A research study entitled

Investigating the impact of Alum ($KAl(SO_4)_2.12H_20$) in reducing the temperature of hot water and reducing waste in water and electricity

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Title of Study:

Investigating the impact of Alum (hydrated potassium sulphate and aluminum with the formula $KAI(SO_4)_2.12H_20$) in reducing the temperature of hot water and reducing waste in water and electricity

Introduction to the problem of study:

In the farm owned by (MOHAMMED SALAH JERIBE) being located in Jazan province, Sabya city, Alhajariyah village where sheep are bred for the purpose of trading and personal interest as well. (Farm Site GPS) (Picture)

In hot weather days and when tap water is used (even indoors), it is very difficult to use it for personal hygiene and for wa
tering animals because the water tanks and pipes are made of iron or plastic, which is heated a lot with high temperature ranging between 40-50 Celsius degree.

But it was noted in an area of this farm, specifically in the small garden of the farm (designated for workers) some small ponds are formed and two ponds of them characterized with cold water when irrigating the garden and farm although the water used for irrigation is very hot at a temperature of 50 degrees sometimes and its source is tanks made of iron which increases the heat of this water.

How can this water be cold though it is very hot at the time of pouring it, and it is also noticeable that these workers use alum for health purposes. They grind it in their garden and then use it in the treatment of sheep in the farm to stop the bleeding injuries caused by animal nails or wounds.

In this research study, we started the search journey first from the farm to find out why the water cooler compared to the rest of the water in the farm, which is characterized by high temperature? Why? Does the source

of water is different (from underground) or rainwater? Or is there a substance (salt) found in these ponds is the cause of cold water?

Suppose that the water in these ponds from groundwater! We also suppose that some kind of material or salts present in this pond (Alum grinded by workers) made the water cooler, if so what is the composition of this material and what is its role in that and how to generalize the benefit on a wider scale to cool the water and then using it easily in the farms and most importantly in homes, schools and institutions and stop wasting in water, which is always when you open the tap for a period to get rid of hot water waiting for cold water somewhat as well as solve the problem of sewage and waste of electricity if the use of cold water from the fridge for personal hygiene. The problem of increasing the temperature of water for personal use is a problem that worries everyone in Saudi Arabia and the Gulf countries.

Problem of study:

The study addresses the problem of (hotness) high temperature of water during summer season in Saudi Arabia, which may reach (40-50 degrees) and reduce waste in water and electricity resulting from this problem.

Objectives :

General objective: To treat the problem of increasing the temperature of water (personal use) in summer and at the lowest cost and stop waste in water and electricity.

Detailed Objectives:

- ☒ Solve the problem of water high temperature in summer using alum (hydrated potassium sulphate and aluminum with the formula $KAI(SO_4)_2.12H_20$)
- ☒ Reduce waste of water and electricity.
- ☒ Provide solutions that are not economically expensive.

Research Importance :

- The study reveals the possibility of using alum as a means to reduce the heat of hot water and solve a problem experienced by Saudi

Arabia in summer where the high temperature leads to very hot water (40-50 degrees).

- Reduce the waste of water that is usually poured from the tap until the hot water is disposed of.
- Reduce waste of electricity when citizens use refrigerated water for personal hygiene.

Scientific Background:

First: With regard to alum:

An alum is a type of chemical compound, usually a hydrated double sulfate salt of aluminium with the general formula $KAI(SO_4)_2.12H_20$)

The most common classification of compounds known as alum is the same as the standard of the elements. It has the general formula A_2 (SO_4) .M2 (SO_4) $_3.24H_2O$, where A represents monovalent cation such as potassium or ammonium, and M represents trivalent metal ion such as aluminum.

Applications

Alum compounds are useful in a range of industrial processes. It is soluble in water, has an acidic taste, astringent, sweetish, reacts with acids, and crystallizes according to octahedron. Potassium alum is the commercially available alum, although other types are also made: semi-soda alum, semi-iron alum, and ammonium alum.

