ION EXCHANGE FILTER MEDIA CAPABILITIES REDUCE LEVEL OF NITRATE DUG WELL WATER COASTAL AREA REGIONAL

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ABSTRACT

Ion Exchange Filter Media Capabilities in Well Water Nitrate Levels Lowering Gali in the Areas of the Coastal Zone. Nitrogen compounds in small quantities does not cause interference, whereas in high levels can cause illness and even death. It also can cause methoemoglobinaemia baby through foods containing nitrates come mainly water wells that have not memenuhin conditions. Filtration technology with ion exchange media to reduce the content of nitrogen contained in the community dug well waterThis study aims to determine the ability of ion exchange filtration in lowering the levels of nitrate (NO_3) in water wells coastal areas. This research is Praexpriment with Pretest-Posttest Design that begins with a literature review, preliminary studies and research core that is making filtration apparatus with zeolite filter media as ion exchangers. Data on laboratory results were analyzed descriptively explained in the form of tables, graphs and narrative that describes the overall process that occurred during the research. Based on the research that the ion exchange filter media for reducing levels of flat-ratanitrat(NO_3) water wellsfrom initial levels of 16.43 mg / l to 5.67 mg / l with efficiency decreased by 10.77 mg / l (65.52%). The result of this processing is compliant with the appropriate standardsMinister of Health Regulation No. 32 year of 2017 about Clean of the Water of nitrate levels (NO_3) as maximum that is allowed is respectively 10 mg/L and Nitrite (NO_2) is respectively 1 mg/L.

Keywords : Filtration, ion exchange, zeolites, activated carbon, nitrate (NO_3).

INTRODUCTION

Clean water is a basic human need that has direct impact to physical, social and economic masyarakat. From now, a half of civitation yet covered by water services, especially in rural areas of fishermen, is still done by the community itself. With the rapid population growth and development of the region, the necessary efforts to accelerate the development of infrastructure and water facilities to improve the level of services is still low.

The coastal area is an area with huge potential to be developed starting from the fisheries sector, small businesses and medium ranging from household industry in the form of food and fodder, fishing nets and even shipping, field service, transportation and even tourism. Seeing the economic potential is so great that the coastal region is expected into the buffer zones for the centers of activity. For that support public facilities ranging from electricity, road and river transport and marine, telecommunications, housing, health, and which is also very important is clean water facilities.

Well water contamination by human activities have an impact on some parameter dinataranya contamination contamination by organic material by causing ammonia and hydrogen sulfide increases. Ammonia dissolves in water and forms ammonium compounds which tend to bind oxygen. With the microbes Nitrosomonas ammonium compounds and oxygen to form compounds nitrite-NO_2 and in the presence of microbes *Nitrobacter* to form compounds Nitrate (NO_3).

Cycle existence Nitrate (NO_3) in the wells used by the people of the coastal region begins with the entry of nitrogen and ammonia from domestic and industrial effluent into water bodies. Organic nitrogen undergo hydrolysis reaction produces ammonia which is a bacterial food source of nitrogen. The oxidation process then occurs by bacteria Nitrosomonas, converting ammonia to nitrite and then bacteria Nitrobacter oxidize nitrite to nitrate (NO_3).

Once nitrite is formed, further oxidized to nitrate (NO_3) by the *Nitrobacter* species of bacteria, it is commonly known as nitrification. Furthermore, in a state of low dissolved oxygen concentration to reducing nitrate (NO_3) to nitrite followed by further reduction of ammonia and nitrite to nitrogen gas.

