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CALCIUM CARBONATE SCALES IN RUNNING WATER BASED ON MAGNETIC FIELD EXPERIMENTAL ANALYSIS

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ABSTRACT:

This paper center to show that the flow of water in a lasting attractive field having transition thickness of Tesla diminishes the nucleation acceptance time and degree of decay of all out alkalinity, represses lessening of electrical conductivity, TDS expulsion effectiveness and augmentation of the pH level. Attractive treatment expands the nucleation pace of calcium carbonate, and restrains gem molecule development. The impact is progressively articulated for homogeneous nucleation. The impact of water speed at 7l/min indicated higher convergence of Ca^{2+} and Mg^{2+} in profluent of water test contrasted and 5l/min. The attractive field restrains bicarbonate substance to diminish, and in this manner represses arrangement of calcium carbonate. Attractive field essentially lessens turbidity. The dissemination of water in a fixed MF upgrades the expulsion of scale in water pipeline. With higher attractive field force and higher water stream speed, the pace of scale expulsion from the water pipeline is higher.

Keywords— magnetic field, electrical conductivity, calcium carbonate

I. INTRODUCTION

The forecast, observing, and outcomes of $CaCO_3$ arrangement have for quite some time been a key issue in consumable water treatment. An early concern was that waters exceptionally under soaked with $CaCO_3$ would be destructive to metallic and solid channel foundation (Baylis, 1935), and for waters profoundly supersaturated with $CaCO_3$, issues identified with scaling (i.e., pipe stopping up, head misfortune, higher warming expenses) are the essential concerns (Garrett-Price et al., 1985). In the 80+ years since the milestone contemplates looking at these issues were distributed, numerous progressions have happened that can significantly adjust the probability of $CaCO_3$ scaling in consumable water frameworks including synthetic consumption control, changing water warmer set-point temperatures, autogenous fix, an unnatural weather change, biofilm development, and disintegration erosion.

This audit is planned for summing up these progressions and featuring their commonsense ramifications for water utilities, controllers, building administrators and shoppers. Attractive fields can change the physicochemical properties of water particles when the water test went through an attractive field. Accordingly, it will assist with forestalling the crystallization of calcium carbonate in water test and this prompts forestall the arrangement of in water pipeline. The development of scales inside cooling water funnels and evaporator dividers is a typical and expensive issue for some modern procedures. Among these techniques, an increasingly practical and helpful strategy is the attractive treatment. Be that as it may, the counter scale attractive treatment has had along and questionable history (Al-Malack et al., 2001). Analyses were additionally acted in the research facility to examine the attractive consequences for $CaCO_3$ nucleation and gem development by means of a progressively orderly methodology; be that as it may, clashing outcomes likewise exist in the writing.

II LITERATURE SURVEY

As demonstrated by Brower (2005), case records of the achievement of appealingly rewarded water return to 1803. The alluring effect was first recorded when there was a noticeable differentiation in the outside of the mineral storing up inside soup and dress pots. These pots were put over blazes and tremendous stones were placed in the base to shield them from swinging in the windy atmosphere. Evidently, two of the five pots, which were completely delivered utilizing a comparative cast iron metal, didn't have hard scale improvement. Or maybe, they had a

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sensitive, fine substance which was disregarded with no issue. It was later found that the two ofcthe five rocks used to adjust the pots in the breeze were lodestones which are normal alluring rocks. As demonstrated by the Marshutz et al (1996) Michael Faraday was the principle pro who genuinely dove into magneto science beginning in 1863. From 1890 and onwards, the subject of appealingly rewarding water had gotten extremely questionable, and was named "gadgetry" and "not acceptable under coherent examination". An association called Solavite, arranged in France, began to feature a MTD in 1936.

In the Eastern Bloc Countries, particularly Russia, extended exploration and usages of MTDs begun after the Second World War. This was by and large a direct result of the way that the U.S.S.R didn't have the substance inclination or on the other hand financing to treat their water artificially like that in the U.S.A. (Lobley, 1990). Marshutz(1996) reports that in 1954 the Federal Trade Commission archived a complaint against the Evis Manufacturing Company, which created an early appealing water conditioner. They blamed the association for absurd contention and false publicizing by its opponents. Following wide hearings, the dissent was pardoned two years sometime later. Tests and studies in the west extended after different productive employments of MTDs came out of the U.S.S.R. By the 1990's, various dependable foundations were investigating the topic with mixed results. Today, there are different collections of MTDs accessible to be bought, stretching out from $100 up to $10000. The flawed conversation over the ampleness of charged water is up 'til now dubious. There have been various productive present day uses of MTDs in the west, including structures for NASA, yet the treatment has not been released standard or recognized by the Water Quality Association (Federal Technology Alert, 1996).

