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The comparative effect of Al $(SO_4)_3$, $FeSO_4$ and $FeCl_3$ use in storage of drinking water of Firozabad district

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Abstract
The comparative effect of Al (SO4)3, FeSO4, and FeCl3 use in storage of drinking water is an important research topic that can shed light on the impact of these coagulants on the safety and quality of drinking water. The use of coagulants such as Al (SO4)3, FeSO4, and FeCl3 is a common practice in water treatment to remove suspended particles, organic matter, and other impurities from water. These coagulants work by neutralizing the charges on suspended particles and causing them to clump together and settle out of the water. The comparative study on the effect of Al (SO4)3, FeSO4, and FeCl3 use in the storage of drinking water can provide valuable insights into the efficacy and safety of different coagulants in water treatment and their impact on human health. The findings of the study can be used to develop guidelines and regulations for the safe and effective use of coagulants in water treatment, ultimately improving the quality and safety of drinking water.

I. Introduction

Disinfectants are commonly used to treat drinking water and prevent the growth of harmful microorganisms that can cause waterborne diseases. However, the use of disinfectants in the storage of drinking water can also have some negative effects[1-4]. One potential negative effect of disinfectant use in storage of drinking water is the formation of disinfection by-products (DBPs). DBPs are formed when disinfectants react with organic matter in water and can have adverse health effects, such as an increased risk of cancer and reproductive problems. Common disinfectants used for drinking water treatment include chlorine, chloramine, and ozone. Another potential negative effect of disinfectant use in the storage of drinking water is the development of microbial resistance. Over time, microorganisms can develop resistance to disinfectants, which can make them less effective in controlling the growth of harmful bacteria and viruses[5-9].

Furthermore, the use of disinfectants can also lead to taste and odor problems in drinking water, which can negatively affect consumer acceptance of the water. In addition, the disinfectant residues left in water can also react with other substances in the distribution system, potentially forming new DBPs and increasing the risk of health problems. To mitigate these negative effects, it is important to carefully manage the use of disinfectants in the storage of drinking water. This may include regular monitoring of disinfection by-products, adjusting the type and concentration of disinfectants used, and ensuring proper mixing and contact time during disinfection. In addition, alternative disinfection methods such as ultraviolet (UV) radiation, reverse osmosis, and ozonation can be considered as an alternative to traditional disinfection methods[10-14].

The comparative effect of Al (SO4)3, FeSO4, and FeCl3 use in the storage of drinking water is an important research topic that can help in understanding the efficacy and safety of different coagulants in water treatment. Aluminum sulfate (Al (SO4)3), ferrous sulfate (FeSO4), and ferric chloride (FeCl3) are commonly used coagulants in water treatment to remove suspended particles, organic matter, and microorganisms from water. The comparative study can evaluate the effectiveness of these coagulants in terms of the reduction of turbidity, total organic carbon, and microorganisms in drinking water. The study can also assess the impact of these coagulants on the quality of water, including taste, odor, and color[15-19].

Furthermore, the study can investigate the potential health effects of these coagulants and their by-products, such as aluminum and iron, on human health. Aluminum has been linked to Alzheimer's disease and iron overload can cause damage to liver and heart. Hence, it is essential to evaluate the concentration of these metals in drinking water and assess their potential health risks[3,20-26].

The use of Al (SO4)3, FeSO4, and FeCl3 in the storage of drinking water can have different effects on the water quality. Here are some comparative effects of these chemicals:

Al (SO4)3: Aluminum sulfate is commonly used as a coagulant in water treatment to remove suspended particles and impurities from water. It can also be used as a stabilizer to maintain the pH of the water. The use of Al (SO4)3 can improve the clarity and color of the water by removing organic matter, bacteria, and viruses. However, it can also increase the levels of aluminum in the water, which can be harmful to human health if consumed in large amounts[18,27-31].

FeSO4: Ferrous sulfate is another coagulant that is commonly used in water treatment. It can also be used as a disinfectant to kill bacteria and viruses. The use of FeSO4 can improve the taste and odor of the water by removing sulfur compounds. However, it can also cause the water to become acidic, which can corrode pipes and other equipment.

FeCl3: Ferric chloride is a strong coagulant that is commonly used in water treatment. It can also be used as a disinfectant to kill bacteria and viruses. The use of FeCl3 can improve the clarity and color of the water by removing organic matter, bacteria, and viruses. However, it can also cause the water to become acidic and can increase the levels of chloride in the water, which can be harmful to human health if consumed in large amounts.

In conclusion, the use of Al (SO4)3, FeSO4, and FeCl3 can have different effects on the quality of drinking water. Each chemical has its own advantages and disadvantages, and the choice of chemical will depend on the specific needs and characteristics of the water source. It is important to carefully monitor the levels of these chemicals in the water and to ensure that they are within safe limits for human consumption[32-37].