Alum is available in large quantities in Yemen and is among the natural salty stones in some mountains of Yemen and is known as alum. It is also sold in the spices markets to remove sweat and in folk medicine as a treatment for constipation and increase leads to severe constipation and is also used to clean the teeth due to the acidic properties of ammonium sulphate in the compound it has astringent.

Second: Regarding the endothermic reaction in the environment:

The endothermic reaction in chemistry and in thermodynamics is the interaction that needs converting the bonds of interacting or interfering materials into energy greater than the energy of the materials produced from the reaction. Therefore, the interaction requires heat to be given to it from the outside so that the reaction is done. This is why we say it is endothermic reaction, without the heat we provide it, the interaction

does not start and does not continue. The reaction may be done by absorbing heat from the surrounding medium.

Reactors + energy (heat) → outputs
Chemical reactions are described as heat-absorbent when the difference in the (thermal content) enthalpy ΔH° is positive.

Research Question and Hypothesis:

The Question: What is the reason for the coldness of water in bonds of the farm, although the whole farm water is very hot (temperature of 40-50). How to take advantage of the coolness of hot water in homes, schools and others to solve the problem of too hot water and reduce wasting water in search of cold water.

Hypothesis:

Suppose using Alum (hydrated potassium sulphate and aluminum with the formula $KAI(SO_4)_2.12H_20$) as a type of energy-absorbing reaction reduces the temperature of hot water by 13 ° and at a lower economic cost regardless of water source.

Materials and Methods:

In our study and for data collection, we communicated with the owner of the farm (Mr. AHMAD SHWEIHI) and the first secondary school for girls in Sabya and secondary school for girls in Al Farshah which are all located on the same latitude (images via GPS)

and then we moved in three paths:

The first path: to ascertain the source of water whether it is the groundwater or water collected after the rain and certainty of these things was easy because in the same year the owner of the farm conducted a survey of the land through a specialized company to establish an artesian well and then the location of ponds not because of groundwater. Upon reviewing weather reports to track the latest rainfall, it did rain in the period 7l9 - 7l15 to 9l21 -9l27, and then the source of the ponds is not rain.

The second path:

To make sure that Alum (hydrated potassium sulphate and aluminum with the formula $KAI(SO_4)_2.12H_20$) is the material responsible for water coolness and conduct measurements on water samples from the farm water and comparing it with water from the school (first secondary school for girls in Sabya) and then comparing it with farm measurements (AHMED SHWEIHI) and Secondary School for Girls in Al Farsha. We used Globe environmental instruments (temperature, pH, and solubility)

The third path:

To study the practical application for using these in homes, schools and institutions to solve the problem of water high temperature, which is an Arab national problem, as solving this problem stops waste water and maintenance (Note: when using the too hot water in summer season and to get the somewhat cold water, the person opens the tap and makes the water pour to the ground with large quantities to get rid of the hot water coming from the pipes and then use them) in addition to solving the problem of sewage and waste in electricity in case of using cold water from the fridge for personal hygiene.

Through procedures of the second path in this study, we conducted several experiments that included these experiments:

1) Test water solubility in water at temperature (25).
2) Experiments to measure the pH of the solution of water and alum.
3) Experiments to measure the drop in water temperature after melting the alum.

Measures (Procedures):

The first experiment: test the solubility of alum in water at 25 ° C.
Materials :

- Alum (hydrated potassium sulphate and aluminum with the formula $KAI(SO_4)_2.12H_20$)
- Water from the farm as well as water from the school at temperature (25).

Tools: 500ml cup, glass stalk, electronic scale.
Steps - Experiment (1):
• Grind the alum and melt 20 g of it in 100 ml of water and note the solubility.
• Repeat the first step in different quantities and note the solubility and saturation of the solution.
• We try steps first on the farm water and then repeat them on the school water.
• Record data in a special table.
Photos of experiment I

The second experiment: experiments to measure (pH) of water solution and the water at concentration of (1%).
Materials: Alum solution in water at a concentration of 1%
Tools: 500ml cup, glass stalk, ph scale.

