Radiofrequency Technique to Prevent the Formation of Limestone in Water System

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***Abstract*— Limestone, stone, scab caused by the so-called hard water to get rid of this situation, many methods have been tried so far. The latest technology to prevent water limestone to make a special radiofrequency technique. In this study, the water system radiofrequency technique to prevent the formation of limestone is used. Very private and a variable radiowave, the transmitter antenna with the transfer of the water system that acts as a water supply by means of strips of limestone for the most effective method of prevention today. Producing radiofrequency limestone protection devices, all of these private radiowaves allow the spread of installation, so that the water system, and the water is constantly under the influence of this radiowave and the radiowave reaches the point limestone crystals can not occur. With this technique, the investment cost and the operating cost is very low powered devices, this technique could easily use all types of organizations.**

***Keywords*— Limestone, radiofrequency technique, water system, radiowave.**

I. INTRODUCTION

First conceived in 1948, radiofrequency (RF) has taken many years for the technology to mature to the point where it is sufficiently affordable and reliable for wide spread use. In the 1950s there was a theoretical exploration of RF techniques with a number of pioneering research and scientific papers being published. Today RF identification is a generic term for technologies that use radiowaves to automatically identify people or object [1, 2]. In the past, one issue that has stymied standards development is the question of frequency. Most RF systems operate in one of the internationally mandated industrial scientific medical RF bands. However, all frequencies do not have the same benefits for every application. Low frequencies are preferable for transmission through media such as water, and high frequencies are preferable for greater range in unclouded environments [3]. Because allowing different frequencies to operate under the same system would enhance functionality and also, RF systems could become inexpensive and offer enough performance to satisfy a wide range of commercial applications, one day connecting consumer products in a dynamic, real time, automated supply chain.

Investigations show that, there are no significant health effects of RF radiation at low intensity. But, for a long exposure time at high intensity, there are some adverse consequences. So, for the RF sources, there are national and international intensity limits. For human exposure, as long as one is exposed to the radiation below these standards, there are no definite adverse effects of RF radiation for human health. So, it is wrong to say the RF radiation is very harmful. On the other hand, it is wrong to say RF energy does not induce adverse health effects; it depends on frequency, intensity and exposure time [4].

RF range more radio and television broadcasts, mobile phones and other communication systems used for magnetic resonance imaging in medicine. Frequency allocations are generally managed through legislation and regulation by individual governments. Internationally, there are differences in frequencies allocated for RF applications although standardisation through ISO and similar organisations is assisting in compatibility [1, 3]. RF technology consists of the remote identification of objects that bear specific tags, which transmit individualised information to antenna receivers. Currently, this technology is widely used in industrial chains for the processing and distribution of raw materials or derived products [5]. The propagation of RF signals through water is very different from their propagation through air because of differences in the permittivity and electrical conductivity of the medium. Wave attenuation in water is high compared to the attenuation in air and increases rapidly with increasing frequency [6].

Of course, referred to as the hardness in water and calcium (Ca) and magnesium (Mg) minerals are not harmful to human health, but the crystals formed by these minerals water systems in homes, businesses and industrial establishments, water, equipment malfunction and cause clogging of the pipes. Magnesium is found in the water together with calcium limestone, silicate and water carried by substances such as solids, water systems are rigid boards. Water system must struggle with limestone. Because limestone houses, tourist and industrial plants increases energy expenditure, maintenance multiplies and causes economic losses.

The latest technology to prevent water limestone to make a special radiofrequency technique. Very private and a variable radiowave, the transmitter antenna with the transfer of the water system that acts as a water supply by means of strips of limestone for the most effective method of prevention today. With this technique, the investment cost and the operating cost is very low powered devices, this technique could easily use

all types of organizations. Limestone, stone, scabs caused by the so-called hard water to get rid of this situation, many methods have been tried so far. In this study, the water system radiofrequency technique to prevent the formation of limestone is used. Producing radiofrequency limestone protection devices, all of these private radiowaves allow the spread of installation, so that the water hardness water, and the water is constantly under the influence of this radiowave and the radiowave reaches the point limestone crystals can not occur.

