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To cite this article: A S N Amirah *et al* 2021 *IOP Conf. Ser.: Earth Environ. Sci.* **646** 012034

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The use of media filters in treatment of runoff pollution

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Abstract. The study will examine the ability of recycled aggregates and sand to classify wastewater in a manner that decreases the level of environmental pollution. The sample was taken from Kg Wang Ulu, Perlis agricultural district, Jejawi, Perlis industrial area and Taman Desa Katong, Perlis residential area. Water quality research has been investigated to find the characteristics of effluent such as suspended solids, BOD, COD and TSS. Three rainfall intensity values, of 5 LPM as low rainfall, 12.5 LPM as mean precipitation intensity, and 22.5 LPM as high-cut rainfall consisted of recycled aggregate and high-absorptive sand as drainage beds, were included in this operating system. Experimental findings indicate that the recycling of aggregates and sand filters has a positive effect on water in industrial and residential areas. It shows that the use of recycled aggregates as a drainage bed can increase the permeability of the region by reducing erosion, preventing flooding and promoting natural infiltration.

1. Introduction

Urban area mainly exists the contaminated water. Rapid population growth is a process of development and urban growth which is being defined by harmful impacts, such as higher environmental pollution, higher impermeable surfaces, more significant stormwater, greater use of national resources, significantly lower stream water performance, and loss of biodiversity and ecosystems [1]. Growing urban areas cause increased flooding, imperviousness and direct runoff. It would also increase the flow velocity and thus cause the fluid to change its geomorphic properties. Biological consequences include floods, deforestation, climate change, water pollution, and the loss of marine life and biodiversity. This also enables flow in the region to become polluted as a result of a number of manufacturing, residential, stormwater, commercial or agricultural.

2. Material and Methods

2.1. Study area

The untreated wastewater sample will be taken from drains at 3 sites in the Kangar, Perlis, Wang Ulu agricultural area, Taman Desa Katong Kangar residential area, and Jejawi industrial area.



2.2. Maximum drainage capacity

The relationship between the dry density of the material and the water content has been acquired to achieve the maximum moisture content and the maximum dry density of the aggregate and sand. The laboratory tests were preceded by the British Standard Test (BS 1377-4-1990). The model acts as a bed channel was built in 0.525m x 0.565m Perspex, which was set up with a hole on the bottom plate to allow the fluid to drain out to assess the infiltration capacity. In this bed layer, which comprises of the first bedding layer, sand was added to the end of the plate with a depth of 100 cm, a geotextile layer, led by an aggregate of 2 mm with a depth of 0.1 m. A model with 800 uniformly distributed 5 cm medium to medium sprays was constructed 5 m above the drain outer edge to cover an area of 0.5m x 0.565m and achieve terminal velocity. A control valve has controlled various conditions of the simulated water flow. The flow through the simulator ranged from 5 LPM to 42 LPM. The fluid flow through the drainage system was obtained just below the bed of the drain is through a funnel attached to only the main 0.5m x 0.5m area. The area is regulated to 0.5m x 0.5m to avoid flow separation affecting the hydraulic flow inside this PVC box. The average thickness is 0.12 m and is attached to the controlled valve.

2.3. Water quality

Each element is essential as it will state the contaminants in the water, and the findings are checked in terms of the INWQS standards. The parameters to be measured are total suspended solids (TSS), chemical oxygen demand (COD) and biochemical oxygen demand (BOD). The objective is seeing the quality of the water. In this test, the depth of the channel bed and the flow of the simulation were maintained.

3. Results and discussion

3.1. Sand and aggregates characteristic and the infiltration capacity

A set of preliminary results measured the physical characteristics of the bedding of the porosity channel layer. These experiments included the relationship between the optimal moisture and the optimum density test, the particle size distribution test, the specific gravity test and the hydraulic conductivity test. The characterization of the bedding layer is shown in table 1.

Table 1. Properties of the bedding layer consist of aggregates and sand.

