater load.

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In addition to fluctuations in water usage, compliance with the use of masks (World Health Organization, 2020d), especially in cloths, which can be washed for reuse, also increases the amount of water used. Also, compliance with personal hygiene and objects using antiseptics and disinfectants (World Health Organization, 2020e,f,g) certainly increase the amount of water used. Additional use of water for washing cloth masks, personal hygiene and other objects, each person for 40-60 seconds (World Health Organization, (2020c with a tap flow of 10 L/min is about 4 L/person. The frequency of water use varies between people. But in this COVID-19 era, the additional water requirements would certainly be significant, because the user coverage was the entire population. As a result, the amount of wastewater increases and goes out into the environment.

In addition to increasing water usage, the use of antiseptics and disinfectants adds substances in wastewater that are released into the environment. Antiseptics contain toxic organic substances such as ethanol (World Health Organization, 2020e) and disinfectant sodium hypochlorite inorganic substances (World Health Organization, 2020f), which enrich the quality of wastewater. Toxic organic substances can be measured with a BOD/COD ratio of less than Inorganic substances from disinfectants are.0.5 chlorides. Both types of substances are toxic to microbes. These toxic substances increase the toxicity of wastewater.

In all seasons, people face increasing levels of fluctuations, amounts and toxic substances in wastewater. Whereas in the rainy season, people face the addition of toxic substances in rain water. Both of these waste sources can directly flow into the land and water environment.

GREENING UNITS

Greening the land and waters

Farmers in the days of crop pests tried to disinfect the soil to kill soil microbial pests. Annual soil disinfection results in changes in soil quality to loose particles, cracks, infertility, and increased manganese pollution (Leeper, 1947; Sonneveld & Voogt, 1975). However, chloride is a plant's micro-macro nutrients (Nagajyoti et al., 2010; Wege et al., 2017; Colmenero-Flores et al., 2019), therefore this should be utilized to intensify the greening of land as greenspace.

Various forms of greenspace actually need to be promoted such as in the median of roads, elevated land, public facilities, settlements, buildings, housing, and wherever there is activity of washing personal hygiene and objects. Architecturally, the implementation of greening in each part of the city, settlements, buildings (Samudro et al., 2011) is a way to lead a healthy life, and aesthetically the environment. Therefore, adjusting the condition of buildings for greening intensification is necessary and important in responding to health protocols in the COVID-19 era.

Greening of bodies of water, such as rivers, lakes and coasts, is known as a riparian zone. Unlike missions with terrestrial green open space, riparian zones are not only intended to extract chloride from waste, but also to increase aeration of waters. The aerial uses a water cooling approach, which can be achieved through the shade of tall plants along a body of water. Cold water can dissolve more oxygen than hot water (Deacutis, 2016), thus it can be used by aquatic organisms to nourish water.

Rainwater drainage

Drainage is the drying of rainwater from the land surface. For the purpose of maximum drying, naturally surface conditions are needed to facilitate rain absorption. How to make porous land naturally is greening. There is ample evidence that reforestation of land increases the drainage of rainwater into the ground (Ellis, 2013; Cutillas et al., 2018; Yao et al., 2020) and of course reduces runoff to surface waters.

In addition to the benefits of rainwater flow, there are two benefits of greening drainage related to improving rainwater quality. First, the toxic substances carried by rainwater can be treated in a soil matrix. Secondly, by itself toxic runoff substances become small and diluted when discharged into the water bodies.

Included in the greening of drainage is the drainage of water from the roof of the building. This is a way of implementing green building (Samudro et al., 2011), which improves building comfort. This implementation has begun to develop in Indonesia, and is responding to health protocols in the context of a new life in the COVID-19 era.

On-site sanitation

On-site sanitation is generally characterized by wastewater infiltration on the ground. However there is a kind of wastewater infiltration that uses plants, known as evapotranspiration bed (Patterson, 2006; Mangkoedihardjo & April, 2012; Curneen & Gill, 2016). This can be applied individually, both on a home scale and broader scale, for example household coverage, coverage of commercial activities, and the like where there is sufficient land.