II. Limestone Reactivity

Chemical composition of at least 90% calcium carbonate ($CaCO_3$) in limestone or limestone called sedimentary rocks. Mineralogical composition of the mineral is also found in at least 90% of calcite or limestone rocks are called. That are abundant in nature, limestone, calcareous sedimentary rocks and fossils are used for a general statement, in principle, the structure of only calcium carbonate or calcium carbonate/magnesium carbonate compounds ($CaCO_3/MgCO_3$) are combined. In addition, various amounts of iron, aluminum, silicon, sulfur impurities such as the obstruction. There are wide variety of limestone formation and types available in the world. Travertine in the form of underground waters, sea or fresh waters of chemical, organic, or as a result of mechanical deposition consists of limestone beds. As can be seen in two main groups, collected limestone formation processes. Autochthonous organic and chemical limestone, clastic limestones are considered to be allochthonous. Most commonly occurring organic limestones, detrital and chemical materials are contained. Calcite ($CaCO_3$ hexagonal) and aragonite (orthorhombic $CaCO_3$) crystals can take place both younger limestone formations. Transformation into calcite crystals of aragonite crystals easier aragonite crystals is difficult to find an old limestone formation.

A. What is the pH Value of the Water?

The pH value of the water; in fact the acid-base behaviour of the alphabet and the laying down of water or other liquid acid or alkaline character is a number. In other words, the hydrogen ions (H^+) or (OH^-) in the water are a number indicating the concentration. Found in the water (H^+) or (OH^-) ion moles/liter of water with the pH value of the amount of calculation is given below.

pH=-log [moles/liter of H^+ or OH^- ion concentration]

If the substance of the acidic (0-7) of pH value, the substance of alkaline (7-14).

- Environment of a substance dissolved in water, the pH value drops and the acidity of the force increases as the number of H^+.
- pH value of the substance approaches zero is a stronger acid.
- As the number of substances dissolved in water, setting the pH of the OH^- ion and the pH value increases the closer the material 14, which is so strong base.
- If the substance is dissolved in water, the environment is equal to the number of H^+ ions and OH^- ions that substance pH of 7 is neutral.

One of the most important factors is the pH balance of the pool water. Richter 1.0 earthquake, just as measure pH measurement refers to the 10-fold difference. Neutral water at pH 7.0 and below indicates that the acid and on the base. For example, eyes of pH 7.2-7.4 and value we aim to pool these values. Can be used chlorine ratio is due to pH, high pH they very low rate of active chlorine and chlorine at low pH to a rise in assets ratio of chlorine is used up quickly fly away.

pH is low, the following problems occur:

- quickly running out of chlorine,
- plastered surfaces and dissolves grouts,
- corrodes metal parts,
- sulphates occurs, occurs in patches,
- lights up the eyes and noses,
- dry and itchy skin,
- fade swimsuits worn.

pH is high, the following problems occur:

- chlorine in the pool water is ineffective and distorted,
- consists of limestone and sand filters can become clogged,
- water becomes dark, dim and brightness loses,
- lights up the eyes and noses,
- dry and itchy skin.

B. What is the Hardness of Water?

Water contains ions of significant amount of a precipitate may, hard water is defined as water. Hard water, calcium, magnesium and contains heavy metal ions. Creates soap curd. Hardness present, the total concentration of the sample for all the highly charged cations are expressed in terms of an equivalent concentration of calcium carbonate.

There are two types of hard water;

- Temporary hard water: Bicarbonate ion, HCO_3^- contains. HCO_3^- containing water is heated, the bicarbonate ion, CO_3^{2-}, CO_2 and water to give the easily degradable. Multivalent cations in the water react with CO_3^{2-}, $CaCO_3$-$MgCO_3$ mixed precipitate and form scale called sludge. Industrial boilers and steam boiler produces steam formation of stone fired power plants can cause very serious problems. Win stone formation and may cause overheating reduce the effectiveness of water heaters.
- Permanent hard water: Next to the significant concentrations of HCO_3^-, SO_4^{2-} anions contains like no other. Permanently to soften hard water, into the Na_2CO_3 (washing soda) is added. Medium Ca^{2+} and Mg^{2+} cations are precipitated as carbonates. Na^+ ion-containing water, the remaining water is softened. Ca^{2+} and Mg^{2+} ions to form the precipitate with water containing soap and foam blocks. Bath tubs in the residue, a mixture of calcium and magnesium soaps. Foaming soaps and shampoos make it difficult for the formation of a precipitate.