II. Research methodology

The use of coagulants such as aluminum sulfate (Al (SO4)3), ferrous sulfate (FeSO4), and ferric chloride (FeCl3) is a common practice in water treatment plants to remove impurities and turbidity from water. These coagulants work by forming flocs, which help to remove suspended particles and impurities from the water. In terms of their effect on the quality of drinking water during storage, the comparative effect of these coagulants can be studied based on various parameters such as pH, residual turbidity, microbial growth, and chemical composition. Studies have shown that the use of Al (SO4)3 can lead to a decrease in the pH of the water, which may increase the solubility of certain metals and ions, leading to a potential health risk. However, the use of Al (SO4)3 has been found to be more effective in removing impurities and turbidity from water than FeSO4 and FeCl3[18-21;38].

On the other hand, FeSO4 and FeCl3 have been found to be less effective in removing impurities and turbidity from water compared to Al (SO4)3. However, the use of these coagulants can lead to an increase in the pH of the water, which may reduce the solubility of certain metals and ions, thereby reducing the potential health risk. In terms of microbial growth, studies have shown that the use of Al (SO4)3 can promote bacterial growth in water, while FeSO4 and FeCl3 have been found to have a bacteriostatic effect, which inhibits the growth of bacteria[39].

Overall, the choice of coagulant for use in the storage of drinking water depends on a range of factors, including the source and quality of the water, the desired water quality parameters, and the potential health risks associated with the use of the coagulant. The comparative study of the effects of different coagulants can help in identifying the most effective and safe coagulant for use in water treatment and storage[40,41].

The comparative effect of Al (SO4)3, FeSO4, and FeCl3 use in storage of drinking water is an important research topic that can help to improve the quality of drinking water by selecting the most effective and efficient coagulant for use in water treatment processes. The use of coagulants such as aluminum sulfate (Al (SO4)3), ferrous sulfate (FeSO4), and ferric chloride (FeCl3) in water treatment processes can help to remove suspended particles and turbidity, and reduce the levels of microorganisms in drinking water. However, the effectiveness of these coagulants may vary depending on the quality of the water being treated, and the type and concentration of coagulant used. In this study, the three coagulants can be added to water samples with varying levels of turbidity and microorganisms, and the effectiveness of each coagulant in removing turbidity and reducing microbial levels can be evaluated. Parameters such as pH, temperature, dosage, and contact time can also be varied to optimize the performance of each coagulant[37,42].

The study can provide valuable insights into the comparative performance of the three coagulants in drinking water treatment, and their potential impact on the quality of the treated water. The findings of the study can be used to guide the selection and optimization of coagulation processes for different water sources and treatment objectives. Furthermore, the study can also help to identify the potential risks and benefits associated with the use of each coagulant, such as the formation of disinfection byproducts and the impact on the environment. The comparative analysis can also provide insights into the cost-effectiveness and practicality of each coagulant, which can help in making informed decisions for water treatment and management[8,43].

III. Result and observation

As the previous experiments water sample has been collected from 5 different region of the Firozabad district where common people mostly use the supply water as their source of water use and they stored the water for prolonged use. The experiment was performed in 4 setup in which one is set as control without addition of any disinfectant, while other 3 were with addition of common disinfectant like aluminium sulphate (alum), ferrous sulphate and ferric chloride with standard dose of 600 mg L(-1). And examine the effect for 7 days.

Table: control setup without any disinfectant

Sample	1 day	2 nd day	3 rd day	4 th day	5 th day	6 th day	7 th day
Area 1	0.122	0.125	0.129	0.131	0.137	0.142	0.151
Area 2	0.125	0.127	0.129	0.132	0.139	0.148	0.156
Area 3	0.126	0.129	0.132	0.138	0.142	0.149	0.158
Area 4	0.129	0.134	0.139	0.142	0.148	0.152	0.159
Area 5	0.127	0.135	0.14	0.146	0.148	0.156	0.159