The reaction -reaksi provide oxygen for the microorganisms used in the organic material without disrupting the balance of dissolved oxygen available. In the state actually anaerobic nitrification reaction can not take place. It is proved that the reduction of nitrate (NO_3) can be increased in the low dissolved oxygen conditions (0 to 2 mg / l) from *Aswadi, 2006*. Effect of nitrite on human health that can cause toxic effects

methamoglobinemia and nitrite content in water is greater than 0 (zero) mg / l from *Soeparman, 2001.*

Nitrate (NO_3) and nitrite (NO_2) is a natural inorganic ions, which is part of the nitrogen cycle. Microbial activity in the soil or water down any organic waste organic nitrogen-containing first-first into ammonia, then oxidized to nitrite and nitrate (NO_3). Therefore can be easily oxidized nitrite into nitrate (NO_3), then the compound most commonly found in underground water and water contained in the surface by the NO_3. Nitrogen compounds in small quantities does not cause interference, whereas in high levels can cause illness and even death. It also can cause methoemoglobinaemia in young infants, especially given food mixed with water containing nitrate / nitrite (mainly sourced well water).

A reality in society, water quality problems are often encountered that allows people less qualified as healthy drinking water. Drinking water sources are often polluted by industrial waste containing nitrates, nitrites, and ammonia. Another source is from agricultural waste clams excessive use of fertilizers. Therefore, according to Minister of Health Regulation No. 32 of 2017 established that the levels of nitrate and nitrite maximum allowed in the clean of water are respectively 10 mg / L and 1 mg / L.

By looking at the effects caused by the levels of nitrate (NO_3) in water wells used by the community in littoral region, then the chances of the occurrence or risk of poisoning nitrate (NO_3) in infants exposed through breast-feeding mothers. For his efforts in reducing and minimizing the parameter levels Nitrate (NO_3) for the dug area of coastal and island to do one through the method by ion exchange (ion exchange).

Based on the survey of environmental health ever conducted area coastal region that is the island Sappuli in the district of Pangkep, it was shown and the condition of society that still use a source of clean water from wells that no island that, while the results of interviews with the community around is known that most of society still the use of water wells as a source of clean water to meet the needs bath wash rinse and so as for the purposes of drinking water supply through the course with a previous heating as well as to be used for washing rice, vegetables, and other foods.

Activities clean water supply and drinking water existing in everyday society of coastal areas considered highly potential as a route of entry (port de entry) levels of nitrate (NO_3) nitrogen into the human body. Laundering and compliance with drinking water if it is not received prior efforts certainly ekan memeberi pengelohan serious effect kejadiankeracunan (blue baby disease) primarily to human nitrite vulnerable in this case of mothers and infants.

As a preventive measure to minimize or avoid the incident then peneliti Attempting applied technology as an alternative in reducing the levels of nitrate (NO_3) in water wells that area of the coast dnatural minimize the risk of occurrence of blue baby disease in the mother and child. Besides the processing is expected to meet the effluent quality standards and safe course is accepted by the body of water and is environmentally friendly.

In an effort to address the problem, have a variety of ways and removal technology that can be created, developed and implemented in accordance with the conditions of the existing problems and social culture. In this guide will be presented several technology removal of nitrogen compounds, especially nitrates, As for the development of skills in this research, it will be chosen for the two technologies in the form of making available system processing equipment household water that can eliminate or reduce the content of nitrogen contained in water wells, water groundwater and surface water. The technology is ion exchange.

RESEARCH METHODS

This research is praexperiment which serves to determine the reduced levels of nitrate (NO_3) by the method of ion exchange water wells area coastal region. The study was conducted at the Laboratory of Applied and Environmental Engineering Polytechnic of Makassar Health Department Environmental Health. Sampling sites are in some water wells are located in the village of Mattiro Baji Sappuli island district of Pangkep.

Processing **water wells**has done by stage shelter on the vessel so that further drainage reservoir on the filter media and

subsequently further ion exchange media flow in the multimedia filter tank. The water sampling wells before processing a total of three samples and after treatment subsequent processing as much as three samples examined in the laboratory.