For existing on-site sanitation conditions, for example absorption of wastewater in the ground, the application of this bed evapotranspiration can be implemented. The practical way, soil infiltration is modified into additional soil mounds with plants. This evapotranspiration bed configuration makes the potential for groundwater pollution can be minimized, because some of its flow into the air through the process of plant transpiration.

The use of evapotranspiration bed is effective by mixing growth media with compost. Compost adds biodegradable organic matter (Mangkoedihardjo & April, 2012; Samudro et al., 2018) to soil microbial activity, which then mineralizes organic matter into carbon dioxide. The end product is the main substance needed by plants. This plant growth is intended to eliminate chloride from disinfectant-containing wastewater.

Wastewater treatment

Microbiological wastewater treatment processes, which are generally applied in Indonesia, need operational attention. Potential out of operation is caused by two problems, namely due to a small ratio of BOD/COD and chloride, both of which eliminate microbial life. How to maintain the operation of existing microbiological processes is to place the processing plants in front of the existing processing.

Processing plants in front of microbiological treatment is intended to improve two things the quality of wastewater. First, plants are intended to absorb more chemical decomposed organic matter (COD) than microbiologically decomposed organic matter (BOD). From here the results clearly increase the BOD/COD ratio, so it is safe to enter the microbiological process installation. The author's experience and many similar studies prove that plant processing can improve the properties of organic matter into microbial decomposition (García-Ávila et al., 2019; Mangkoedihardjo, 2007; Samudro et al., 2018; Sandoval et al., 2019). Second is to absorb inorganic chloride as a plant macronutrient, so that entry into existing installations does not eliminate microbiological processes. Thus, wastewater treatment by plants produces qualities that can be further processed microbiologically. This method secures the installation of biological processes that already exist.

Greening biodiversity

The absorption ability of chloride and COD is different between plant species. Even differences in plant species have an effect on differences in the ability to remediate heavy metals in the presence of chloride. Sunflower plants, for example, are better able to absorb cadmium in the presence of chloride compared to kenaf and sorghum (Hattori et al., 2006). The same results have previously been found to be the difference in metal absorption by some plant species under the conditions of chloride rich growth media (Liópez-Chuken et al., 2012).

This fact can be applied to environmentally diverse biodiversity, both in the on-site sanitation, rainwater drainage, wastewater treatment, land and water greening. In addition to the purpose of eliminating toxicants, biodiversity can be selected according to local preferences and conditions (Lawrence et al., 2005; Newbold et al., 2015). Therefore, greening the environment can be accepted by the community, and they can participate sustainably to maintain personal and environmental health.

CONCLUSION

Health protocols produce wastewater enriched with organic and inorganic toxic substances. The wastewater has the potential to be effectively treated through greening in environmental media of land and riparian zone, rainwater drainage, on-site sanitation, and wastewater treatment. In each treatment unit, It is highly recommended to use various types of plants, which are accepted by the community for sustainable acceptance of greening.

REFERENCES

Balacco, G., Antonio Carbonara, Andrea Gioia, Vito Iacobellis and Alberto Ferruccio Piccinni (2017). Evaluation of Peak Water Demand Factors in Puglia (Southern Italy). Water 2017, 9, 96; https://doi:10.3390/w9020096.

Bao, R., & Zhang, A. (2020). Does lockdown reduce air pollution? Evidence from 44 cities in northern China. Science of the Total Environment, 731. https://doi.org/10.1016/j.scitotenv.2020.139052.

Colmenero-Flores, J. M., Franco-Navarro, J. D., Cubero-Font, P., Peinado-Torrubia, P., & Rosales, M. A. (2019, October 1). Chloride as a beneficial macronutrient in higher plants: New roles and regulation. International Journal of Molecular Sciences. MDPI AG. https://doi.org/10.3390/ijms20194686.