Steps - Experiment (2):
• We prepare the alum solution in water (farm water) at a concentration of 1% at 25 °.
• We prepare the alum solution in water (school water) at a concentration of 1% at 25 °.
• We use pH scale to measure the acidity of the solution.

• Repeat the steps and calculate the pH of the solution.
• Record data in a special table

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Photos of experiment II

The third experiment: Experiments to measure the drop in water temperature after melting the alum in it.
The experiment is carried out in two stages: First, measuring the rate of decline on the water of the farm and the second measuring the rate of decline on the water of the school:

Materials :

- Alum (hydrated potassium sulphate and aluminum with the formula $KAI(SO_4)_2.12H_20$)
- Water from tanks of the farm

Tools :

Cup (500 ml) - Thermometer - Tester - Electronic scale - glass stalk.
Steps of the experiment (3):
• Weigh 20 grams of alum using the electronic scale.
• Put 100 ml of water in the cup.
• We measure the water initial temperature and record it.
• Dissolve the material in the water cup.
• We measure the water temperature after melting and record it with the special table.
• Repeat the experiment.

Photos of experiment III

Data Summary:

• Results and data of the first experiment (solubility of alum, in water) in 100 ml of water:

Trial	Alum Mass	Solubility in water of the farm at 25	Solubility in water of the school at 25	Saturation
1	20g	Dissolves strongly	Dissolves strongly	Unsaturated
2	50g	Dissolves strongly	Dissolves strongly	Unsaturated
3	70g	Dissolves strongly	Dissolves strongly	Unsaturated
4	100g	Dissolves strongly	Dissolves strongly	Unsaturated
5	115g	Dissolves by extreme stirring	Dissolves by extreme stirring	closer to saturation
5	120g	Dissolves by extreme stirring	Dissolves by extreme stirring	Saturated
6	125g	Precipitate	Precipitate	Above saturated
7	135g	Precipitate	Precipitate	Above saturated

Solubility of alum in water = 120 g/100 ml water

- Results and data of second experiment (measuring the (ph) & concentration of water solution and alum):

Trial	Ph of (alum solution in the farm water at 25)	Average Ph	Ph of (alum solution in the school water at 25)	Average Ph
1	3.6	3.5	3.5	3.5
2	3.4		3.6	
3	3.4		3.4	
4	3.5		3.4	
5	3.6		3.5	
5	3.4		3.5	

Ph of alum solution in water = 3.5

- Results and data of third experiment A (Farm water):

Trial	Initial temperature	Temperature after adding alum	Ratio of decline
1	50	37	13
2	45	32	13
3	43	28	15
4	40	28	12
5	43	32	10
6	45	30	15

- Ratio of decline: 13 degrees
- Results and data of third experiment (School water):

Trial	Initial temperature	Temperature after adding alum	Ratio of decline
1	43	29	14
2	44	31	12
3	43	30	13
4	49	37	12
5	50	38	14
6	45	32	13

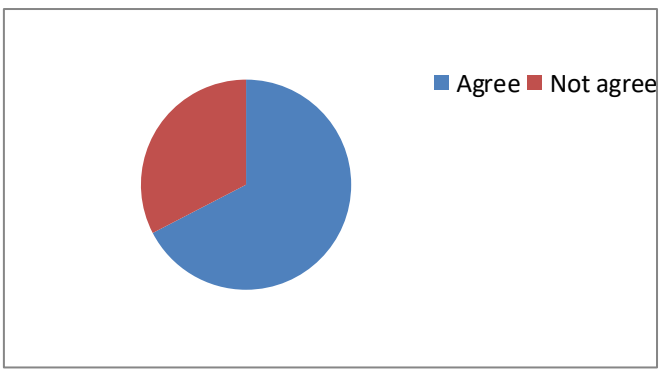
Rate of decline: 13 degrees

One of the procedures is also to identify a questionnaire about the problem as follows:

• The questionnaire was distributed to a sample of 100 persons and the response rate was 100% for age groups of 18-60

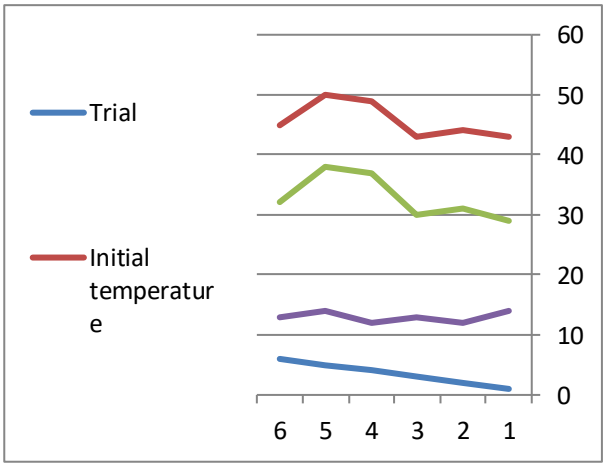
• 67.4% of them think that the high temperature of the water in summer is a problem to be solved and cause waste of water while 32.6 did not care about waste water.

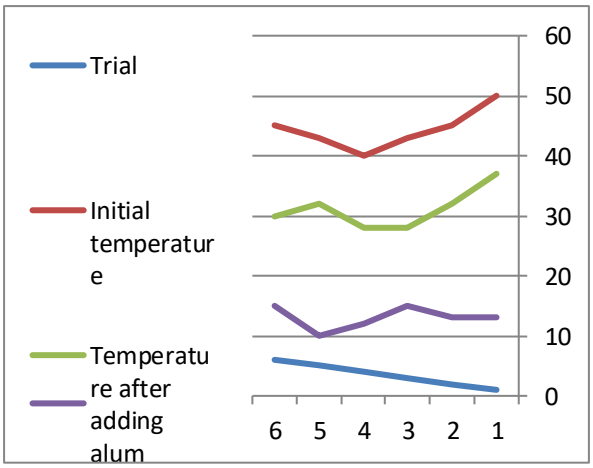
(Graph showing ratios)



Analysis and Results:

From the above data it is clear that:
• Water solubility is approximately 120 grams per 100 ml of water, which is very soluble in water.
• The ph of the alum solution in water is approximately 3.5. Through research and studies, the higher ph of the water, the better the hygiene and health of the body. Acid water is used for household hygiene and household cleaning, so that our use of the water will not have any health damage.
(See http://avb.s-oman.net/showthread.php?t=1323354)
• The rate of decline in water temperature after melting the alum is approximately 13 degrees and is suitable for reliance on it as a way to reduce the temperature of hot water.
• By relying on this method, it will reduce the waste of water and electricity.





By repeating experiments in both (Ahmed Shweihi) Farm and Secondary School for girls in Al Farshah, results were very similar. (photos from the site)

CONCLUSIONS:

From the previous results it is clear that we can rely on alum as a material to help reduce the temperature of water used personally and through previous research of the material we find that alum is suitable for external use and even healthy, and its use in the process of cooling water will reduce waste in water and electricity.

Discussion:

How to use alum in water cooling. This can be done in two ways:
The first is to add alum powder to water in the storage tanks. Although the material is healthy as proven by the studies for external use, we hope to continue the studies to ascertain the feasibility of using it in the water storage and the specified percentages. This is a modest invitation for me to work in cooperation with the Ministry of Water and Health for that purpose. (My next research study will about that)
Second: Use an innovative product (like the one in the picture) by placing a filter (which can be changed from time to time) containing alum powder and provide the schools and houses with this product.



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