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Using Biocide Materials for Remove Pollution from Anion Resins Packed Beds

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Abstract
Concerning the blades corrosion in Mashhad power plant, it was known that the refined water was impure. One of the things that had to be checked out was the resin columns which were old and it was one of the reasons of water pollution. Sampling the anion and cat ion resins of these columns was done and at first bacterial test was done in Microbiology Lab and the result was positive. On the next step a sample of anion resin was SEM analyzed in Lab and cracks, slit and steel pollution were observed. According to the above mentioned pollution some biocides such as Formaldehyde and Peracetic Acid were suggested for eliminating bacterial pollution and using Sodium Dithionite or Chloridric Acid for elimination steel pollution as well. The results show that the use of these biocides can help considerably improve the process of refining water with resins.

Keywords: Corrosion, Resin column, Bacterial pollution, SEM analyze, Biocides

1 Introduction

Ion exchange resins are solid particles which can find undesirable ion in solution with the same amount equivalent with the desired ion can substitute the same load. Hydrogen cation resins remove all water cations and anion resins remove all water anions such as the silica, so can use both types of resin to produce deionized water. Researchers also realized that aluminum silicate in the soil is capable to ionic exchange. This conclusion gel prepared with a combination of aluminum silicate aluminum sulfate and sodium silicate was proved. So the first synthetic resin, which was built in aluminum silicate. Today, most of the ionic exchange resins used in water treatment that it goes with polymer resins synthetic organic compounds [1]. To mineral resins say Zeolite that it able find calcium and magnesium ion to remove the water and instead it should release the sodium. Therefore it is famous to sodium Zeolite but it have been unable to find Silicon water treatment and because scientists were not Zeolite on it was to be made that some in the Netherlands instead of sodium, which were active hydrogen active Zeolite. However cation could be known all water-soluble salts of fatty acids into the relevant currently weak and strong cation resins and weak and strong anion resins production has been established [2].

Mineral exchangers can not compete with artificial and synthetic resins. Thus, this exchange frequently uses specific cases, but found that high temperature and exchanger is a radioactive mineral used. Resin columns in the special stainless steel (stainless steel) layers on Silicon retiform raw water is poured from the top and poured it down the column exit [3]. Home resin suitable conditions are as follows:

- In addition to resin that is solid enough case to jelly must be able to wash when come to the pending case.
- Porous resin should be possible.
- Must contain enough resin network connection is to be only partial solubility.
- Should be enough hydrophil resin (like water) until the ion is to be released easily building resin.
- Should include enough resin groups and ion exchange Information in terms of chemical is stable.
- Swollen resin must be heavier than water.

Water treatment in three major characteristics of ionic solids converters are expected to be the following:

- Non-soluble but water impervious
- Ability to exchange ions with the ionic solution in water
- Passage of the flow bed, creating low pressure drop and when is necessary to act as a filter [2].

2 Water treatment units in power plant of Mashhad

Water treatment unit supply required consumption water for power plant that will provide a 24 hours shift work, which will be returned by 5 per shift including 1 expert as shift engineer, 3 technicians, one and two laboratory worker is responsible. Since the plant was established in 1347 since the water treatment unit to help certain types of resins, water steam generators units required to provide the steam power plant. Water needed the plant will be supply from 6 wells. The rate of water withdrawals is 400 tons per hours. Water is removed from each well into a separate tank. Water

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storage tanks to be separated from any well not the same concentration of input water from purification unit and this subject can be difficult control of the output concentration.
While if water is harvested from each well into a six-unit tank, all times nearly equal to the filtration system. Part of water withdrawal used for irrigation purposes and gardening. Water input unit, into the two reactors, and after crossing the system gas loss aids and CO2 are decarbonate. 20 cubic meters per hour rate has two water reactor is out. After filtering out remaining water (380 m^3/h) the password of 6 sand filters water and is collected decarbonate unit. Part of the cooling water pumps is used and bearing in the power plant. Another part of the passing System for Ion Exchange is sent in the four boiler units Eshkoda and Elyn.
Resins and anion resins are consumed as Prolayt type A100 and A380 and cation resin type Duolite C20. Size filters 2500 liters of resin. System used in power plants of Mashhad is types that two parallel lines A and B flow in each path of anion and cation resins and strong and weak separately placed in a filter (Total 4 filter), and after them a mixed filter is placed. These two alternative path as they act, the two route alternatives to the act, i.e. when one of the filters in the path A status is retrieved from the similar filter flow path of B is entered.