Curneen, S., & Gill, L. W. (2016). Willow-based evapotranspiration systems for on-site wastewater effluent in areas of low permeability subsoils. Ecological Engineering, 92, 199–209. https://doi.org/10.1016/j.ecoleng.2016.03.032.

Cutillas, P. P., Cataldo, M. F., Zema, D. A., de Vente, J., & Boix-Fayos, C. (2018). Greening-up effects on streamflow and evapotranspiration in mediterranean catchments. An example of taibilla catchment (Se Spain). Bosque, 39(1), 119–129. https://doi.org/10.4067/S0717-92002018000100119.

Deacutis, C. F. (2016). Dissolved oxygen. In Encyclopedia of Earth Sciences Series (pp. 202–203). Springer Netherlands. https://doi.org/10.1007/978-94-017-8801-4_72.

Ellis, J. B. (2013). Sustainable surface water management and green infrastructure in UK urban catchment planning. Journal of Environmental Planning and Management, 56(1), 24–41. https://doi.org/10.1080/09640568.2011.648752.

García-Ávila, F., Patiño-Chávez, J., Zhinín-Chimbo, F., Donoso-Moscoso, S., Flores del Pino, L., & Avilés-Añazco, A. (2019). Performance of Phragmites Australis and Cyperus Papyrus in the treatment of municipal wastewater by vertical flow subsurface constructed wetlands. International Soil and Water Conservation Research, 7(3), 286–296. https://doi.org/10.1016/j.iswcr.2019.04.001.

Gupta, K., Roy, A., Luthra, K., Maithani, S., & Mahavir. (2016). GIS based analysis for assessing the accessibility at hierarchical levels of urban green spaces. Urban Forestry and Urban Greening, 18, 198–211. https://doi.org/10.1016/j.ufug.2016.06.005.

Hattori, H., Kuniyasu, K., Chiba, K., & Chino, M. (2006). Effect of chloride application and low soil pH on cadmium uptake from soil by plants. Soil Science and Plant Nutrition, 52(1), 89–94. https://doi.org/10.1111/j.1747-0765.2006.00007.x.

Lawrence, A., Phillips, O. L., Ismodes, A. R., Lopez, M., Rose, S., Wood, D., & Farfan, A. J. (2005). Local values for harvested forest plants in Madre de Dios, Peru: Towards a more contextualised interpretation of quantitative ethnobotanical data. Biodiversity and Conservation, 14(1), 45–79. https://doi.org/10.1007/s10531-005-4050-8.

Leeper, G. W. (1947). The forms and reactions of manganese in the soil. Soil Science. 63(2): 79-94. https://doi.org/10.1097/00010694-194702000-00001.

Lewis, O., Home, R., & Kizos, T. (2018). Digging for the roots of urban gardening behaviours. Urban Forestry and Urban Greening, 34, 105–113. https://doi.org/10.1016/j.ufug.2018.06.012.

Liópez-Chuken, U. J., López-Domi´nguez, U., Parra-Saldivar, R., Moreno-Jiménez, E., Hinojosa-Reyes, L., Guzmán-Mar, J. L., & Olivares-Sáenz, E. (2012). Implications of chloride-enhanced cadmium uptake in saline agriculture: Modeling cadmium uptake by maize and tobacco. International Journal of Environmental Science and Technology, 9(1), 69–77. https://doi.org/10.1007/s13762-011-0018-2.

Mahato, S., Pal, S., & Ghosh, K. G. (2020). Effect of lockdown amid COVID-19 pandemic on air quality of the megacity Delhi, India. Science of the Total Environment, 730. https://doi.org/10.1016/j.scitotenv.2020.139086.

Mandi, L. (2020). Urgent Needs to Consider and Assess the Transmission of Coronavirus (COVID-19) via Hospital Sewage and Wastewater. Journal of Clinical and Experimental Investigations, 11(3), em00745.