Table 1.
Equipment and Materials Research

No.	Equipment / Materials	Unit	total
1	Reservoir	piece	
2	6-inch PVC filter tube	rod	
4	½ inch PVC pipe	rod	
5	Quartz sand	kg	
6	Ion exchange media (ze	kg	
7	anion / cation)	kg	
8	Activated carbon	piece	
9	filter matt	piece	
10	+ Filter cartridge tube	piece	
11	beams	piece	
12	Nail	piece	
13	stop Kran	piece	
	Sock ½ inch (Tee, Elbo straight)		

Methods of this process begins with the extraction of water wells and then inserted into tubs equalization subsequently flowed up flow (flow direction from the bottom up), on penagliran this water will be dug will be screened by a layer of quartz will then undergo a process of ion exchange (ion exchange) in the layer zeolite filter media with a thickness and drainage adjusted in units of ml / sec. Furthermore, the dug well water creeping into activated carbon layer to undergo a process of adsorption neutralize the smell taste and color of the final stage next water through the cartridge filter as processing to purify the treated water.

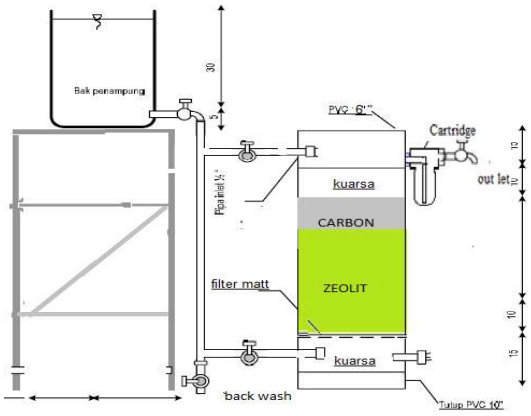

Figure 1. Dug Well Water Treatment Design Method Ion Exchangers

Data were obtained from observations and laboratory tests before and after treatment for 3 times (replication) were analyzed descriptively equipped with tables, graphs and narrative that describes the whole of the processing in reducing parameter Nitrate (NO_3). To find out how big the reduction efficiency is calculated by the following formula:

$$\text{Elimination} = \frac{\overline{X}\ before\ treatment - \overline{X}\ After\ treatment}{Xbefore\ treatment} \text{ x } 100\%$$

RESULTS

Quality of Nitrate (NO_3) Water Well Drilling

Water quality analysis results and dig well studied through preliminary investigation before and after treatment with ion exchange filtration, processed products examined in laboratory with the following results:

Table 2. Levels Examination nitrate (NO 3) Water Well Drilling

No.	Quality Nitrate (NO3)		reduction (mg/l)	Percentage (%)
	Before (mg/l)	After (mg/l)		
1.	16.6	5.8	10.8	65.06
2.	16.5	5.6	10.9	66.06
3.	16.2	5.6	10.6	65.43
Average	*16.43*	*5.67*	*10.77*	*65.52*

Berdaskan table above test results showed levels of nitrate (NO 3) with an average initial levels of 16.43 mg / l with -rata Average levels after treatment for 5.67 mg / l with an average decrease of 10.77 mg / l or decreased with the percentage of 65, 52%. Water Quality Gumur Gali after processing meets the requirements, in accordance meet clean water requirements by Permenkes 416/1990 is 10 mg / L. The result of the decline can be seen in the following figure.

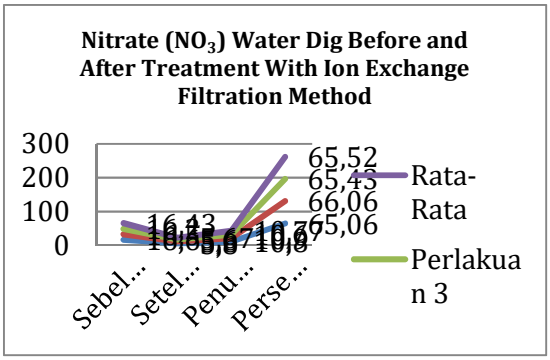

Figure 2. Condition Levels DeclineNitrate (NO3) Air Gumur Gali Before and After Treatment With filtration method Ion Exchange Makassar Year 2017

Based on the graph above it can be seen that the treatment method used has the capability to reduce levels Nitrate (NO_3) Water in dig well although terms of requirements not met the requirements.

