Technical Processing Wastewater Treatment Plant of Balangan Regional Public Hospital, Balangan Regency, South Kalimantan, Indonesia : Study Waste Wastewater Spreading in Water Resources

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Technical Processing Wastewater Treatment Plant of Balangan Regional Public Hospital, Balangan Regency, South Kalimantan, Indonesia: Study Waste Waterwastewater Spreading in Water Sources

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ABSTRACT

Wastewater produced from the Balangan Regional Public Hospital activities can be dangerous to the environment because it can damage the soil, pollute groundwater, and cause contamination in river water. Because of this contamination, the transmission of diseases caused by bacteria found in wastewater was made feasible. Therefore, it is crucial to consider hospital environmental health while managing waste to ensure that it complies with specified hospital wastewater quality standards. This can be done by managing wastewater appropriately and under criteria. Using the Watershed-Based Model, these community development activities provide insight into how wastewater generated by the Balangan Regional Public Hospital could be distributed and transformed (physical, chemical, and biological). Based on the study's findings, it was discovered that the number of contaminants that can be tolerated would be affected by variations in river water discharge measured at different places. The bigger the water outflow, the greater the capacity to receive pollutants. Large water outflow has the potential to thin the contaminants even further. Rainfall in the Balangan River Basin will impact river water discharge and pollution levels.

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INTRODUCTION

The Balangan Regional Public Hospital is a social facility that cannot be separated from the community. The community anticipates its existence since we all want our health to be preserved as a human or a community. As a result, the hospital has a tight relationship with the existence of a group of people or the community. In the past, a hospital was established in a location far from residential areas, usually beside a river, to ensure that the management of solids and wastewater has no negative influence on the people or that any negative impact is mitigated. "Active sludge" wastewater treatment technology is commonly used for large-capacity hospital wastewater treatment. However, due to high operational expenses, the approach is less cost-effective for small-capacity wastewater treatment. Hospital wastewater consists of all wastewater generated by all hospital activities, including domestic wastewater, namely bathroom, kitchen, and washing clothes; clinical liquid waste, namely wastewater generated by hospital clinical activities, such as water used for washing wounds, blood washing, and laboratory wastewater. Hospital wastewater originating from domestic and clinical wastewater typically contains high concentrations of organic pollutant compounds and can be treated with biological treatment processes, whereas hospital wastewater originating from laboratories typically contains high concentrations of heavy metals that can interfere with the wastewater's processing if it is channeled through a biological treatment process. As a result, laboratory wastewater is separated and accommodated for hospital wastewater management, chemically processed, mixed with other wastewater, and finally biologically processed (Proia *et al*., 2018; Wang *et al*., 2022).

Wastewater is more environmentally hazardous since it can harm the soil and pollute groundwater. Furthermore, it is vital to be aware of contamination in river water, which can create a contagious disease caused by the bacteria in it to the surrounding community's health (Yazdanbakhsh *et al*., 2020). Hospital environmental health is critical; thus, it is critical to strive to manage the correct waste following the requirements so that the trash that is thrown satisfies the quality level of liquid waste that has been established. Services at the Balangan Regional Public Hospital are available 24 hours a day and are located near residential areas; in addition to dealing with the safety and health of personnel, patients, and visitors, the hospital environment is also important. This hospital has many supporting services; thus, each installation generates solid, wastewater, or air contaminant. According to sanitation reports and WWTP, there are still various issues with the waste treatment process, including the amount of processed wastewater and an unpleasant odor. Based on the situation described above, the authors want to investigate the spread of wastewater in water sources. This study's findings are expected to provide information to the community and related agencies to reduce environmental pollution caused by hospital waste (Arisma, 2021; Baeti *et al*., 2022; Ebomah & Okoh, 2020).

METHODS

The community development activities were performed in September 2022 at the Balangan Regional Public Hospital, Balangan Regency of South Kalimantan Province. The primary data consists of observations and in-depth interviews conducted following interview standards and documentation. Secondary data are supplementary information derived from the Balangan Regional General Hospital's quality test evaluation findings. In this service activity, there are three phases: observation, data processing, and the distribution of recommendations to the Balangan Regional Public Hospital and other entities associated with this service(Annisa *et al*., 2021).

RESULT AND DISCUSSION

Designing Wastewater Treatment Plants

In the current WWTP procedure, all wastewater generated by hospital activities, including domestic and clinical waste, was collected via pipelines. Furthermore, wastewater is routed to the control tub. The function of the control tub is to prevent solid waste such as plastic, cans, and wood from entering the WWTP unit, as well as solids that cannot be degraded, such as mud, sand, ash rubbing, and others, from entering the WWTP unit. Wastewater is sent from the control tub to the equalization tub. The WWTP decomposition tub is divided into three rooms: sedimentation tub (initial decomposition tub), biofilm tanks with the up flow, and effluent tanks. In addition, wastewater is sent from the Effluent tub to an advanced processing unit. The advanced processing unit comprises many process units that contain media for breeding microorganisms that will decipher the harmful components in the wastewater. Processed water is pumped into the output after passing through advanced processing equipment. Inside the wastewater discharge, UV light was used to kill all pathogenic microorganisms. The wastewater exit might discharge directly into a river or public canal.