There are several disadvantages of hardness of water. Greater consumption of soap in hard water, soap bubbles now. Calcium and magnesium in the water, sodium and potassium in the composition of replacing it with soap after soap bubbles completely consumable. Hardness of the water and the occurrence of the self stick to surfaces or water heated begin to lose its resolution. Inside of these pipes is quickly filled, the water pressure and flow is reduced. Water is heated to an increasing calcification surfaces, sticking is caused and electricity consumption. Heating installation may cause an increase in fuel consumption limestone. Hard water is not suitable for heating technique. In particular, hot water, steam boilers configuration causes the contraction of the pipe cross section as soon as possible the formation of limestone. Hard water is used in the textile industry dyes to penetrate fully into the tissues difficult. Hard water is not conducive to the kitchen in terms of jobs.

C. Key Parameters for Relative Reactivity Measurement

Reactivity is a direct measure of how readily a given limestone will provide alkalinity and react with the acid resulting from the dissolution of sulphur dioxide into water. This term is used in estimation of the amount of limestone that must be fed into the absorber to maintain a given pH for a given Ca/S stoichiometry and solids residence time. When a limestone possessing lower than design reactivity is used, reaction tanks designed for more reactive limestones may be inadequate to fully dissolve the limestone, feed rates may increase and gypsum purity would decrease due to increased inerts and unreacted $CaCO_3$ and $MgCO_3$ fed to the dewatering system. Due to natural variation occurring in crystal structure among limestones, this parameter has to be empirically determined, rather than predicted from the results of compositional analysis [7]. In a compound (+) and (-) electrically charged particles in space and three dimensional images depending on the nature of the material brought about by the sequencing of the solid phase is called crystal. The size and shape of the crystals, crystallization and crystallization time varies depending on the environment [8]. Ideally, limestone reactivity test methods would provide an absolute reactivity constant that could be directly used to evaluate a limestone and determine the performance of a specific absorber design. Presently, an industry standard is not available and a number of different procedures exist for conducting such measurements.

While systems can be constructed to utilize a wide range of limestone composition and reactivity, limestone quality must be agreed upon early during system design because this parameter affects unit sizing, product quality, wastewater treatment, and limestone consumption rate and system performance. Though lower quality limestone may provide an advantage in system operating cost, the benefit of these savings should be weighed against impacts on system performance. Limestone of acceptable quality is necessary for achieving design level performance [5]. Limestone reactivity is used during system design to determine the amount of limestone that must be fed into the absorber to maintain a given pH for a given Ca/S stoichiometry and solids residence time. Ideally, limestone reactivity test methods would provide an absolute reactivity constant that could be directly used to evaluate limestone and determine the performance of a specific absorber design. However, development of a method to determine absolute reactivity in terms of reaction rate constant is very difficult. Most methods determine the relative reactivity, which provides a measure of reactivity as compared to a reference limestone of known performance [9].

At a study, simple fluid flow measurements were made in an attempt to learn more about the pore characteristics of coarse aggregates and their influence on the freezing and thawing durability of concrete. Determinations of density, porosity, absorption, degree of saturation, specific surface area, capillary absorptivity, permeability, and tortuosity factor were made on Turkey limestones with both good and poor field and laboratory durabilities. Absorptive was found to be better than permeability as an index of surface area. The poor stones had consistently larger values of porosity, absorption, specific surface, permeability, absorptivity, ratio of absorptivity to permeability, and coefficient of rate of saturation increase than those for the more durable materials [10, 11].

Critical parameters for methodologies aimed at relative measurement of limestone reactivity include, but are not limited to the following:

- Sample preparation,
- pH and automatic titrator control settings,
- Acid used for titration,
- Common ion concentration,
- Use of and type of wetting agent,
- Selection of a control limestone.

Limestone is thought to be less reactive as dolomite fraction increases. The magnesium within the dolomite crystal matrix causes a stronger and more cohesive crystal matrix than the calcite phase, rendering it less reactive. One measure of the dolomite content of limestone is magnesium content in Fig. 1.

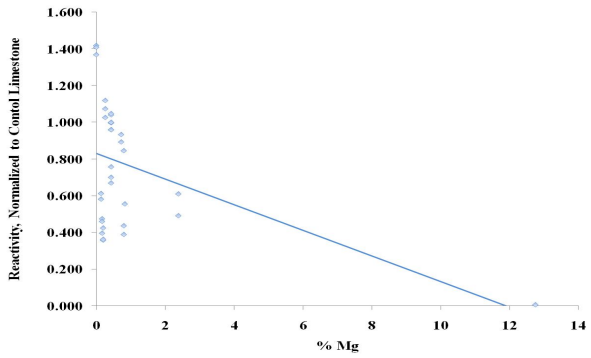

Fig. 1 Reactivity of various limestone samples, shown as a function of magnesium content, relative to the control limestone [7]

Their concentration in the gypsum product is increased, decreasing gypsum product quality. To improve gypsum quality with less reactive limestone, a higher fraction of purge may be used, sending greater material to wastewater treatment.