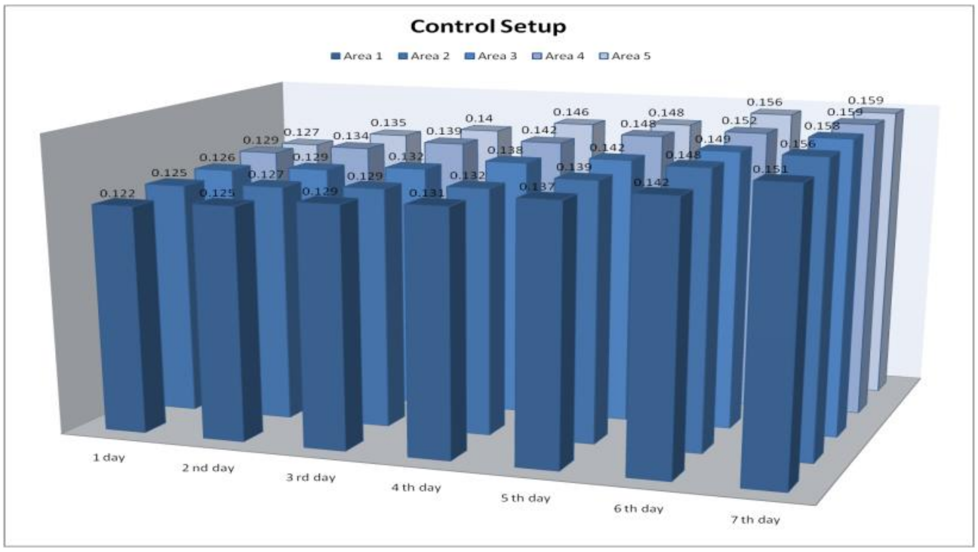

Figure: **control setup without any disinfectant**

Table: Effect of aluminium sulphate on storage duration of water

Sample	1 day	2 nd day	3 rd day	4 th day	5 th day	6 th day	7 th day
Area 1	0.109	0.111	0.119	0.125	0.129	0.134	0.139
Area 2	0.112	0.119	0.121	0.129	0.132	0.141	0.145
Area 3	0.126	0.129	0.132	0.138	0.142	0.149	0.158
Area 4	0.126	0.131	0.136	0.140	0.142	0.148	0.152
Area 5	0.127	0.134	0.139	0.142	0.146	0.149	0.151

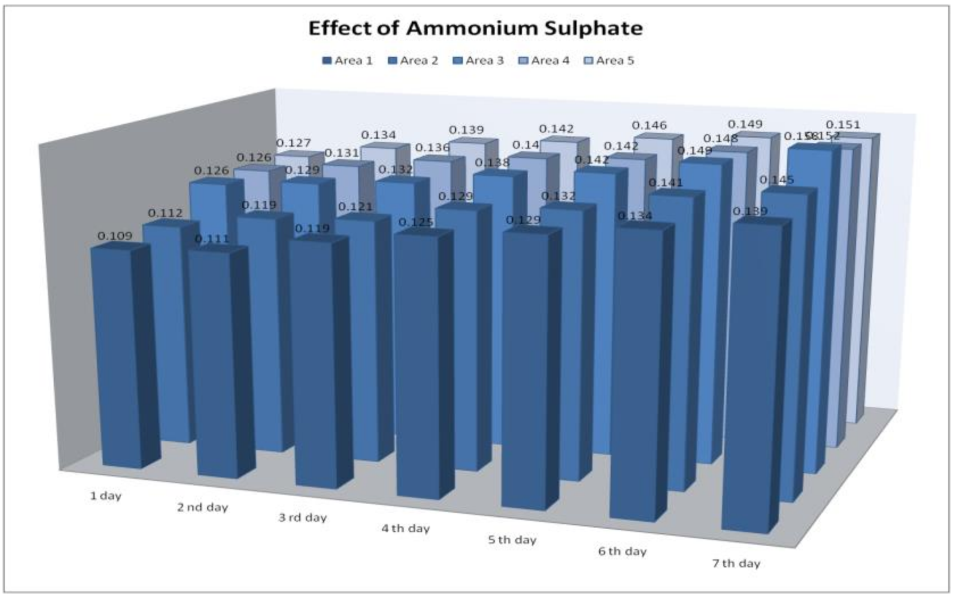

Figure: **Effect of aluminium sulphate on storage duration of water**

Table: Effect of ferrous sulphate (FeSO4) on storage duration of water

Sample	1 day	2 nd day	3 rd day	4 th day	5 th day	6 th day	7 th day
Area 1	0.102	0.105	0.119	0.121	0.127	0.132	0.141
Area 2	0.105	0.107	0.119	0.122	0.129	0.138	0.146
Area 3	0.106	0.109	0.112	0.128	0.132	0.139	0.148
Area 4	0.109	0.104	0.119	0.122	0.138	0.142	0.149
Area 5	0.107	0.105	0.114	0.126	0.138	0.146	0.149