DISCUSSION

This research was conducted sabagai one effort in adopting appropriate technologies for community and solutions in dealing with problems of environmental health especially for conditions of environmental pollution due to human activity on the environment. Through this research is expected to be an alternative application of technology in order to maintain the environmental balance conditions and the availability of alternative solutions at the same time, clean water used by society in the area of coastal region. In anticipation dearth of clean water sources in the community it can be said the achievements or targets are still required to obtain a more serious concern. Therefore, efforts should be accompanied by the implementation of proven methods so as to give an optimal and sustainable results,

Efforts to implementation of a technology must be able to answer the issues and problems faced by the system based on the rules and regulations governing public health, especially the analysis and environmental quality standards related to particular water-quality monitoring.

The existence of levels Nitrate (NO_3) at Dug Well Water Used in Public

Based on observations at the study site dug well known conditions with the characteristics of brackish water or slightly salty and strongly influenced by sea water intrusion at the time of the tides and the seasons. The land area that makes a coastal region or island has the characteristics and conditions that couples affected by sea water.

Conditions dug wells still considered not qualify the ring wells that have not been fully watertight and menhana water seepage, the well wall and floor sumuryang sebaian are already cracked so that a factor of contamination the environment, in addition to the distance dug by sewerage and household waste not handled properly, this condition is a factor contaminant on the quality of water wells used by the local society to meet the needs of clean water or drinking water through the washing process groceries and vegetables to be consumed by the public.

The content of nitrate in water wells are inspected is below standard, but in the presence of high nitrate levels in wells may indicate the presence of contaminants that the reform process of nitrogen by microorganisms. Nitrate (NO3) is a natural inorganic ions, which is part of the nitrogen cycle. Microbial activity in the soil or water containing garbage decompose organic nitrogen first into ammonia, then oxidized to nitrate, the nitrate is a compound that constantly found in underground water and water contained in the surface.

It is very dangerous when nitrate is consumed by infants and will cause acute poisoning. Baby a few months old who have not had a good balance between the intestine and the intestinal bacteria. As a result, nitrates entering the digestive tract will be directly converted into nitrites which then binds with hemoglobin to form methemoglobin formed in the body they will lead to the emergence of cyanosis in infants. Nitrates are consumed by infants at 3 months of age will bring turn into nitrates are dangerous, because it will inhibit blood nitrate releases oxygen cell to cell of the body. Once nitrates enter the circulatory system, the patient may experience a lack of oxygen in the body.

Consumptions water containing high nitrate by pregnant women and breastfeeding mothers who do not like when the baby was consumed immediately. In this case is not very clear, for it is only recommended for women who are pregnant

and while breastfeeding in order to reduce the possibility of consuming water containing nitrate.

Ion Exchange Ability filtration method in Lowering levels of nitrate (NO_3) in Water Well Drilling

The decrease in levels nitrate (NO_3) water wells that have been through the treatment stage from our preliminary composed of medium sand that serves as a separator of particle-solid particles and cause turbidity then the water running through it up flow to the filter medium zeolite cations that serves as an ion exchanger (ion exchange). Water of dig well the characteristics of the negatively charged ions (anions) which is a zeolite adsorbent. Zeolites have a porous structure that is very open and has a vast internal surface area so as to adsorb a large amount of particles other than water. Decreased levelsnitrate (NO_3) This is due to the higher packing material used causes the pH of the treated water wells towards neutral, because the nature of the zeolite-like limestone. At a certain point allowancenitrate (NO_3) not too significant. This is because the zeolite used is experiencing saturation, adding zeolite altitude cause greater volume, the addition of this volume does cause clots adsorbent so that the surface of the adsorbent is not entirely open. This causes a reduction in the active surface area of the adsorbent so that the process of adsorption (*Afrianita et al, 2010)*. In the adsorption process, and the contaminant particle size affects the ability of allowance *(Reri Afrianita Watson, et al, 2010)*. It is reducing its absorption capacitynitrate (NO_3), In addition, Watson also explained that selectivity media in the designated pollutants will be reduced if there are a lot of components that want to set aside. One character is from the establishment of the framework zeolite molecular structure of the molecule merger - tetrahedral molecules forming a gap to gap and regular channels, causing their porous structure that allows a molecule to pass through or trapped in the crystal structure.