III MATERIALS AND METHODS

In order to survey of magnetic field effect on hardness water reducing, has done water treatment experiment in presence of magnetic field.

Preparing magnetic field

The device is containing of magnets with dimensions 40mm length, 25mm breadth, 10mm thick of ferrite black magnet with north pole and south pole as shown in (Figure 2), That have consoled in form of same axis and is create length equal 40mm length on the magnetic field.

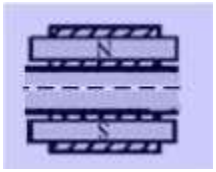

Fig: (3.1) Sample of magnet with north pole and south pole

For measuring magnetic field intensity of each magnet, we used the gauss meter. The magnetic field intensity of magnets is calculated the reading by gauss meter device and the magnets is 5700 gauss each.

Magnetic field

Lasting magnets of 5700 gauss were utilized during the analyses. Two sets of magnet with north and south faces confronting each other were related at the outside of cylinder as appeared in figure (3). In this position the acceptance of the MF was opposite to the arrangement stream. The water stream rate was about 5lit/min and 7lit/min. Every magnet was the set together of two rectangular lasting magnets. The MF quality delivered by every magnet was around 5700 (gauss).

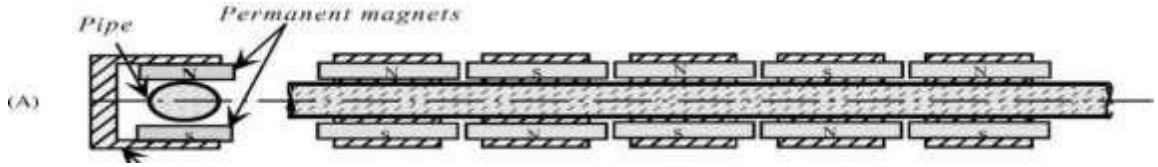

Fig: (3.2) Inverted Permanent magnet

ISSN- 2394-5125 VOL 7, ISSUE 04, 2020

Magneto hydrodynamics

Magneto hydrodynamics (MHD) is a branch of mechanics that deals with the motion of an electrically conducting fluid in the presence of a magnetic field. Therefore, the magnetic unit may be considered as a MHD device which is the key for the explanation of its performance under various conditions and applications. The motion of conducting material across the magnetic lines of force creates potential differences which, in general, cause electric current to flow. The magnetic field associated with these currents modifies the applied (imposed) magnetic field which creates them. In other words, the fluid flow alters the electromagnetic state of the system. When a conducting fluid passes down an insulating pipe across which a steady magnetic field is applied, a potential gradient (proportional to the flow rate) is created and can be measured by probes embedded in the walls of the pipe.

Magneto chemistry

Disassociated dissolved molecules of $CaCO_3$ in water have a tendency to recombine by forming scale which adheres to the inner walls of the piping system, containers, steam vessels, etc. When the water flows through a magnetic field of relatively low intensity, the formation of scale in the treated water is prevented in many instances. Instead, aragonite is formed within the flowing bulk water (aragonite forms dilute slurry in the water, the sediment of which can be easily removed by blow- down or bleed-off). In other words, the magnetic field causes preferentially the recombination of the disassociated $CaCO_3$ molecule into aragonite form. It, apparently, takes place by as little energy as needed for spin flopping in the electronic or nuclear energy levels, a process of very low energy of activation. The magneto chemical reaction, is only one of the many cross effect reactions that enable the transformation of calcite to aragonite. Other reactions include: the thermo chemical and mechano chemical reaction.

Pipe material and their properties

The pipe material we were used is PVC, Iron, copper with the diameter of 0.5 each and length of pipes is 1.5m, 1m, 0.5m respectively shown in figure (3.3). we were used three sets of each pipes for analysis with magnets and without magnets and the flow of water in each pipes is 5 L/m and 7L/m the valves are set on 5 L/m and 7L/m flow with the help of a digital flow meter shown in figure(3.5).

