



Testing The Effectiveness Of Media Thickness For Filtering Dried Tofu Dreggs In Decreasing Iron (Fe) Levels In Groundwater

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Abstract

Water is a natural resource that has a crucial function for the life of all living things. One of the waters used by humans is groundwater which contains many natural minerals needed for life, but if excessive, it can cause negative impacts, for example, iron (Fe). The presence of high iron (Fe) in groundwater can cause problems, such as polluting tubs, sinks, toilets, corrosiveness to pipes that result in petrification, color, odor and taste and cause health problems.

This research is an experimental study to know the effectiveness of the thickness of the dry tofu dreggs filter media in reducing iron (Fe) levels in groundwater. This research was conducted in South Tangerang City, Banten, Indonesia. The water sample was 35 liters from an electric pump well, which was treated with the filtration-adsorption method using dry tofu dreggs filter media with variations in the thickness of 0 cm (control), 30 cm, 45 cm, and 60 cm and contact time for 120 minutes. With a flow rate of 100 ml in

7 minutes. Then 4 treatments were carried out with 3 repetitions in each treatment.

The study results on the content of iron (Fe) in groundwater and iron (Fe) before processing by a filtration-adsorption method using dry tofu dreggs filter media was 3.05 mg/l. The top iron (Fe) level allowed for clean water quality requirements is 1.0 mg/l.

Of the four treatments, the thickness of the dry tofu dreggs filter media was the most effective in reducing iron (Fe) levels, namely at a thickness of 45 cm. The ones with low thickness reduced iron levels below the maximum allowable standard with an average yield of 0.83 mg. /l.

Therefore, traders must pay attention to environmental sanitation, especially to carry out proper washing techniques based on regulations Minister of Health of the Republic of Indonesia No. 1096 of 2011 concerning food service sanitation hygiene.

Keywords: Clean Water: Tofu Dreggs: Iron: Effectiveness: Quick Sand Filter

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Introduction

Water is a natural resource that has an essential function for the life of all living things. One of the waters used by humans is groundwater. Lots of groundwater contains natural minerals needed for life, but excessive use can cause negative impacts (Gao et al.,2018). One of the natural minerals in groundwater is iron (Fe) (Lyu et al.,2020).

The presence of high iron (Fe) in groundwater can cause problems (Arisanty et al.,2020). The concentration of dissolved iron (Fe) in water that exceeds the quality standard limits will cause issues such as technical problems (contaminating tubs, sinks, toilets, corrosiveness in pipes that cause petrification) and physical disturbances (appearance of color, odor, and taste) as well as causing health problems (damage the intestinal wall, irritate the eyes and skin) (Aleksandrova & Timofeeva, 2021).

Some Villa Mutiara Serpong Housing residents, South Tangerang City, use groundwater (bore wells) for their daily needs. Physically the water is cloudy, yellowish, smells of rust, and produces a precipitate if allowed to stand, and the water also used over time leaves brownish stains on the floor, equipment, and makes white clothes turn yellow. After laboratory tests, the results showed that the groundwater contained iron (Fe) levels of 3.05 mg/l, which means that the levels of ferrous metal (Fe) in the groundwater did not meet the existing requirements.

Based on the description above, efforts can be made to improve groundwater quality containing iron (Fe) into clean water. Several methods that can be used to reduce iron (Fe) levels in groundwater include coagulation, sedimentation, adsorption, and filtration (li et al.,2019). Of these



methods, the most commonly used is the filtration-adsorption method. In addition to obtaining maximum results in reducing iron (Fe) levels, the advantages of this method are also able to provide alternative filtering models that can be carried out by the community (Chiavola et al.,2019). And also, the materials used as filter media or adsorbents can be obtained quickly and cheaply (Braniwati & Priyambodo, 2021).

The tofu processing industry produces a by-product of solid waste (tofu dregs) and liquid waste (Widayat et al.,2019). Utilization of tofu dregs can be used as an absorbent because tofu dregs still contain high enough protein, which has absorption of amino acids (Hieu et al.,2021). Other innovations in using tofu dregs are an adsorbent that can be used as filter media infiltration (Pangestu et al.,2020).