	Aggregate	Sand
Specific Gravity, Gs	1.52	1.44
Hydraulic Conductivity, k	0.016 cm/s	0.010 cm/s
Bulk densities, ρ_s	0.998 g/cm ³	0.8995 g/cm ³
Moisture Content, %	55.26%	89.90%
Porosity, n	0.31	0.46
Void ratio, e	0.6	0.85

Control parameters of precipitation intensity, 5 LPM, 12.5 LPM and 22.5 LPM, consisting of a recycled aggregate and sand with more excellent permeability. As mentioned in figure 1, this study found that the infiltration capacity could be up to 155L for 5 LPM, 80L for 12.5 LPM, and 31L for 22.5 LPM. Drains bed waterway will boost the penetrability of the area by helping to reduce surface water, regulating floods and allowing natural infiltration. Infiltration, which is the soaking of moisture in the soil, reduces the stormwater and could be a means of resupplying groundwater [2].

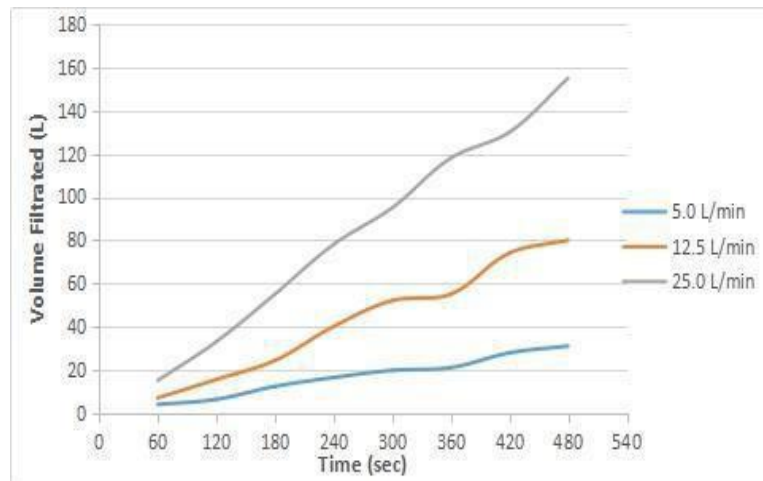


Figure 1. Infiltration Capacity.

3.2. Biological Oxygen Demand (BOD)

Figure 2 shows a comparison of three different BOD samples which increases the reliability for the agricultural area reduced from 317.32 mg / l to 102.95 mg / l, for the industrial area initially 75.84 mg / l to 70.75 mg / l, and the residential area deducted 100.98 mg / l to 62.80 mg / l. The highest removal efficiency achieved for agriculture is 67.56 per cent, followed by residential areas is 37.81 per cent, and the industrial area is 7.98 per cent. Surface water from highways typically includes greater amounts of pollutants than runoff from the roof [3]. Precipitation may retain 5-day BOD (1–2 mg / l), sulphate (0.56–14.40 mg / l), ammonia (0.1–2.0 mg / l), chloride (0.2–5.2 mg / l), total phosphate (0.01–0.19 mg / l), nitrate (0.1–7.4 mg / l), copper (1–355 mg / l) and zinc (5–235 mg / l).

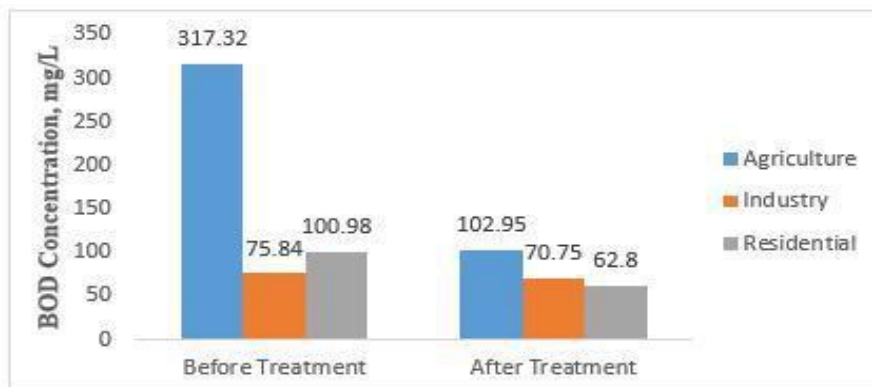


Figure 2. BOD analysis.