3 Resins pollution
Cation resin can be usually in the first stage filtration process. Hence likely it exposed to too much new sand particles, iron oxide and aluminum hydroxide, etc., or through the water or raw water pre-filtration stage that it appears in output will be the impact of effect [3]. Reverse acid wash and the use of the resin with hydrogen can be mentioned in the above problem to minimize. But the larger problem of youth Harder when it joins the water to form sodium triturating is used. Cations resins can result from calcium sulfate with sulfuric acid regeneration process are the deposition, particularly if the regeneration process very high concentration and flow is very low. Weak acid resins, as can calcium ion influence of the water are removed, vulnerability increased. Such resins often in some beds and two-layer high strong acid cation resin are put and when sediment and take, their density is increased and the separate layers can not be created. Result of this action is operational capacity loss. Some common resins pollution has been summary in the following. Wide range of metallic elements such as iron, aluminum, calcium, barium, copper and nickel can sit on the cation resin. Sediment can be a certain element of society such as calcium or a metal such as iron, copper and nickel has occurred.

3.1 Iron contamination
New Iron likely a unit ion exchange is the following resources:
1-consuming contaminated water
2-branch water pipe corrosion
3-surface water input to the segregated with iron compounds
4-subject regeneration chemical contaminated
More pollution occurs that the iron is entered to the unit as Ferric solution. If this solution is smoothing, the soluble iron is cleared. Result of iron contamination, seeds mantle surface resin by soluble iron and diminish the ability of contact water-resin [4].

3.2 Microbiological contamination
Since the resin bed by microbiological growth will accelerate, the importance of this kind of pollution has important. Stands for this kind of pollution industry MB (Micro Biology) will be determined. Organic compounds by condensation resins such as ammonia, nitrate, and etc. the bacteria food were good and thus exacerbate the aforementioned activity and pollution is MB. This kind of growth and become infected from the point of destruction of chemical resin is not, but issues such as increased pressure drop in the bed width, obstruction of side horizontal blade distributor of water filtration products and to create highly contaminated .In very bad condition, probably comes to introducing appropriate use of sterilizing. Sometimes corruption chemical ionic exchange resins of open transverse oxide grain resin due to the occurrence of resin joins. Immediately after the resin to be broken because of greater absorption of water, are inflated. The grain will absorb much water pressure to power the internal osmosis. Main effect of this action and ultimately increase the amount of moisture resin being greater pressure drop is within bed. Oxidation of transverse bands is connection to high amounts of dissolved oxygen or the presence of oxidizing reagent such as chlorine.

3.3 Organic pollution
General organic pollution rarely original poster cation exchange is seen, particularly if the cycle is hydrogen. Pollution, Aforementioned pollution mostly in the original poster, anion exchange occurs, because organic matter on sediment areas are anion exchange, as a result of this settlement, damage and blocked resin exchange capacity and reduces the ability to descend again making resin. Main source of this type of pollution created Folvik acid, Humic acid, and tannic acid through organic matter decay [5].

These acids were very heavy organic material and the point of acidic, acid is in the range having been weak. Same reason other organic pollution anion resin is de vinyl benzene bad products for the DVB resins Cation [6, 7]. DVB compounds with non-returnable states that produce the new anion resins during descending to the pollution created. Often is necessary to remove organic matter from raw water to do this but anion resins may make deposits. In any case, this is the most common precipitate in the water purification units occurs. Subject anion exchange resins due to play a poor role having property exchange extent the organic compounds are resistant to organic pollution. Thus protect resins play a strong role from resins used weak organic materials and wipe with a bed through several layers of these findings is important. Resin suitable to weak to play a strong role based on the amount of resin input water to weak acid comes to hand. Also be cleared in this case because these kinds of compounds by subject anion exchange resins [8].

4 sampling resin

Resin and evaluate how the result of sampling depends on the resin. It is usually preferred that the sample used for testing representative of the mass is removed. Obtain a representative sample of suitable resins or other units in a mixed bed suitable for mixing with air, the resin bed should be 5 minutes after mixing and occur in the sample. Facilities where there is no mixing, cleaning bed because generally reverse order, are classified in the situation. Depending on the situation and services resuscitation pollution, a substantial sample surface can be modified and the amount of pollution and aggregation resin samples can not represent the real situation is bed. Regarding this issue it is necessary to sample several different bed depths be removed and re-mixed or a sample taken is mixed before the nuclear test of delivery.

