Australian Journal of Basic and Applied Sciences, 5(8): 518-522, 2011
ISSN 1991-8178

Designing and Manufacturing Pressurized (Hydraulic) Hydro Chlorinator

[1]Masood Poornajaf , [2]Leila Najafi, [3]Ali Aamarlooie, [4]Hasan Emami, [5]Abdolhossein Poornajaf, [6]Mohammad Ghiasi, [7]Mohammadhadi Rajabinejad, [8]Timour Kavanie, [9]Ali Gooranie

[1]Islamic Azad University,Faculty of Agriculture,Graduate, Student,Sanandaj, Iran.
[2]Ph.D. student in health services Administration, Department of Management and Economics, Science and Research Branch, Islamic Azad University, Tehran, Iran.
[3,5]The member of academic board of Ilam University of Medical sciences, Ilam Iran.
[4]Diroctor, IT and Statistics Center, Shahid Beheshti university of Medical Sciences, Tehran,Iran. (M.C.).
[6]Shahid Beheshti University of Medical Sciences, Tehran, Iran, Ph.D. candidate in Health services Administration.
[7,8,9]Ilam University of Medical sciences, Ilam, Iran.

Abstract: At present, one method of drinking water disinfection is use of per chlorine. It must be added with a certain amount. There are mechanical devices to do this work which need the energy to perform. Hence, giving attention to energy consumption and access to its supplier resources has special importance. Use of cost effective, recyclable and accessible energies forces the human to take daily efficient steps to optimal use of energy resources. This plan has been performed with the aim of using cheap and recyclable energies in order to injecting per chlorine to drinking water in areas without electrical power or where the problem is energy storage. Apparatus operation method: at present on our country the gaseous, electrical, hydro mechanical devices and a manual method have been used to chlorination . Especially, electrical and gaseous chlorine mixer have been used to inject chlorine to water supply pressure lines. But hydraulic chlorine mixer has the ability to inject chlorine by using hydraulic energy present in water supply pressure line, it means that the device will capture the hydraulic energy, it & inject per chlorine solution to water supply network with this force. Results: after studying and considering the operation method of these devices, research have been done and finally by using cylinder and piston and four containers were designed and made and tested successfully. This set is very heavy and complex. After investigation, a very small and portable set was made of light weight materials (polyethylene and pp) and its complexity has been reduced considerable. The presented sample can be produced in a mass.

Key words: Designing , manufacturing, pressurize, (hydraulic) hydro chlorinator

INTRODUCTION

Use of per chlorine is common as a disinfectant in Iran. In order to do this work, the electrical devices have been applied to injection of solution to water supply network.

Use of electrical chlorine mixer equipped with electromotor and injection pump need a permanent maintenance and has depreciation. Also there is water supply network in which the natural fountain and slope will be used and water supply pipes have afar distance from electrical network which need network installation and considerable cost. Using these simple systems has a high importance in industry. Cost loss and depreciation are among of advantage of this plan.

On the other hand, injection of solution must be based on water volume of network. Changes in this amount in the water supply pipe change the line pressure. In the case of using hydraulic chlorine mixer, pressure change in water supply network will change the machine speed, which in turn changes the solution rate injected to network. With regard this change, it's possible to achieve a specific volume of per chlorine injection based on water dB to water supply network.

Corresponding Author: Leila Najafi, Ph.D. student in health services Administration, Department of Management and Economics , Science and Research Branch , Islamic Azad University, Tehran, Iran.
E-mail: lnajafikia@gmail.com or l_najafikia@yahoo.com).

Therefore, the investor team by knowing the mentioned problem, also having enough knowledge of various characteristics of liquids decided to design and manufacture an apparatus which is able to produce a pressure more than pipe pressure by using pressure energy of water supply line and by this means it's possible to inject the disinfected solution to mentioned water supply line.

With regard to it's special abilities, this device was accepted as an invention in the national industrial propriety with patent 129713.

Today, disinfecting water by using hypo chloride sodium is common in many countries. This material must be mixed with water with a specific amount. If the amount of chlorine be less than optimal extent, haven't full disinfection property. And it's more use, is harmful for consumer. Therefore the extent of use must be common and continual.

