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Removal of soluble impurities from water by charcoal powder of coconut shell

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ABSTRACT

Main characteristic of ground water sources in Maharashtra is hardness. In this case water sample from sangli (ashta) used. This hardness produces bad/adverse effects on water pipes, boilers and soap consumption therefore several methods have been used to remove the hardness from hard water .one of the recent trends in this regard is to convert soluble impurities into insoluble impurities. Hardness can be removed from hard water by using calcium carbonate crystalline water reactor. The chemistry of water softening process is essentially the same as conventional softening process instead of precipitation of calcium carbonate which does not have any useful consumption And must be removed once in a while somehow crystallization process .in this process reactor produces pure solid grain of calcium impurities. in this process generally the water is taking in reactor 30 l/hr and water hardness ranging from 100-500 ppm with the additional of caustic soda and lime, lime milk was fed to system, in this process the filter bed is made from charcoal of coconut of shell which plays significant roll .the formation of white crystals on the surface charcoal represent the reduction of hardness.

Key Words: Hardness, Soluble-insoluble impurities, coconut shell charcoal powder

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INTRODUCTION

One of the chemical characteristics of water is Hardness which having a cation concentration of some metals in the water sample. The cations in the water can precipitate as a hard scale. The metal cations concentration sensitive to temperature and can precipitate easily. They are temporary hardness

Reactions

1) $Ca(HCO_3)_2$ (Soluble) $\rightarrow$ $CaCO_3 + CO_2 + H_2O$ (insoluble)

2) $Mg(HCO_3)_2$ (Soluble) $\rightarrow$ $MgCO_3 + CO_2 + H_2O$ (insoluble)

In Maharashtra(India) calcium and magnesium are found in natural water most often in this calcium percentage is two time greater than magnesium in sangli district the hardness of underground water is near about 300-400 ppm due to this there is a problem occurring of salty soil (4) .water containing different type of impurities like Fe ,Mn ,Mg ,P ,F they are contribute to hardness there several physical and chemical methods are used to remove hardness such as hot lime , ion exchange reverse osmosis all of methods having some advantage and disadvantages . all the above methods requires filter. If we use filter made from powder of charcoal of coconut shell reduces additional 10-

15 % hardness (3). In this in summer the soil shows the white color which shows the amount calcium carbonate is high, due to this reason the recent water reactor with charcoal of coconut shell is used .

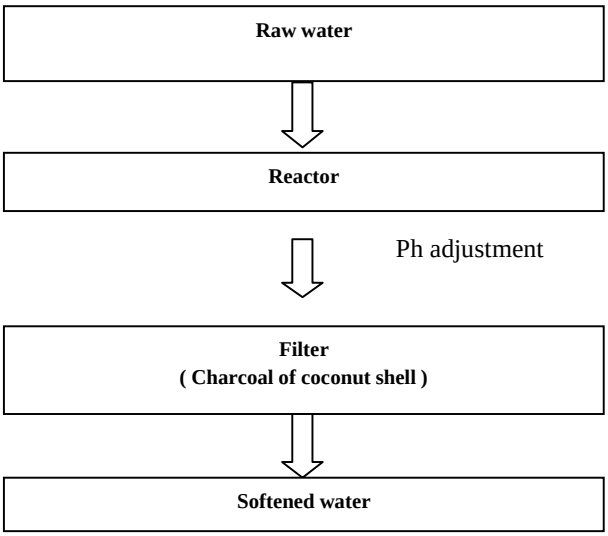
One of the new innovation in treatment of hard water is application of reactor with filter made from powder of charcoal of coconut shell(2). The another beneficial point of this process it reduces sulphate concentration, it also reduces another cations as Fe, Mn, Mg, P

MATERIALS AND METHODS

The reactor is down flow stream was selected the area of reactor is diameter 3 cm, height 275 cm, volume 0.75 lit is a uniform distribution of reactor . in reactor there are hinders which acts as stirrer.

Characteristics of Filter:
Diameter of 30 cm, height 250 cm volume 95 lit is water reactor is a cylindrical shape that is packed with suitable materials such as sand. There is another cylindrical shape filter bed which made up from small charcoal powder of coconut shell which is arranged in different size layer.

Fig. (a) represents a flow diagram



The caco3 was produced around charcoal of coconut shell. the softening run in different phases addition of $Ca(OH)_2$, addition of Na_2CO_3& addition of both & finally water was passed through filter of charcoal of coconut shell .

The soluble metallic soluble ions can be convert into insoluble ions which are found on filter upper layer.