Fig: (3.3) Pipes and these materials used in the setup

The pipes are essential components in any water supply and distribution network. Water supply is the process of supply of water from public water supply system to individual building and subsequent distribution of water to various parts of the building. The water from public water supply system to individual buildings is supplied through pipes. A large proportion of capital is invested on pipes while designing water supply distribution system. The domestic pipes are available in several types and sizes. They may be classified into three groups according to the material used in their manufacturing as Metallic pipes such as Copper (AC) pipes, iron pipes PVC pipes and Polythene pipes (low density). The corrosion products on the surface of copper pipe were appeared as light brown and/or blue green color.

ISSN- 2394-5125 VOL 7, ISSUE 04, 2020

Scale formation in pipes

It has been observed practically that when water, especially ground water, flows through a pipe, the salts and various dissolved particles present in water, generally tend to deposit on the inner walls of the pipe. Such deposits may strengthen over a period of time, thus hindering the flow as well as friction factor and eventually even close the pipe completely. Thus in the case of water supply pipes, it is observed that as the usage increases, the diameter of the pipe is getting reduced because of the deposits that are taking place along the inner walls of the pipes as shown in the figure (3.4). In the coastal regions, where the water is saline in nature, the deposits have occupied the entire area of cross section of the pipe because of which the entire pipe system had to be replaced.

Fig: (3.4) scale formation inside pipe

Practical observations in the case of domestic pipes revealed the presence of certain deposits on the inner walls of the pipes over a period of usage. This problem increases when the fluid of appreciable hardness flows for a considerable period of time. This phenomenon will render the pipes less useful when the hardness or salinity of the water flowing in the pipes is high. The white colored deposits on the inner walls of domestic pipes and other plumbing fittings are deposits of calcium compounds - they are present where there is hard water or water with high mineral content. As the water runs through the pipes and fittings, the calcium ions present in the water, which are highly reactive, react with the air inside the pipes to form compounds of calcium, that deposit all around the inner surface of the pipe, making the smooth passage of water difficult or causing hot water to cool down too fast. Buildup of calcium in pipes and plumbing fittings can cause them to clog partially or completely, making them partially or totally dysfunctional. If the water has a high content of minerals in it, it will take as less as a month for the calcium deposits to build up in and around the pipes and plumbing fittings. Thus, the importance of cleaning the plumbing fittings and other pipes regularly cannot be over emphasized. The reasons for scale to take place on the inner walls of the pipe may be attributed to the electromagnetic forces that are being developed in between the flow of fluid and the walls of the pipes, which is a common phenomenon of any pipe material. These electromagnetic forces may be probably acting on the water flowing through the pipe, thus precipitating the salts on the pipe surface that is in contact with the flow. Such salt particles, because of their affinity, stick to the walls of the pipes and remain there. Gradually as the phenomena of deposition continues with the time of usage, the thickness of the deposit also increases. The pressure in the fluid flow and the crystalline nature of the particles (dissolved or suspended) present in the fluid are the main factors affecting the thickness of the deposit.

Equipments used in the setup

Digital flow meter: Volumetric flow meters directly measure the volume of fluid passing through the flow meter. The only flow meter technology that measures volume directly is the positive displacement flow meter. Velocity flow meters utilize techniques that measure the velocity (v) of the flowing stream to determine the volumetric flow.

Fig: (3.5) Digital flow meter

ISSN- 2394-5125 VOL 7, ISSUE 04, 2020

Water pump: this pump is used in this setup for proper flow of water in specific quantity according to the height of setup the pump capacity 0.5hp.

Fig: (3.6) Water pump of 0.5 hp.

Opening closing valve: A valve is a device that regulates, directs or controls the flow of a fluid (gases, liquids, fluidized solids by opening, closing, or partially obstructing various passageways. Valves are technically fittings but are usually discussed as a separate category. In an open valve, fluid flows in a direction from higher pressure to lower pressure.

Fig: (3.7) opening and closing valves

Mini pump: The mini water pump is used in the setup for water reveres to main tank for balance the water level in both of the tanks.

Fig: (3.8) A mini pump for reveres flow of water to the main tank.

IV. EXPERIMENTAL PROCEDURE

ISSN- 2394-5125 VOL 7, ISSUE 04, 2020

Water goes through the attractive field, every single super-atom vibrate this will increase the interior vibration of these super- particles to the limit. These super-atoms crack and discharge their imprisoned particles (Ca, Mg). Hastens come out of arrangement as slop and can be effortlessly expelled from the framework.