To ensure the disinfection sampling is done at the end of water supply line and the amount of the present chlorine is measured by work measuring kits kits. Chlorine can be used in the form of gas and solid. In the first method the chlorine gas is maintained in special capsules then injected to water supply line with related machines. In the second method, chlorine is provided in the form of tablet and powder. To disinfect the restricted amount of water, the tablet will be used and in other cases its solution and by using following methods:

Manual Method:

In this method, first powder will be soled in some water. In the case of adding water from source, first the amount of chlorine will be increased then its amount diluted.

Using Electrical Apparatus:

In this method, the needed amount of chlorine will be mixed with water then injected to water supply line source or network during the determined time.

Using Hydro Chlorinator:

Like electrical method, this machine has an injection pump, but the motional force of internal water is used instead to water supply source instead of electrical current. This apparatus among previous inventions of this inventors group has been recorded by financial and scientific supports of Ilam medical science university with patent number 26708.

Machine Literature:

Hydraulic apparatus is a device to chlorinate drinking water resources and networks by using per chlorine solution which supplies its necessary energy from the pressure of water inside water supply network. Therefore, other energies like electrical current aren't needed.

Water being in water pipe line has a considerable amount of energy as potential and motional forms. In the case of availability of o mechanism (suitable and cheap), the use of present energies in water supply lines will be cost effective in this case it's not necessary to use very expensive power.

Purpose:

Designing and manufacturing the injector of per chlorine solution to networks und water supply pressure secondary purpose.

Using tools which are related to hydraulic system in such a way that the pressure of per chlorine solution to injection is more that water inside the water supply network.

Setting related tools in a collection as hydraulic chlorine mixer

Findings:

Hydro chlorinator under the pressure has been designed by using the primary principles of mechanics and enough knowledge of liquids and a characteristic (especially water) which is able to produce pressure from water supply line pressure that overcome primary pressure. In this way it's possible to inject disinfection solution to water supply lines.

Total Machine Performance:

In this apparatus a minimal amount of water is transformed into a cylinder in which a piston is installed.

The movement of piston is transferred to the primary piston with fewer diameters. Therefore it's possible to inject chlorine solution with less volume of water entered to water supply lines.

With regard to the following specific characteristics, designing and manufacturing this device is important technically and economically. Because of the following features it was accepted and registered as an invention.
Unnecessary of power.
Simplicity of its mechanism.
Simplicity of its installation.
Cheapness of its installment and maintain ace.

It expensive application in different industries including petrochemical and oil industries, under pressure irrigation, water and sewage industry.

Under pressure irrigation means injection of chemical materials like poisons and manure to irrigation networks which have pressure (pump age system in agriculture).

Description of Machine Performance (Procedure):

If from under pressure water supply lines the water will be transferred into cylinder with its internal piston, the force will be produced that its volume depends on piston section level and water pressure. This force caused to cylinder movement along the cylinder. Now, if the force of first piston movement is transferred to a piston with smaller section level, it's possible to overcome the pressure of water supply lines as a result of injection of chlorine solution to water supply lines. (Figure 1)

Computations of apparatus energy. If we consider 90% output for this machine, by the following features, the produced pressure is computed as following:
Da=0cm
Db=5cm

In this case a piston level is as following:
Sa=πr2 ⟶ Sa=3/14*25=78/5cm2
Sa= (78.5/10000) = 0/00785m2 a movable piston level
Sb = πr2 ⟶ Sb = 3/14*(3/75)2 = 44/15m2
Sb = (45.15/10000)=0/0045/15m2 b movable piston level

Motive piston is one with bigger section level. If it is connected to a cylinder that piston (a) is placed in it with water current with 1 bar pressure, the produced force with 90% output is computed as following we have:
1 bar = 100/000pa
Then:
Fa= P.A ⟶ 0/000785*100/000= 785N
Fma= Pi.We ⟶ Fma=785*90%= 706N

Now, if this amount of force acts on piston b, then we have
Fa= Fa
Fb= Pb.Ab ⟶ 706/5= Pb*0/00415
Pb= (706.5/0/00415)= 170240/96Pa
Pb= (170240.96/100.000) = 1.7bar/cm

Then, if pressure on surface of motive piston is 1 bar, pressure on motive piston will be 1/7bar.
Computation of lost water
Va= Sa * La 78.5*10=785cm3 volume of one movable cylinder
785*2=1570Cm3 ⟶ volume of one movable cylinder

