

Sodium Hypochlorite Dosage For Rainwater Harvesting System For Potable Use In Gambang, Malaysia

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Abstract

Rainwater harvesting system for potable use is essential in many parts around the world from the aspects of both sustainable water supply and public health. In a remote rural area, rainwater harvesting can be the important or the sole supplementary source where the supply of clean drinking water is limited. However, rainwater can be contaminated by following contact with the catchment surface and could be potential public health risks associated with microbiological and pathogens. Sodium hypochlorite solution NaOCl was used as antimicrobial and for disinfection purposes with a specific dosage to eliminate the microbial contamination. Rainwater samples were collected two times a week from the main storage tank of WASRA harvesting system for six months' period of time and all rainwater were examined in the environmental laboratory of the Universiti of Malaysia Pahang. The efficiency of sodium hypochlorite solution NaOCl concentration and optimum dosage for disinfection was 3.5 mg/L which was added to rainwater harvesting system to maintain free chlorine residuals not more than 2.0 mg/L after one hour of sodium hypochlorite addition and not less than 0.2 mg/L after 24 hours' of storage within the approved standard limits of World Health Organization WHO and Center for Disease Control Prevention CDC.

Back ground of the study

- This Study took place in a rural area of Gambang, Pahang state south east coast of Malaysia.
- Malaysia is a tropical country and receiving an average annual rainfall of 2500 mm.
- Rainfall considered one of the main water resources especially in remote rural areas.

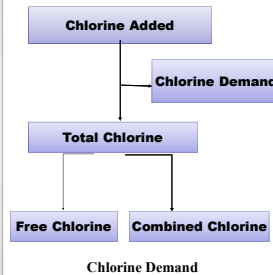


Objectives

- To determine the optimum dose of sodium hypochlorite in a project area
- To monitor and evaluate the rainwater harvesting system by testing the household water
- To improve the quality of harvested rainwater projects in far rural areas and maintain an access to alternative safe clean drinking for people during floods and emergencies according to WHO, EPA and CDC.

Materials and Methods

Water samples were dosed with sodium hypochlorite solution of 15% concentration after dilution at Laboratory and the water samples were dosed with 1.5, 2.5, 3.5 and 4 mg/L respectively to 1 Liter of rainwater sample. FAC and TC were measured by using APHA DPD 4500-Cl G) approved method. FAC residuals were measured for a certain time period (0.5, 2, 4, 8 and 24 hours) to obtain the optimum dose according to SWS and CDC and within range of no more 2 mg/L after 30 minutes contact time and not less than 0.2 mg/L after 24 hours contact time. Also chlorine demand was satisfied first.



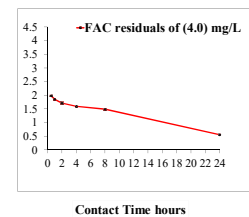
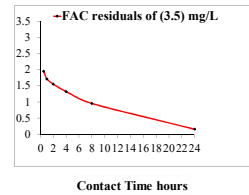
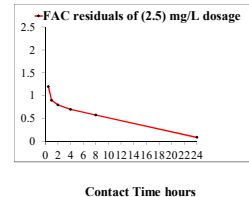
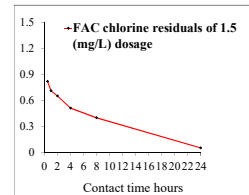
pH, Turbidity, TDS, Temperature, Alkalinity Nitrogen ammonia were measures as part of water quality Parameter by using APHA Standard Methods.

Results

Descriptive Analysis of Rainwater

Parameters	Mean	ST. Dev.	Min.	Max.
Temp.	26.632	2.054	22.3	33.2
pH	6.015	0.6774	4.580	7.190
Total Alkalinity (CaCO ₃ mg/L)	10.495	2.311	6.0	17
Turbidity(NTU)	1.226	0.415	0.610	2.10
TDS (mg/L)	42.382	3.481	35.30	48.30
NH ₃ -N (mg/L)	0.090	0.988	0.000	0.500

FAC Residuals Results



Conclusion

The Optimum dosage for Rainwater harvesting system was conducted at 3.5 mg/L within the recommendation for SWS program and CDC as it met the requirements of not less than 0.2 mg/L after 24 hours contacting time and not more than 2.0 mg/L after 30 minutes to make sure that the test and odor is acceptable for the consumers.

Recommendations

- For health safety, the harvested rainwater should be treated with optimum chlorination dosage prior to use for drinking purpose.
- Increasing the size of rainwater harvesting tank in WASRA system up to 5000 L capacity.
- To improve the quality of harvested rainwater system, a screen wire mesh should be installed over to avoid any blocking into the gutters.
- Health extension community workers should be training on maintaining good sanitary conditions of harvested rainwater.

Future Work

- Further future investigation studies should be carried out to assess the quality of harvested rainwater.
- Risk assessment studies more needed on these type of waters as they are uncommon and specific knowledge regarding contamination and how to improve the design and collection of rainwater system.
- More studies should be applied regarding the chlorination for rainwater harvesting systems, the needed concentration and dosage to be applied and more awareness should be separated between local people in remote rural areas about how to use the sodium hypochlorite solution for disinfection of harvested rainwater systems to be used as an alternative safe drinking water source and especially in natural common disasters and during floods in Malaysia.

Acknowledgments

The work presented in this study would not have been completed without assistance of my
 ➢ Supervisor Mr. Abd Syukor Abd. Razak
 ➢ My Co. Super Visor Dr. Nurul Islam Siddique
 ➢ Madam Suryati Sulaiman
 ➢ The staff laboratory of Universiti of Malaysia Pahang.

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