In the new WWTP system, all hospital-generated wastewater flows through a waste channel and is filtered by a bar screen to remove big trash such as medical waste, leaves, paper, and plastic. After passing through the bar screen, the effluent is channeled into the collection tub. The collection tub collects sand, soil, and other solid chemicals that cannot be degraded biologically. In addition, the runoff from the collecting tub is directed to the equalization tub, which serves as a waste storage tank and a flow control tank. The following equalization tub's wastewater is pumped to the WWTP unit. The WWTP unit sends wastewater into the first setup tub to precipitate mud particles, sand, and organic contaminants. In addition to being a deposition tub, it serves as a tub for decomposing organic components in the form of solids, sludge digestion, and mud containers. The runoff water from the initial setup tub is then directed to the anaerobic contractor from top to bottom and bottom to top. Plastic-based media are contained within the WWTP container. The number of anaerobic contractors consists of two rooms where aerobic facultative bacteria decompose organic compounds in wastewater. After a few days of surgery, a layer of film bacteria will form on the surface of the filter media. This bacterium will identify organic molecules in the settling tub that have not yet degraded. The aerobic contactor tub is supplied wastewater from anaerobic contactor tubs. In the aerobic contractor, a tub is filled with media while air is blown through it so that microorganisms can degrade organic components in wastewater, proliferate, and attach themselves to the surface of the medium. Thus, wastewater will come into touch with microorganisms suspended in water or adhering to the surface of the media, which can boost the effectiveness of organic and detergent degradation and speed up the nitrification process, resulting in a larger removal efficiency of ammonia. This procedure is commonly referred to as Contact Aeration. The water is transferred from the aeration tank to the final settling tub. In this tub, microorganism-rich active mud is deposited and returned back to the input aeration using a mud circulation pump. While the excess air is directed to the chlorination tub. This chlorination tub introduces chlorine compounds to wastewater to eliminate pathogenic germs. Processed water, or water that has been chlorinated, can be dumped directly into rivers or public channels. In addition to reducing organic compounds (BOD, COD), anaerobic and aerobic procedures can reduce ammonia, suspended solids (TSS), phosphate, and others (Gan *et a*l., 2022; Proia *et al*., 2018; Wang *et al*., 2022).

Watershed-based model

Utilizing the laws of conservation of mass and momentum, hydrodynamic modeling with a receiving-based model is based on describing mechanisms that influence circulation and mixing water phases. In hydrodynamic modeling, the following characteristics are utilized: tides, hydraulic slope, temperature, friction, turbulence, wind and air pressure, and the effect of the Coriolis Force. Predictions of the distribution and transformation (physical-chemical-biological changes) of contaminants in the water are based on data derived from current, velocity, direction, and elevation patterns. The process is modeled as the movement and concentration of pollutants after dispersion, ionization, sorption, and degradation using several processes (volatilization, biodegradation, hydrolysis, and photolysis) (Wang *et al.*, 2022). The output consists of spatial and temporal data distributions of pollutant concentrations (Figure 1).

Figure 1. Physical Model of Pollutant Distribution in The River.

The most significant conditions include fluctuations in biological conditions, volume and composition, and the potential for bioaccumulation (persistence) of wastewater released into the river body, which can carry and dissolve pollutants. Pollutants can become diluted in a vast flow of water. Pollutant concentrations in river water decrease. If the flow velocity is also great, it will be capable of "transporting and washing" all pollutants in the Balangan River Basin. All contaminants will be transferred to the river mouth and eventually to the sea. Pollutant levels in the river will fall. There is a variance in river water discharge measured at various sites and times. The difference in river water discharge is influenced by the amount of moisture in the soil before it rains, the surface of the groundwater before it rains, the infiltration rate, the presence of waterproof buildings, and land usage (Wang *et al*., 2022).

The presence of plants, soil texture, soil moisture, soil structure, and litter at the soil surface all influence the infiltration rate. If the river water discharge condition is referred to, the Balangan River contains water that runs throughout the year with various discharge fluctuations. Fluctuations in the Balangan River's water discharge might provide information on the river's type. According to geological literature, the Balangan River's flow pattern (system) is described as influent, effluent, and intermittent. The Influent River Flow System is a groundwater supply river. The river flow originating from groundwater is the Effluent River Flow system. Rivers that fall within the Effluent flow category often flow all year (perennial). Meanwhile, the Jilatan river that flows to the Balangan River is an intermittent flow system. Using river water will undoubtedly diminish water output downstream of the river. The number of contaminants that can be tolerated will be affected by variations in river water discharge measured at different places. The bigger the water outflow, the greater the capacity to receive pollutants. Large water outflow has the potential to thin the contaminants even further. Rainfall in the Balangan River Basin will impact river water discharge and pollution levels (Figure 2).