Mangkoedihardjo, S. (2007). Leaf area for phytopumping of wastewater. Applied Ecology and Environmental Research, 5(1), 37–42. https://doi.org/10.15666/aeer/0501_037042.

Mangkoedihardjo, S. (2010). Individual or communal sanitation services?: Decision based on wastewater storage capacity. Advances in Natural and Applied Sciences, 4(3), 226–228.

Mangkoedihardjo, S., & April, S. (2012). Compost on evapotranspiration bed planted with yellow flag for treatment of wastewater containing anionic surfactant. Journal of Applied Sciences Research, 8(3), 1630–1633.

Nagajyoti, P. C., Lee, K. D., & Sreekanth, T. V. M. (2010). https://doi.org/10.1007/s10311-010-0297-8.

Nakada, L. Y. K., & Urban, R. C. (2020). COVID-19 pandemic: Impacts on the air quality during the partial lockdown in São Paulo state, Brazil. Science of the Total Environment, 730. https://doi.org/10.1016/j.scitotenv.2020.139087.

Newbold, T., Hudson, L. N., Hill, S. L. L., Contu, S., Lysenko, I., Senior, R. A., … Purvis, A. (2015). Global effects of land use on local terrestrial biodiversity. Nature, 520(7545), 45–50. https://doi.org/10.1038/nature14324.

Omaghomi, T., Buchberger, S., Cole, D., Hewitt, J., & Wolfe, T. (2020). Probability of Water Fixture Use during Peak Hour in Residential Buildings. Journal of Water Resources Planning and Management, 146(5). https://doi.org/10.1061/(ASCE)WR.1943-5452.0001207.

Ordóñez-Barona, C. (2017, August 1). How different ethno-cultural groups value urban forests and its implications for managing urban nature in a multicultural landscape: A systematic review of the literature. Urban Forestry and Urban Greening. Elsevier GmbH. https://doi.org/10.1016/j.ufug.2017.06.006.

Parvin, S., Hossen, A., Rahman, W., Hossen, I., Halim, A., Biswas, B. K., & Khan, A. S. (2019). Uptake Hazardous Dye from Wastewater Using Water Hyacinth as Bio-Adsorbent. European Journal of Sustainable Development Research, 3(1), em0065.

Patterson, R. (2006). Evapotranspiration Bed Designs for Inland Areas. Septic Safe, 1–5. Retrieved from http://lanfaxlabs.com.au/papers/P51-Technical%20Sheet%20%20Evapotranspiration-aug06.pdf on 29 May 2020.

Peng, L. L. H., & Jim, C. Y. (2015). Economic evaluation of green-roof environmental benefits in the context of climate change: The case of Hong Kong. Urban Forestry and Urban Greening, 14(3), 554–561. https://doi.org/10.1016/j.ufug.2015.05.006.

Reynolds, C. C., Escobedo, F. J., Clerici, N., & Zea-Camaño, J. (2017). Does "greening" of neotropical cities considerably mitigate carbon dioxide emissions? The case of Medellin, Colombia. Sustainability (Switzerland), 9(5). https://doi.org/10.3390/su9050785.

Samudro, G., Syafrudin, Wardana, I., Harida Samudro, & Sarwoko Mangkoedihardjo. (2018). Determination of the specific energy of mixed waste decomposition in compost solid phase microbial fuel cells (CSMFCS). International Journal of Civil Engineering and Technology, 9(11), 1316–1324.

Samudro, H., Faqih, M., E Sudarma, E. (2011). Green architecture criteria for high-rise building that serves as a rental office in the city of Surabaya. Journal of Applied Sciences Research, 7(5): 566-571.

Sandoval, L., Zamora-Castro, S. A., Vidal-Álvarez, M., & Marín-Muñiz, J. L. (2019). Role of wetland plants and use of ornamental flowering plants in constructed wetlands for wastewater treatment: A review. Applied Sciences (Switzerland). MDPI AG. https://doi.org/10.3390/app9040685.