III. Material and Method

As the water temperature of the water, of course, mostly solves several items such as salt and sugar. There is a single substance but not obey this rule; chemical name calcium carbonate and magnesium carbonate. These carbonate in water, soluble in water and reduce water warms hardness forming minerals are separated from the water by forming crystals in reverse. These unwanted crystals stick to the cold water pipe and the device. During the evaporation of the water phase by changing only the "pure water molecules" evaporate. Impurities in the water with dissolved minerals in the water so the water evaporates, and their ratio is increased. However, the dissolved minerals in the water retention capacity are limited. The minerals contained in the water are saturated and therefore throws out a portion of these minerals. Limestone from these minerals forms crystals that do not want the water.

A. Limestone and Fighting Methods

Limestone and fighting methods vary for each facility and each branch of industry. In general, all the waters of the easiest fight "smooth" are. However, it is not economical for every business to get soft water, so economical solutions are sought separately for each business. Solution criteria on call; raw water quality, location and type of water use, the facility are the working time of the day and year.

For example, not too hard of a tomato paste factory is lucky to have a well water, yet the water softener to use some parts of the business. Lasting up to three or four months, because at the end of tomato season, the company stopped manufacturing all equipment is serviced and cleaned limestones formed. Using the same water in an iron and steel factory that there is no such a possibility. Because of such businesses often operate 365 days a year, and there are opportunities to clean limestone formation, in fact, to not create the limestone would be more economical.

On the other hand, focus strictly on the efficiency of the boiler of a steam boiler with the purchase of the business is very important for the economy. However, you get a very affecting operational efficiency "feed water quality" is sparse on the same care in general. Scaling in the boiler and boiler feed water is not given so much importance that addresses only the hardness of the water supplied to the boiler after smoothing device has been optimized. Ion-exchangers based on the name of the equipment. Therefore, the device minerals calcium and magnesium from the water in the water, while the mineral water which gives the amount of sodium ion equal to the number [12]. That does not change the total amount of mineral in the boiler feed water, even after this, the conductivity of the water rises slightly. Limestone formation damage to the boiler:

- Prevents the transfer of heat to the formation of limestone water. For example, around 20% of 3mm thick limestone creates a waste of fuel.
- Limestone formation impairs the pan. As a result, the production rate decreases and the economic damage occur.
- Duplicates and unnecessary repairs, boiler maintenance leads to the formation of limestone. May cause the boiler to explode.

Today, it is inevitable to fight with water system limestone. Because limestone homes, industrial plants, increases energy expenditure. This in turn leads to economic losses. The so-called hardness minerals calcium and magnesium in water and is not harmful to human health, but the crystals formed by water systems in homes and industrial plants, minerals, water, equipment malfunction and cause clogging of pipes. As for today, the latest technology to prevent water limestone to make a special RF technique. Water hardness in order to prevent the limestone was invented many years ago, no other physical conditioners. However, the present strength of the old physical treaters "frequency technique" is very low compared to that. Frequency of physical techniques to compare with the old technique used with the mobile phone today is like comparing magneto phone. Previous methods used, only the installation of pipes that have been installed at the water influenced. This deficiency of the motion, the use of RF technology considered. In RF technique:

- RF wave spreads all the installation.
- The water system will remain under the influence of the RF wave.
- RF wave reaches the points of lime crystals formed.

Very special and variable radio waves, ribbons, acting as a transmitting antenna system with the transfer of water through the water supply for today, the most effective method to prevent scaling. With this technique, the investment cost and the operating cost is very low-powered devices every organization can easily use this technique. RF generating devices for preventing limestone, this particular installation, the spread of all provide the radiowave. So that the water and the water system remain constantly under the influence of the radiowaves and radiowave reaches the points of lime crystals occur. RF method, defined based on the resonance frequency of the LC resonant circuit tuned. A resonant circuit of the changing magnetic field enters through the resonant circuit resonant circuit coil induced by the changing field of energy (Faraday's law). F_G varying field frequency corresponds to the resonance frequency f_R resonance circuit, the resonant circuit sympathetic oscillation (oscillation occurring due to resonance) produces. The energy necessary for the stimulation of resonant oscillation circuit is provided by the magnetic field. Small changes in voltage or in current coil producer, felt as oscillation [2, 13].