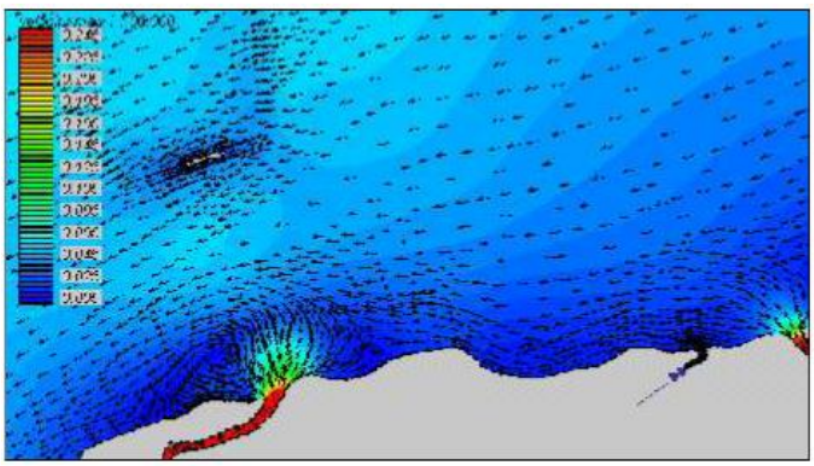

Figure 2. Hec-Ras Model Study

Zone of Initial Dilution

The Zone of Initial Dilution is where organisms, particularly benthos, can be continuously exposed to contaminants at quantities that exceed water quality requirements. To ensure general water quality in locations where points may be polluted, a zone known as the mixing zone is occasionally used. The Department of Environment defines the mixing zone as an "area or volume of water is confined where the initial diluting of the waste occurs and where the numerical water quality limits can be exceeded but acute hazardous circumstances are averted." The Department of Environment can establish other guidelines for pollutant levels in the mixing zone. The goal of establishing the mixing zone is to designate a region of impact when the pollutant level is allowed to exceed the acceptable limit (according to quality standards). When the mixing zone limit is reached, natural mixing must lower pollutant concentrations to an acceptable level. The initial dilution zone is where pollutant concentrations surpass the regulatory limit (ZID). The usage of the mixing zone for specific compounds that are extremely harmful or may be organically accumulated in the food chain has ceased in this scenario(Wang *et al*., 2022) (Figure 3).

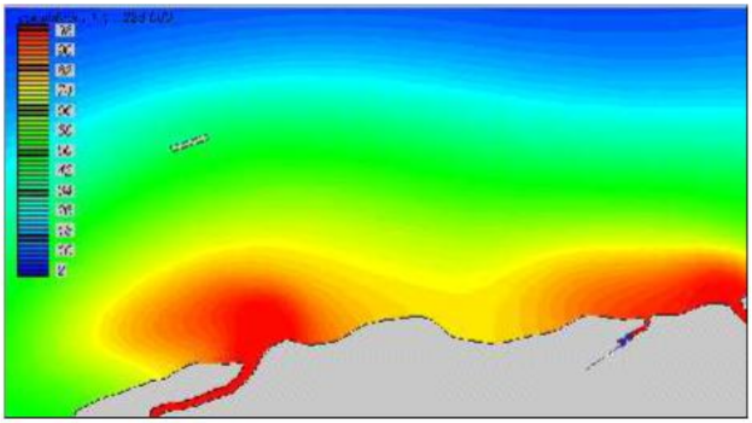

Figure 3. Zone of Initial Dilution Using the Hec-Ras Application.

Figure 4. WWTP Observation

CONCLUSION

Wastewater management must be properly and thoroughly executed to reduce the likelihood of environmental contamination near hospitals. For WWTP planning purposes, knowledge of how wastewater from the Balangan Regional Public Hospital activities in the waters is expected to be distributed and transformed (physical, chemical, and biological) is crucial. These community-based projects use the Watershed-Based Model to give light on potential pathways for the distribution and treatment of wastewater from the Balangan Regional Public Hospital (physical, chemical, and biological). The study found that differences in river water discharge recorded at different locations would influence the maximum allowable pollutant concentration. The larger the water output, the more contaminated water can be absorbed. With much water flowing out, the pollution level can drop even lower. Water flow and pollutant levels in the Balangan River Basin will be affected by rainfall.

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