The chemical reaction take place for hardness removed

For temporary hardness

1) $Ca(HCO_3)_2 \rightarrow CaCO_3 + CO_2 + H_2O$
Soluble insoluble

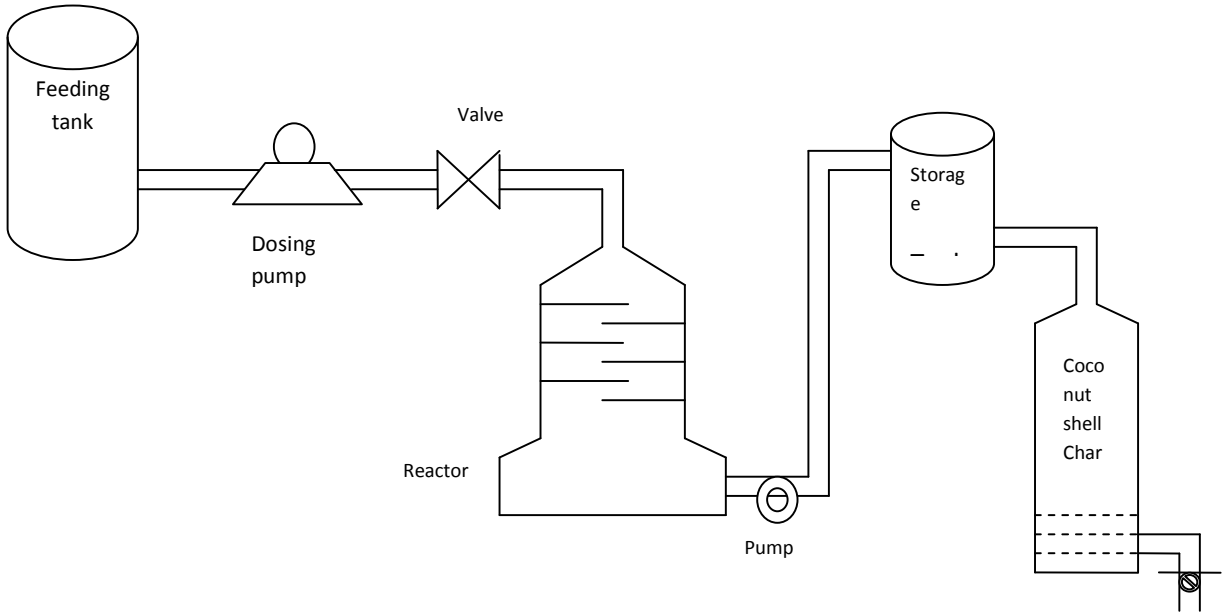
2) $Mg(HCO_3)_2 \rightarrow MgCO_3 + CO_2 + H_2O$
Soluble insoluble

For permanent hardness

1) Na_2CO_3+ $CaCl_2$ ⟹ $CaCO_3$ + 2NaCl
Soluble insoluble

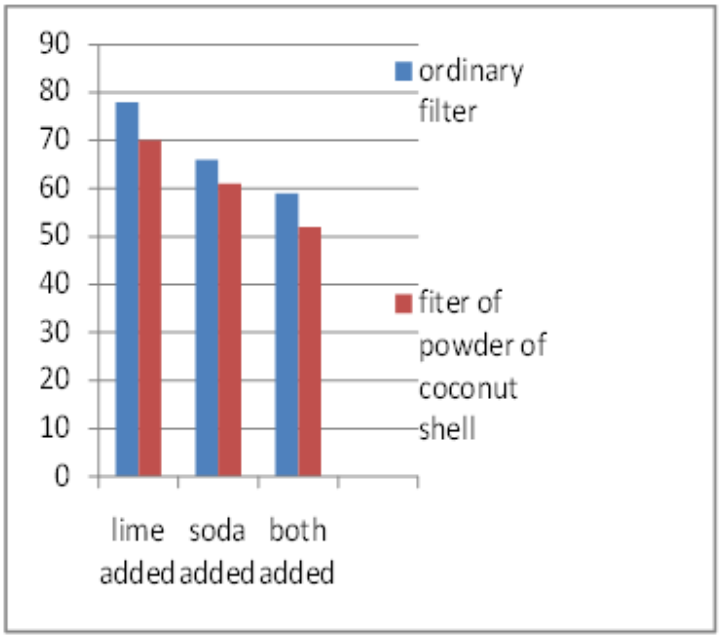
2) Na_2CO_3+ $CaCl_2$ ⟹ $CaCO_3$+Na_2SO_4
Soluble insoluble