Fig. 2 AquaKlear limestone preventive frequency generator [14]

In our study, radiofrequency waves, electromagnetic wave spectrum in the first place, and $3x10^6$ - $3x10^{10}$ Hz frequency range values. RF technology to prevent the formation of limestone, these devices is running the installation, such as water pipes attached to the watch on (Fig. 2). In general terms this device there is no need for the installation of pipe repair. These devices will not be damaged from the water to the water touched. Regardless of speed or the hardness of the water passing through the pipe will help in reducing limestone. In addition, these devices are used to solving the plumbing pipes in the limestone formed saved this undesirable situation. Thus, the movement of the water is provided with radiofrequency waves, small crystals and plumbing installation to be freed from the limestone.

B. Applications of Devices

Previous devices, creating a magnetic field and the water in the pipe to prevent the progression rate of the magnetic powder in the water clog the device was stuck in the device. We believe that these devices are no longer closed the cycle. The following applications will be talking about the use of these devices will give you a better idea.

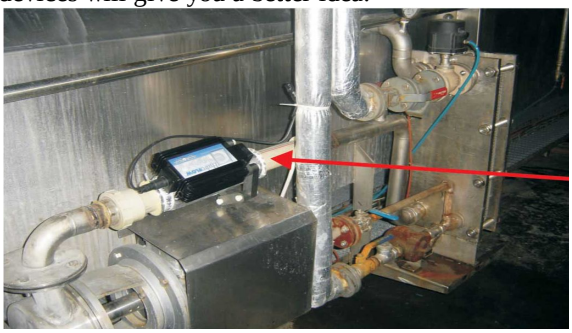

Fig. 3 At heat exchanger

A plastic manufacturing plant, manufacturing molds are cooled with water limestones of the desired section of the business efficiency of cooling, caused delays. Cooling water line was installed radiofrequency limestone inhibitor (Fig. 3), was dissolved limestone, the mold did not need care before and was dismantled and re-formed as soon as possible the formation of algae, not limestone. With this device, plate and tube heat exchangers and solved the problem of limestone. At the same time, the dissolved limestone boiler and hot water supply system. Old limestone decomposition exchanger leaves.

Fig. 4 At autoclave and pasteurized tunnel

Heating plant into a canned (autoclave) unwanted lime spots on the observation that the cans. Radiofrequency calcification inhibitor heating system was installed on the water system; the white spots occur in cans and poured into the bottom of the heater before dissolving limestone (Fig. 4). With the implementation of this device, the food industry, water supply system, and the system solved the problem of limestone is cleared. So that all of the water system pipes are protected against the formation of limestone (Fig. 5). We also removed the old limestone system is cleaned [15, 16].

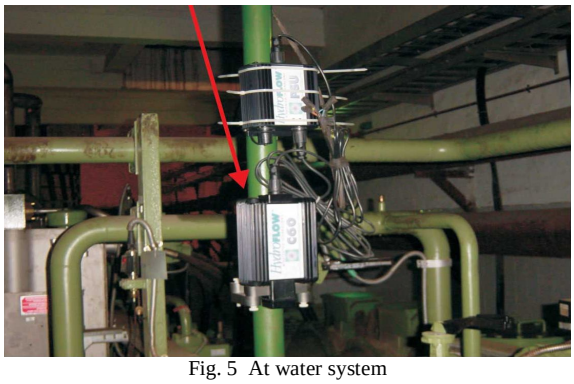

Fig. 5 At water system

This device is the external natural conditions of heavy industry to work in all kinds of conditions, and are specially manufactured for the steel and cement industry operates successfully even in severe environmental conditions (Fig. 6).