Fig: (4.1) Setup image

The home-made magnetic device It consisted of a series ofcpairs of permanent magnets with north and south poles facing each other, which can be associated alternately. The investigations were carried out using the experimental set-up shown in Fig (4.1) In this study, we used model water that was prepared following the method of Parsons who reported that the optimum concentration of Ca^{2+} ions for the best response to the magnetic treatment. Sample solutions of calcium carbonate ($CaCO_3$) were prepared by dissolving finely ground calcium carbonate powder of analytical purity in demonized water and bubbling the suspension with carbon dioxide gas through a porous frit. CO_2 is removed from the system, by bubbling air through the solution.

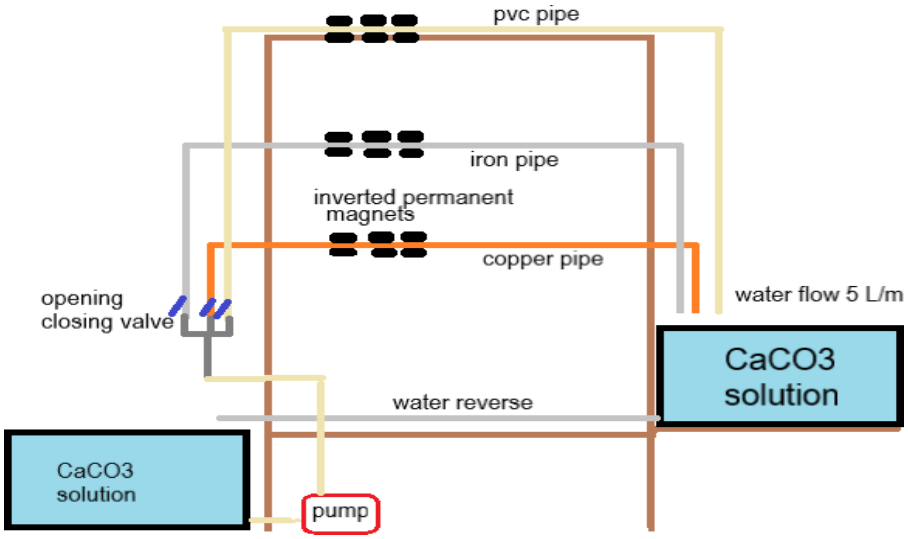

Fig: (4.2) setup layout

Fig. shows the schematic diagram of the magnetic treatment device (MTD) in a closed circulation system. Experiments were performed in parallel runs. One of the runs was treated with a magnetic field of 5700 gauss and the other was without magnetic field for the magnetic water treatment. . The scaling water to be treated was circulated in a pipe through the gap by means of a centrifugal pump. The pipe, unless specified, was of copper, iron, PVC. The water velocity can be uniform with 5 lit/min and 7lit/min.

ISSN- 2394-5125 VOL 7, ISSUE 04, 2020

Fig: (4.3) flow rate

The water to treat passed through a pipe inserted between the polar pieces in opposition of polarity. In this configuration the magnetic induction was perpendicular to the solution flow. The without magnetic water was treated for no memory effect that's why we were firstly circulate water in without magnetic field pipes up to 30 hours at a constant flow of 5lit/min and 7lit/min and after that we close the valve of all three pipes of non magnetic flow and after this process we were open the valve of magnetic field pipes which has the two pair of magnets which is bound around the pipe walls with the stick tape for creating a strong magnetic field of 5700 gauss and the hard water was start flow through the magnetized pipes and this flow of water is also flows up to 30 hours.

Now after that all process we are discussing about pipe materials, in previous researches we found that the researchers generally use PVC, Iron and copper pipes because this pipes are generally used in houses and household products of certain length 1.5m,1m, 0.5m respectively and diameter 0.5 inch each copper, iron, PVC for comparing the effect of hard water effect on the materials of pipes with or without magnetic treatment.

V. RESULTS

In the early stage of this research, the experimental mode was similar to that using the commercial MWTD, the magnet was used to magnetize the solution. The results of calcite growth at various levels of super saturation using the 5700 gauss magnet to magnetize the super saturated solution for 30h prior to growth of seed crystals in which the calcite growth rates without magnetic treatment are also presented. The calcite growth rate increased with an increase in super saturation for either case, and there was almost much difference between these two sets of data. These results meant that the magnetic force induced by 5700 gauss magnet works after magnetizing the solution for 30h.

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