It's notable a system would be designed and manufactured twin and symmetry in order to inject the solution to water supply network permanently and continuously.(figure 1)

If the needed amount of water and chlorine is 500l/h, then repetition number of pistons movement will be 556 courses in 24 hours. As the solution is injected to water supply line with motive piston, then we have:
The volume of two movable cylinder= 441.5*2=883cm3
Pistons in 24 hours =500000/883cm3=566the number of piston movement in24hours

566the number of piston movement in 1 hours = 9/44
566the number of piston movement in 1 minute = 0.16
Therefore, with regard to technical specifications of cylinder and pistons to inject 500 liter solution during 24 hours to water supply line, the amount of lost water is computed as following:
Total volume of movable cylinders * the number of turning and returning of pistons in 24hours= the amount of lost water in 24 hours.
Lost water during 24 hours = 1570*566=888620cm3/24H=889Lit/24H

Then the amount of lost water in 24 hours is equal to 889 liter which is based on injection of 500 liter in 24 hours. If lost water is used to produce chlorine solution then the correct amount of lost water will be 389 liter in 24 hours.

Schematic Diagram of Under-pressured Hydro Chlorinator:

The purpose of this design is to represent a way to increase pressure for injection of solution to water supply lines. The separating container will be neglected their role is only to prevent from entering water and solution to cylinders.
Water supply pipeline
Inlet branches to apparatus
Right hand injection cylinder (b2)
Right hand motional cylinder (b1)
The lever of mechanism to determine the direction of water movement.
Chlorine solution
Left hand motional piston
Left hand motional piston

Hydraulic Procedure of Apparatus: (Finding):

Branch of water supply line is passed through filter then to four directional water sops which have two modes:

Water current which has a pressure equal to water supply line pressure; introduce it to separating container (figure b1, number4). At the right hand diaphragm of this container, the auxiliary liquid is compressed with the movement of diaphragm and is conducted to motive cylinder (b2) through connecting pipe. Motive piston (b3) will be moved to left hand by auxiliary liquid. Force induced by pipe is enforced on movable piston (b4) and caused auxiliary compression of movable cylinder. Movement of this liquid in the solution separating container caused the movement of its diaphragm. On the other side, the solution diaphragm is compressed according to pressure produced in movable cylinder and is injected to water supply network through one-way valves. The cause of increasing pressure to inject solution is the difference between the level of motional and movable pistons, its calculation is performed in page6.

After cylinder pistons (b1) reach to the end of movement way, four-directed valve water moves toward left hand container to pass water and causes the movement of pistons to right side. In this state, the direct of water current (A1) through four-directed valve water is opened and moves-toward left hand by repulsion pipe A cylinder pistons is returned to A1 separating container and the diaphragm moves it to right hand and chamber conduct its internal water outside the system. As a result some water will be lost. These stages will be continued till the adjusting sop is open and there is water pressure in network. The volume of injection depends on opening and closing rate of adjusting sop.

Apparatus Performance (Conclusion):

This device installed besides a per chlorine container. One branch of network is connected to supply energy. Water current rate is adjustable by manual sop or operator. Through another branch per chlorine solution is injected to water supply line after pressure enforcement.

The volume of inject able solution and the proportion of per chlorine in solution container is determined by computing the water and chlorine amount of network based on special time like 24hours. For example, if db of water is 24hours. 1000m3 (in common conditions 5gr is determined for every m3), the needed chlorine is 5 kg in24hours. It's necessary the whole container volume will be injected to mentioned network during 24 hours. It's possible to use water sop to change the volume and time of solution injection.

This sop will decrease or increase the speed of pistons in the device. Of course, environmental health professionals will determine the amount of remained chlorine at the end of consuming lines by means of work measuring kit.

REFERENCES

Step by step training of hydraulics, translator: Engineer Akbar Shir, Khorshidian, Author: Jemsel. Johmson, publication. Tehran Tarah, data of publication: 2004, first print.

Water and sewage disinfection

Complied by: engineer ahmad Asl Hashemie, the member of scientific board of tabriz medical sciences university, publication: national center of health management program of Tabriz medical sciences university, first print 2003.