The allowance due to ion parameters nitrate (NO3) the dug well water passing through or trapped in the crystalline structure of zeolites thus enabling ion exchange evenly before treated water with diverter system down flow to media active carbon which serves as an adsorbent and absorb organic content that can menyabkan nuisance odor, taste and color of the water processed.

The screening process on activated carbon media layer is the adsorption process which is a collection of materials on the surface between the two phases. Most ingredients are dissolved in the liquid will accumulate, and the adsorption process to take advantage of this event to remove material from the liquid phase. Some adsorbents (absorbent materials) used in industry, but only one, activated carbon, which has two advantages, namely in addition to cost price also is nonpolar adsorbent. While the polar adsorbent is attracting water and therefore not very useful.

The process of accumulation on the surface of a solid material which is a layer of molecules of the dissolved substance can take place because of their forces on the solid surface material that is not balanced.

The filtration process is done by pumping raw water catchment basins, which then flowed into the activated carbon filter to remove substances ammonium and other nitrogen-containing materials. Then the water flows into the filter cartridge to remove dissolved solids > 5 microns. The water coming out of the cartridge is already clear. After the activated carbon filter reaches optimum capacity, it should do the washing (backwashing) means sver the ongoing process of activated carbon adsorption capacity for the longer dwindle and eventually become saturated and must be replaced with a new activated carbon activated carbon long life depends on the quality of raw water and the amount of water to be filtered. Under normal circumstances, the replacement is usually once or twice a year.

As the final stage of processing is the use of filter cartridge that serves to improve clarity or reduce the levels of turbidity and solids in the treated water, resulting from the processed water dig well obtained kulitas water physical ie, smell, taste and color better than without this treatment.

By the filtration treatment method with ion exchange media (ion exchange) dug well water nitrate levels decreased by 10.77 mg / l with a percentage of the ability of (65.52%). The method ion-exchange filtration has the ability to lower the concentrationnitrate (NO_3) in water wells. This may be an effort in

the prevention of the consumption of water wells with nitrate (NO_3) high can lead nitrate (NO_3) methemoglobinemia in infants and will give the negative effect is the inhibition of oxygen transport in the blood, in large quantities can cause blood mixed diarrhea, followed by convulsions, coma, and if not helped to die. Chronic poisoning can cause depression, headaches.

Nitrate reducing bacteria in the gut of humans or animals will convert nitrates into nitrites. The nitrite oxidizes hemoglobin in the blood becomes methenoglobin which can not bind oxygen. Although nitrite is the cause of problems in the human body, but because it is very rarely found in food and water, the standard is based on the nitrate that can be found in food, water as well as on vegetable leaves and spinach.

Methemoglobin is hemoglobin in which the Fe ion is converted to Fe ion other and its ability to transport oxygen has been reduced and causes blood to become brown. Methemoglobin may occur when exposed to oxidants including nitrates hemoglobin. Actually normal human blood containing methemoglobin at a concentration of no more than 2% but if methemoglobin increased to be 10% until 20% will result in the ability of blood to carry oxygen became very disturbed. Blood contains a high methemoglobin called methemoglobinemia with symptoms of body blue (cyanosis), shortness of breath, nausea and vomiting and shock. Death can occur if levels of methemoglobin reached 70%. *(Silalahi in Henni, 2009).*

CONCLUSION

As the purpose of this research is to determine the ability ion exchange filter media to reduce levels nitrate (NO_3) water wells research it can be concluded as follows;

1. Content of Nitrate (NO_3) initial average water wells is 16.43 mg / l.
2. Ion exchange filter media able to reduce levels nitrate (NO_3) water wells be 5.67 mg / l with a decrease of 10.77 mg / l (65.52%).

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