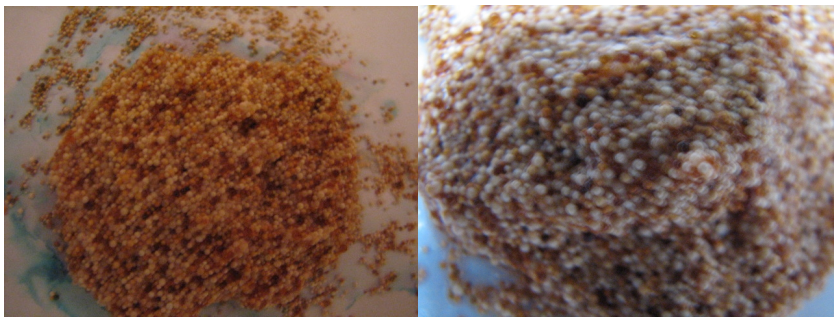

Figure 1. Sample cation and anion resins

5 SEM analysis and identification of iron contamination

Considering the analysis done by machine, and Figure 1 SEM iron contamination on the surface resin is clear. In fact, of the brown stain on the resin in Figure 2 indicate the accuracy of this analysis. Iron can form complex organic material that this case forms a complex anion will. Ferric solution with iron, usually as hydrogen or sodium cation resin is cleared.

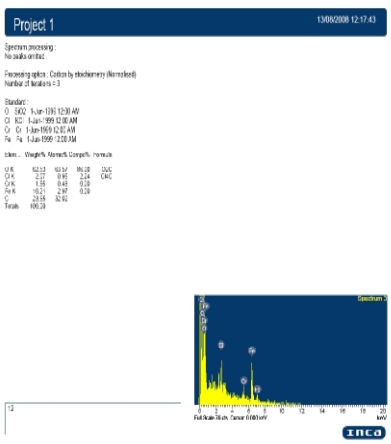

Figure 2: Analysis of a resin contaminated to iron

In case the complex organic-iron is present, an anion complex operation and therefore by the anion resin to remove water. Because the anion resin regeneration NaOH that while organic material per cycle recovery is cleared, but the iron will remain on the resin to cause the deposition of iron on the resin is anion. More forms of iron contamination occurs anion resins and cation resins, the willingness to exchange the original poster anion to form strong hydroxide is higher. Ion exchange on iron sitting areas and porous damage and blocks made of resin and thus reduces the capacity of resin

regeneration and the ability to undergo change and likely to fracture than a lot of resin increased. There is iron in raw water under filtration damages irreparable to the ion Exchange resin makes too approximate, and if amount of 0.2 (gr/lit) ppm is required to exceed before making it into a process to soften the iron content. Any order, or when any type of iron mineral water pollution is raw, device software must be started under the reverse washing and during the restoration process cleaning of resin is suitable for use. Steps such as cleaning and wash with warm salt or sodium hypochlorite part to compensate the loss of capacity.
Iron and manganese can be eliminated with type of cation resins with hydrogen and what type of sodium [9]. But due to problems usually become infected resin and should have adhered to the tips. Firstly, that should be carefully removed before the iron ion by the resin in contact with water and air, because if there is air in water, iron and manganese in water to form oxide and hydroxide and in soluble are really coming on as a result of particle resin and the deposition of resin are infected. If water wells directly pumped to replace the device (rather than pumping to storage tank), this condition is satisfactory. Second, the soluble resin regeneration should be exempt from the air because in this case, the iron and manganese released by acid or salt, by the deposition of oxygen are really coming hydroxide will pollute the resin. This type of pollution can also be the result of water pollution and erosion, caries specter of water transmission pipes. So the first is recommended step, all pipes lead to the column resins to make the revision.

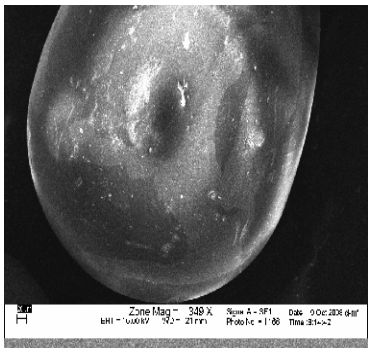

Figure 3: SEM photo of a resin contaminated

5.1 Delete methods for iron contamination
Ideal mode is better than a water filter before the take. Suggested methods include:
1 - oxidation and sedimentation
2 - using Poly Phosphate: poly phosphate with iron to form the solution of complex
3 - sedimentation and oxidation with oxidizing materials such as air, O_2, Cl_2, $KMnO_4$ can Mn^{2+} and Fe^{2+} in the oxide and an insoluble form [8, 9].
While there is iron in water input, some iron accumulation may occur on the resin, which resin will diminish performance. In these conditions with considering building unit and the internal plumbing of accompany is better than the hydrochloric acid be used. In conditions of iron on the resin exchange is total, HCl or sodium dithionite should consider.