DIAGRAM

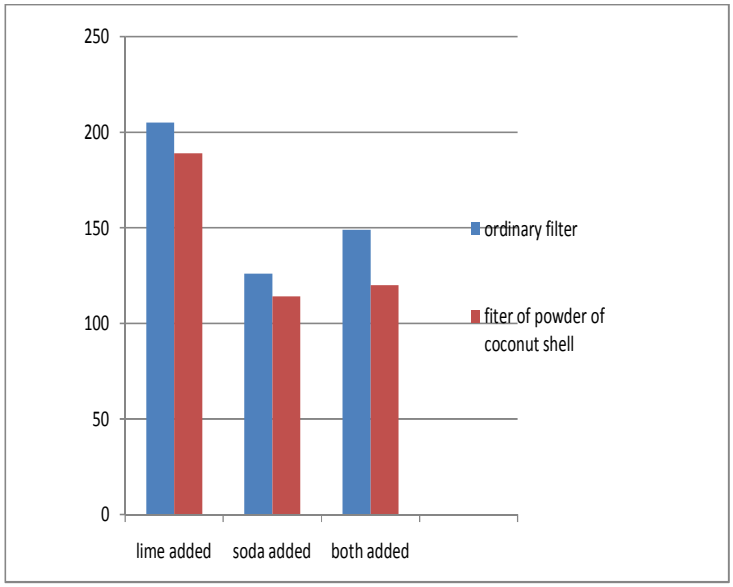


RESULTS

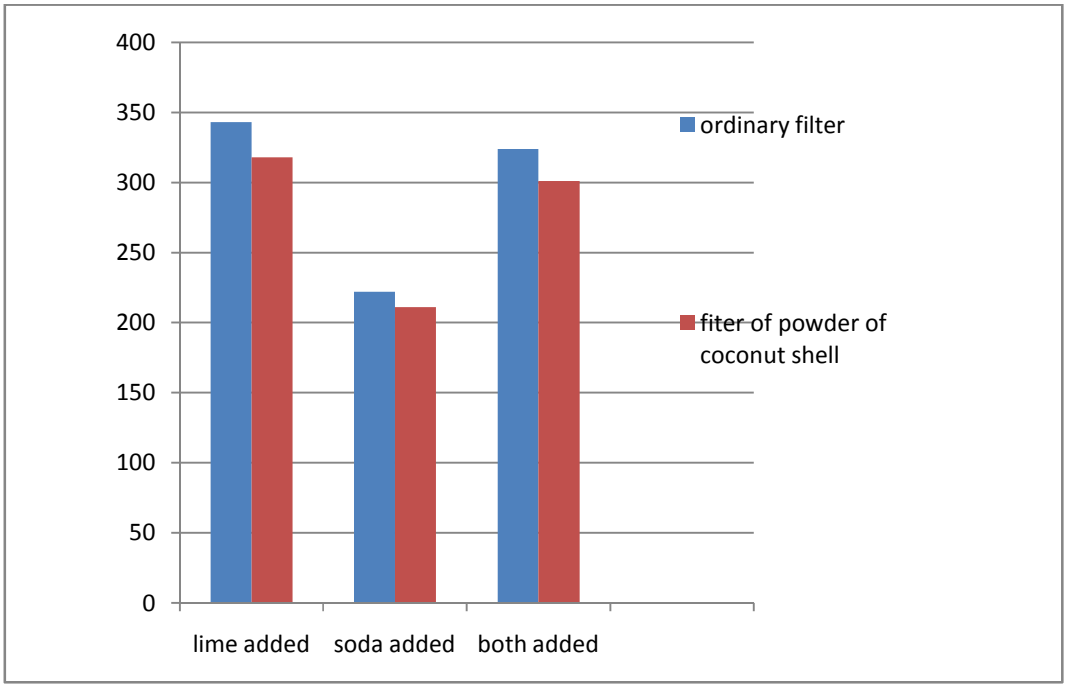
Fig (c) represents the effect of chemical addition on total hardness removed by reactor passing through ordinary filter bed & charcoal of coconut shell bed the raw water have concentration of 180 ppm $CaCO_3$, for each step individual addition of chemical Na_2CO_3, $CaOH_2$ & both of them passes through different filter bed. Fig (D) represents the raw water had fed to reactor with concentration of 250 ppm $CaCo_3$ then each step , lime milk , caustic soda and both of these chemicals were added to the reactor for hardness removal Fig (E) represents the raw water had fed to reactor with concentration of 400 ppm $CaCO_3$ then each step , lime milk , caustic soda and both of these chemicals were added to the reactor for hardness removal . Then finally water is passed throw two different filter bed 1) sand bed 2) charcoal of coconut shell. In above procedure hardness of successfully reduced in each step to different level. Formation of white calcium carbonate crystals on the surface of filter bed confirms removal of hardness.



dia.(c) effect of filter and chemical addition on total hardness removal Total hardness 180 ppm , 30 l/hr



dia.(D) effect of filter and chemical addition on total hardness removal Total hardness 250 ppm , 30 l/hr



dia.(E) effect of filter and chemical addition on total hardness removal Total hardness 400 ppm , 30 l/hr

DISSCUSSION AND CONCLUSION

In the result the removal of hardness with influent concentration of 180, 250,400 ppm as caco3. About 50 % of hardness is removed by reactor & about 10-15 additional hardness removed by using charcoal of coconut shell.thr capacity of removes hardness from water is independent on hardness concentration.

Therefore the addition of both $Ca(OH)_2$ or Na_2CO_3 have no any significant difference with compare to $Ca(OH)_2$ or Na_2CO_3 added separately. This is due to absence of high permanent hardness in the water sample.

There is increase in charcoal mass is as a result of crystal formation on the surface charcoal crystals.

From the system confirms that these kinds of reactor with filter of charcoal powder of coconut shell can be used for domestic & industrial water treatment. The study was in accordance with another similar study for hardness.

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