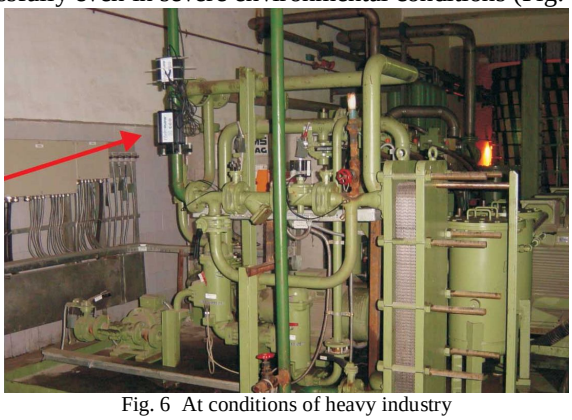

Fig. 6 At conditions of heavy industry

This device works with RF technique, how can you prevent the formation of crystals of limestone? Thermodynamics and mineralogy, as part of the water to evaporate the water, such as temperature and pressure changes or changes in some of the minerals in the water initially the formation of crystals of microscopic size to provide a very small limestone. These crystals are first formed, then according to the law of physics shooting each other, so installation by pulling the pipes to form larger crystals in limestone and multiply. In the meantime, a special and powerful radiofrequency waves and microscopic crystals that disrupt the growth of physical capture, reproduction and installation of plumbing pipes sticking to prevent blocking. This frequency waves used to capture the corrupting disengagement with each other allows the crystals formed. Similarly, the frequencies of these powerful, formerly formed a large crystal affects the strength of the attraction between microscopic units, and enables them to be old limestone crystals do not dissolve well. Small crystals with the movement of water supplies or plumbing limestone manufacturing device and ultimately get rid of leaves.

Fig. 7 Limestone preventive frequency generator [14]

Limestone anti-frequency generators, they produce affect the formation of crystals with a frequency of limestone. These devices produce long-wave frequency of 120-140 kHz. Water system can be measured by the frequency produced by the oscilloscope. This frequency of the water system to a distance of at least a kilometer in both directions by spreading water system protects against the formation of limestone. Water pipe material, water flow, water hardness and temperature of the water does not change the effect of this device (Fig. 7). The device acts as a transmitting antenna located on the ferrite rods. With these ferrites frequency is transmitted directly to the water passing through the pipe. This frequency can be spread to the entire water system. Thus, the frequencies of physical conditioning of the water stops are everywhere.

Most of the high hardness of water in our country. Whose waters they tend to produce limestone, limestone is a major problem in all water systems to contend with. There is one exception, however: carbonate and magnesium minerals dissolved in the water while the water is cold, the water warms up some of these minerals crystallize and turns it into a solid ball. This type of limestone formation, the water temperature starts at about 30-35 °C and the water warms up faster.

IV. Conclusions

These devices are approximately 50 mm to 120 mm diameter water pipes can be installed ones energy can spend as little as 30 to 40 Watts, and it can affect water installation using less energy, thus we assume these devices will be very economical in using them. Today, these devices Hydropath company in the UK are manufactured by Black and Dacker robot technology and the company is exported to all over the world.

Since 1997, many in the food industry in our country autoclaves with RF technology, pasteurization tunnels, heat exchangers, boilers, refrigeration condensers, valves, hot water pipes are protected against limestone. On the other hand; swimming pools, filters and pumps through these devices mounted on the solids in the water before the pipe creates large lumps and provided excellent filtration. Flocculants (precipitant) the use of chemicals will be crystal clear pool water constantly. Flocculant feature of these devices, and the coarsening solids contained in the pool water, sand filter and remain on top of a layer of sand get into the sand. Thus, the increase in pressure loss in the filter is after a long time and a large amount of sand filter backwash water decreases during the process economy.

In technological solutions, the research effort described here involves many universities, more than many companies, and more that many researchers worldwide. The potential economic impact of inexpensive, ubiquitous item identification in the supply chain fuels this research. Several technology alternatives for each system component need testing before an optimal one surfaces. Even after manufacture of the first inexpensive tags, industry will face the challenge of scaling production to the volumes needed to meet demand. It could be many years before supply meets the enormous demand that a technology of this type could generate. As with many new technologies there is potential for great benefit and misuse, particularly in supply chain management. But before we see widespread adoption of RF, tag prices will have to fall significantly, clear benefits will have to be demonstrated and consumers will have to embrace the technology. In contrast, RF systems offer a single platform on which users can implement several applications simultaneously. In versatility can benefit all parties involved in a commercial transaction [17].

Different technologies can be used to achieve the same result. Each can be formed of a different technology in itself. For this reason, the raw water quality is the first, the desired output quality of water, raw water flow rate, the cost of chemicals used, regenerant consumption, water consumption, and system design parameters by examining the regeneration of demineralization and reverse osmosisz systems which are determined to be the most appropriate technology. After selecting the most appropriate system is designed in the selected technology.

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