5.1.1 The use of sodium dithionite
Sodium dithionite (SD) is a strong factor decreasing and when the resin bed with a deposit of iron is used, any form of iron that is the Ferric inverted into Ferro solution. Thus, within a bed of iron discharge cycle is normal. Washing method:
- Add SD 4% water solution to be built.
- The resin should be stirred until uniform solution to be broadcast within the bed. Disturb for air should not use because SD is due to oxidation.
- SD at least 3 hours is in contact with the bed (in possible it is 6 hours)
- After this period the solution discharge unit and the downward flow completely washed. For 30 minutes then brush-off any foreign materials that can flow reverse washing.
- After the last step, the unit must be restored and normal service will be entered.
- Because the relative variation SD, sodium phosphate poly more way to take work to find even more effective is the use of SD alone. In this case, the solution to 2 percent of SD is more poly phosphate. Power resulting solutions to remove iron durability because most of them to 16 hours to maintain.
- In case a preventive approach may be considered, it has been proposed that adding 1 grams SD per 100 grams of NaCl in regeneration is used.

6 To identify microbial contamination

Considering the experiments carried out in Microbiology Laboratory Faculty of Science, Ferdowsi University of microbial contamination in the resins was confirmed this issue with the photos taken to prove the kind appears.

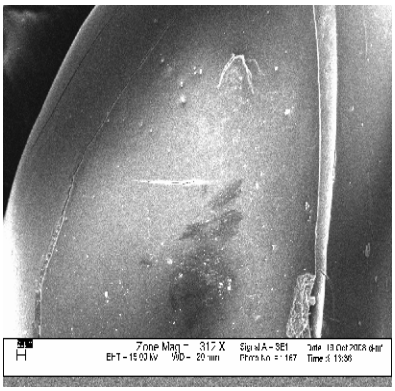

Figure 4: SEM of a shaped resin contaminated

In fact defeat of resins on the images of 3 and 4 is evident also can be caused due to two reasons. One reason is the physical failure of the treated resins and defect of humidity will create and other microbial contamination of the clauses in the transverse rupture and leave some on the resin on the resin create and water penetration into the resin and the resin swollen and it will lessen the performance.

6.1. Strategy deleted microbial contamination

Under some circumstances, Ion Exchange system when exposed to contaminated water sources can be, resins may be contaminated with bacteria or algae are. To deal with proliferation activity in the environment microorganism resin, resin type Bacteriostatic filters that has been produced to prevent the proliferation of fast in the microbiology is filtered.

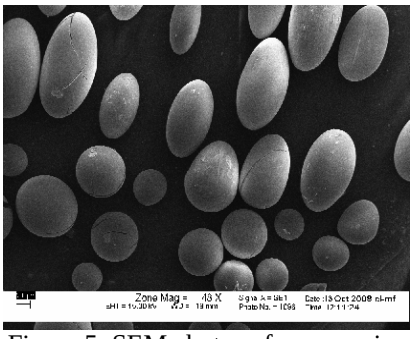

Figure 5: SEM photos of some resins

However, before this type of filter, water disinfection should be completely inert and when the water stay inside the resin bed caused putrefaction is rapid water must be careful that water inside the filter is always current. Using the filter for contaminated waters or suspected Microbiology and parasites are not allowed.

7 biocides

Biocides are chemicals material that kill microorganisms the ability to live. Biocides in medicine, agriculture, forestry and industry, especially for water and oil pipeline deposition aids are used. Biocides disinfection and in particular the deposition aids are used. Biocides with the most famous short life can be noted that chlorine in water treatment industry for the disinfection of pool water is used up. Many are biocides synthetic and artificial, but a kind of biocides, biocides natural bacteria and plants are coming to get [10, 11]. These can also used as pesticides and take anti-microbial property. Biocides to another (usually liquid) and add them in the growth of biological invasion and protects. This material is stable and solid powder, granule and tablets are available. When the amount of water is low, the atom of chlorine in water as acid hydrolysis and hypochlorite comes in kill germs and microorganisms and algae [12, 13].

8 Conclusion

There are two methods to increase plant efficiency for ion exchange systems. Considering that consumer resins plant longevity allowed more used to (approximately 40 years), during this period that the major problem for them but never created to prevent future events that may occur, it is better to replace them as soon as possible to be action. This resin should be suitable for the conditions and operational characteristics of water login ion exchange and output characteristics of the water is selected and purchased. This course, the important point that resin regeneration despite no a functional resin such as new resins. There is method to problem that is called wash the resin bed sediments and pollution. Considering the destruction of most resin and discrete bands of lateral connections them, unfortunately, this problem is not resolved with the restoration, so the researcher for this project recommended the first method and exchange resins. In this research sampling the anion and cat ion resins of these columns was done and at first bacterial test was done in Microbiology Lab and the result was positive. On the next step a sample of anion resin was SEM analyzed in Lab and cracks, slit and steel pollution were observed. According to the above mentioned pollution some biocides such as Formaldehyde and Peracetic Acid were suggested for eliminating bacterial pollution and using Sodium Dithionite or Chloridric Acid for elimination steel pollution as well.

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