Scheepers HM. (2012). Deriving peak factors for residential indoor water demand by means of a probability based end-use model. Thesis Faculty of Engineering, Department of Civil Engineering, Division of Water and Environmental Engineering. Stellenbosch University. Retrieved from https://scholar.sun.ac.za/handle/10019.1/71639 on 29 May 2020.

Sonneveld, C., & Voogt, S. J. (1975). Studies on the manganese uptake of lettuce on steam-sterilised glasshouse soils. Plant and Soil, 42(1), 49–64. https://doi.org/10.1007/BF02186973.

Subiza-Pérez, M., Hauru, K., Korpela, K., Haapala, A., & Lehvävirta, S. (2019). Perceived Environmental Aesthetic Qualities Scale (PEAQS) – A self-report tool for the evaluation of green-blue spaces. Urban Forestry and Urban Greening, 43. https://doi.org/10.1016/j.ufug.2019.126383.

Tyrväinen, L., Silvennoinen, H., & Kolehmainen, O. (2003). Ecological and aesthetic values in urban forest management. In Urban Forestry and Urban Greening (Vol. 1, pp. 135–149). Elsevier GmbH. https://doi.org/10.1078/1618-8667-00014.

Wege, S., Gilliham, M., & Henderson, S. W. (2017, June 1). Chloride: Not simply a "cheap osmoticum", but a beneficial plant macronutrient. Journal of Experimental Botany. Oxford University Press. https://doi.org/10.1093/jxb/erx050.

Wireko-Manu, F. D., & Amamoo, C. (2017). Comparative Studies on Proximate and Some Mineral Composition of Selected Local Rice Varieties and Imported Rice Brands in Ghana. Agriculture and Food Sciences Research, 4(1), 1-7.

World Health Organization archives (2004)e. Disinfectants and antiseptics. http://archives.who.int/eml/wmf/2004/English/Disinfectants%20and%20antiseptics.pdf. Accessed on 1 July 2020.

World Health Organization. (2020)a. COVID-19: operational guidance for maintaining essential health services during an outbreak: interim guidance, 25 March 2020. World Health Organization. https://apps.who.int/iris/handle/10665/331561. Accessed on 29 May 2020.

World Health Organization. (2020)b. Recommendations to Member States to improve hand hygiene practices to help prevent the transmission of the COVID-19 virus. Interim guidance 1 April 2020. https://www.who.int/publications/i/item/recommendations-to-member-states-to-improve-hand-hygiene-practices-to-help-prevent-the-transmission-of-the-covid-19-virus. Accessed on 29 May 2020.

World Health Organization. (2020)c. WHO SAVES LIVES: Clean your hands in the context of COVID-19. https://www.who.int/publications/m/item/who-saves-lives-clean-your-hands-in-the-context-of-covid-19. Accessed on 29 May 2020.

World Health Organization. (2020)d. Advice on the use of masks in the context of COVID-19. Interim guidance 5 June 2020. https://www.who.int/publications/i/item/advice-on-the-use-of-masks-in-the-community-during-home-care-and-in-healthcare-settings-in-the-context-of-the-novel-coronavirus-(2019-ncov)-outbreak. Accessed on 12 July 2020.

World Health Organization. (2020)f. Cleaning and disinfection of environmental surfaces in the context of COVID-19. Interim guidance 15 May 2020. https://www.who.int/publications/i/item/cleaning-and-disinfection-of-environmental-surfaces-inthe-context-of-covid-19. Accessed on 12 July 2020.

World Health Organization. (2020)g. Guide to Local Production: WHO-recommended Handrub Formulations. Revised April 2010. https://www.who.int/gpsc/5may/Guide_to_Local_Production.pdf. Accessed on 29 May 2020.

Yao, L., Wu, Z., Wang, Y., Sun, S., Wei, W., & Xu, Y. (2020). Does the spatial location of green roofs affects runoff mitigation in small urbanized catchments? Journal of Environmental Management, 268. https://doi.org/10.1016/j.jenvman.2020.110707.