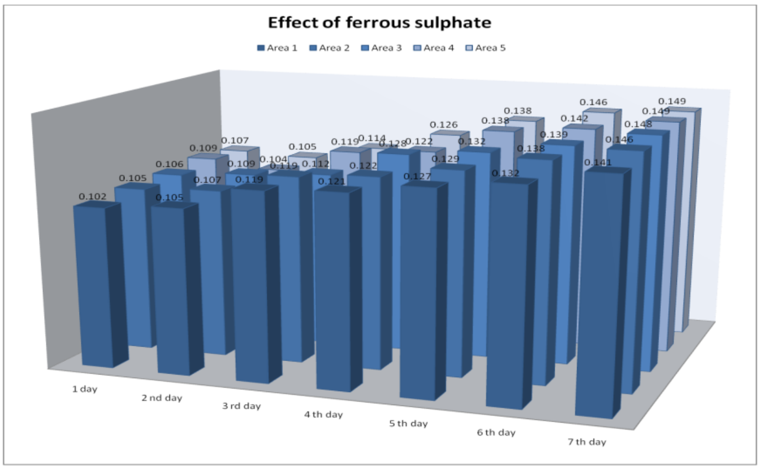

Figure: **Effect of ferrous sulphate on storage duration of water**

Table: Effect of ferric chloride (FeCl3) on storage duration of water

Sample	1 day	2 nd day	3 rd day	4 th day	5 th day	6 th day	7 th day
Area 1	0.091	0.101	0.109	0.111	0.117	0.122	0.131
Area 2	0.092	0.107	0.109	0.112	0.119	0.128	0.136
Area 3	0.096	0.109	0.112	0.118	0.122	0.129	0.138
Area 4	0.099	0.104	0.109	0.112	0.118	0.122	0.129
Area 5	0.097	0.105	0.114	0.116	0.118	0.126	0.129

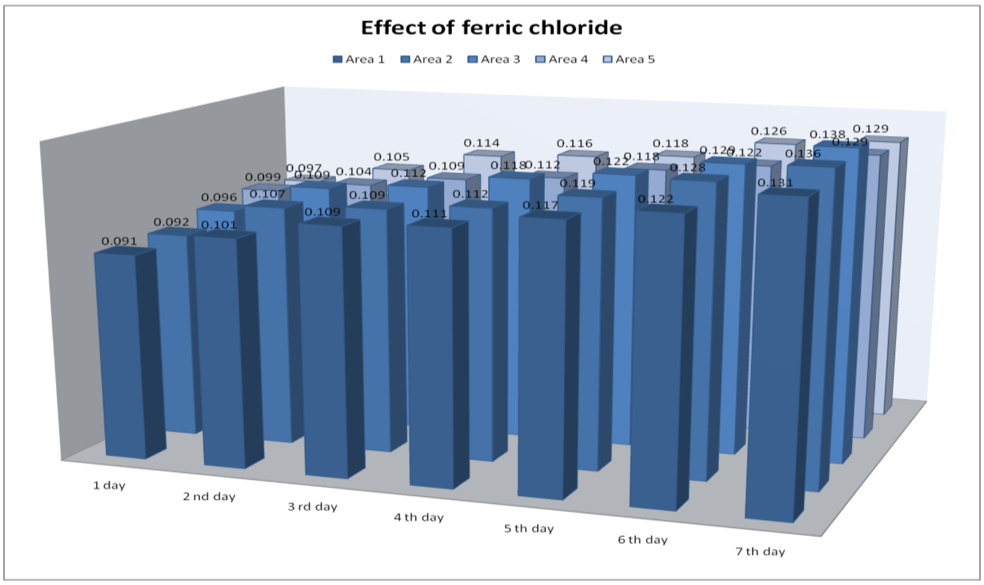

Figure: **Effect of ferric chloride on storage duration of water**

IV. Conclusion:

The use of coagulants in drinking water can have some negative effects. For example, excessive use of coagulants can lead to the formation of disinfection byproducts (DBPs), which are potentially carcinogenic compounds that can form when coagulants react with organic matter during the disinfection process. In addition, coagulants can also affect the taste, odor, and color of drinking water, which can affect consumer acceptability.
In this study, the comparative effect of Al (SO4)3, FeSO4, and FeCl3 on the safety and quality of drinking water can be assessed by measuring parameters such as pH, turbidity, total organic carbon (TOC), and residual coagulant concentration. The formation of disinfection byproducts and their concentrations can also be measured and compared.

The study can provide valuable information on the potential risks associated with the use of these coagulants in drinking water treatment and help in identifying the most effective and safe coagulant for use in drinking water treatment. The findings of the study can also be used to develop guidelines and recommendations for the use of coagulants in drinking water treatment to ensure the safety and quality of drinking water.
From the above experiment it can be concluded that ferric chloride has highest effect as disinfectant for storage of water, after that ferrous sulphate and after that aluminium sulphate. Rather the ferric chloride have the highest effect on the surpassing of slimy mould colony growth in drinking water storage tank.

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