In addition, based on surveys and preliminary tests, the price of wet tofu dregs is relatively low, namely 3,000 rupiah/kg, and to dry 4 kg of damp tofu dregs takes 14 hours at a temperature of 250°C, which produces 800 grams of dry tofu dregs (Indah et al.,2021). And the use of dry tofu dregs as an adsorbent can be used by people who have problems with clean water containing high levels of iron (Fe) (Wikandari et al.,2021).

Based on this description, the authors are interested in researching the effectiveness of the thickness of dry tofu dregs filter media in reducing iron (Fe) levels in groundwater at Villa Mutiara Serpong Housing in South Tangerang City



Methods

This research is an experimental study (Kot & Rajiani, 2020) to know the effectiveness of the thickness of the dry tofu dregs filter media in reducing iron (Fe) levels. This research was conducted in South Tangerang City, Banten. The water sample was 35 liters from an electric pump well, which was treated with the filtration-adsorption method using dry tofu dregs filter media with variations in the thickness of 0 cm (control), 30 cm, 45 cm, and 60 cm and contact time for 120 minutes. With a flow rate of 100 ml in 7 minutes. Then 4 treatments were carried out with 3 repetitions in each treatment.

Results and Discussion

The effectiveness of variation in thickness of dry tofu dregs filter media in reducing iron (fe) levels in groundwater is presented in Table 1.

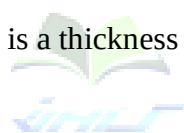
Table 1. Media Thickness and Iron Content

No.	Dried Tofu Dregs Thickness Variation (cm)	Iron (Fe) Content After Treatment (mg/l)	Quality Standards	Effective/Ineffec tive
1	Control	2.04	1 mg/l (Ministry of Health Regulation No. 32 of 2017)	Ineffective
2	30	1.02		Ineffective
3	45	0.83		Effective
4	60	0.72		Effective



Based on the table above, the results show that the thickness of 45 cm and 60 cm is declared effective for reducing iron (Fe) levels compared to PERMENKES (2017) concerning Environmental Health Quality Standards and Health Requirements Sanitary Hygiene.

Based on the results of the study, the average level of iron (Fe) in groundwater after treatment with the control was 2.04 mg/l, the thickness of 30 cm was 1.02 mg/l, the thickness of 45 cm was 0.83 mg/l, and thickness of 60 cm is 0.72 mg/l. From these results, it can be said that the effective thickness of dry tofu dregs filter media is 45 cm thick and 60 cm thick, because it can reduce iron (Fe) levels in groundwater to meet the standards set (PERMENKES RI No. 32 /2017) concerning Environmental Health Quality Standards and Health Requirements for Sanitary Hygiene Needs, Solus Per Aqua, Swimming Pools, and Public Baths for the maximum permissible iron (Fe) content of 1.0 mg/l. It can be concluded that the most effective use of dry tofu dregs filter media is a thickness of 45 cm.



Conclusion and Recommendation

Using dried tofu dregs filter media reduced iron (Fe) content in water with the lowest average decrease at 30 cm thickness of 1.02 mg/l while the highest at 60 cm thickness was 0.72 mg/l.

Using the same discharge and contact time, the lowest percentage reduction in iron (Fe) content in groundwater at a thickness of 30 cm was 66.56%, while the highest was at a thickness of 60 cm at 76.39%. However, with a contact time of 120 minutes, the color of the water changed to brownish. The statistical tests showed differences in the decrease in iron (Fe) levels in groundwater in each variation of the thickness of the dry tofu dregs filter media (30 cm, 45 cm, and 60 cm) after treatment.



The thickness of the dry tofu dregs filter media, which was most effective in reducing iron (Fe) levels in groundwater, was 45 cm thick.

Further research is needed regarding the quality of the physical parameters of the filtered sample water including color, odor, and taste with a maximum research contact time of 120 minutes.

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