3.3. Chemical Oxygen Demand (COD)

Figure 3 shows the COD where the value decreases. The highest elimination found in the agricultural area of 40.78 per cent, followed by the industrial area of 37.49 per cent and the residential area of 23.56 per cent. Sharrer *et al.* [4] found that there was a reduction in COD and ammonia levels compared to highway gullies, but there was also evidence of the efficiency of high pavement surface treatment systems and that there was no frequent need for maintenance.

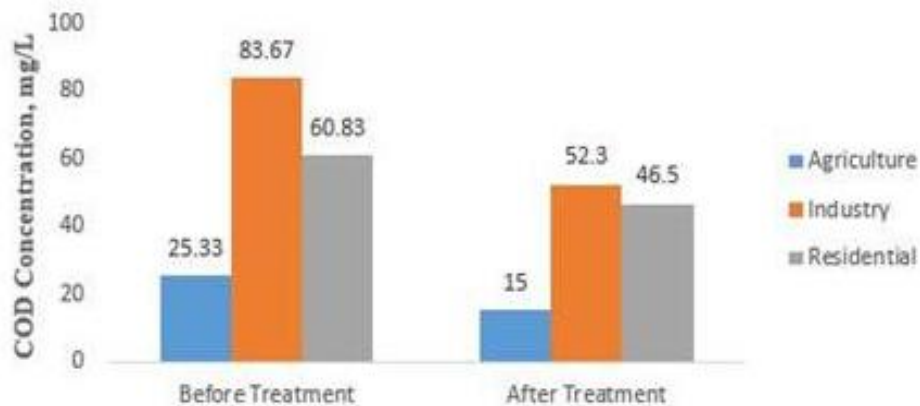


Figure 3. COD analysis.

3.4. Total Suspended Solid (TSS)

Figure 4 below shows precisely the results of the TSS, which shows that the highest efficiency achieved for the industrial area is 47.27 per cent followed by the residential area, 46.64 per cent and the agricultural area is 33.68 per cent. TSS could also affect stormwater suspended solids and the level of water received. TSS concentrations in big cities may vary between 100 and 3000 mg/l. The pebble geotextile layer increases the effectiveness of TSS disposal by an estimated 30% [5].

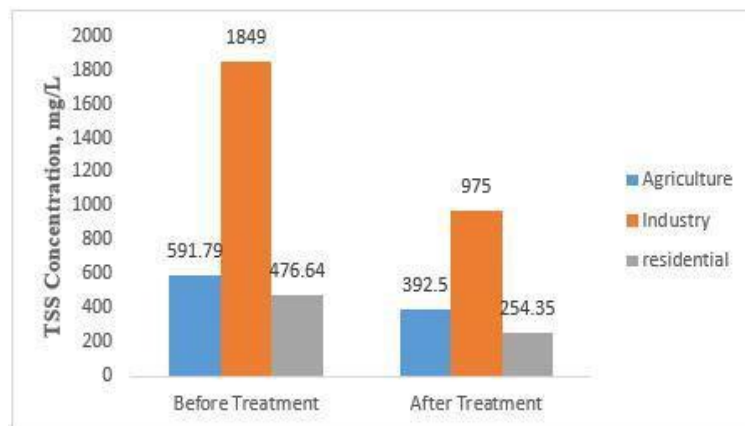


Figure 4. TSS analysis.

4. Conclusions

Based on the analysis, aggregate recycling and sand proved good effects on the quality of water. Low soil moisture content can lessen the infiltration rate of impervious surfaces promotes soil compaction, improves soil hydraulic conductivity by plant roots and reduces runoff infiltration, which ultimately decreases soil permeability. Besides, the presence of recycled aggregates as a drainage bed will increase the permeability of the area by reducing runoff, controlling floods and encouraging natural infiltration.

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