

Difference Between Coagulation and Flocculation in Water Treatment

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Key Difference - Coagulation vs Flocculation in Water Treatment

Water treatment is an important aspect which involves many different steps. Since water treatment is a very sensitive and important process it requires the presence of both physical and chemical processes. Restoration of water quality is assured during water treatment. Coagulation and flocculation steps are important aspects in the context of water treatment since it allows the separation of suspended particles present in water effectively. In coagulation, the process involves the utilization of a coagulant that has the ability to destabilize the charged particles which are nonsettling whilst flocculation involves a similar destabilization process that is achieved through physical mixing and by adding organic polymers. The **key difference** between coagulation and flocculation in water treatment is that the **coagulation is a chemical process while flocculation is a physical process**.

What is Coagulation?

Coagulation, in simple terms, is referred to as curdling or clotting. In the chemical aspect, it could be explained as a process by which destabilizes the charges of particles which are not settling down. This is an important step in many different biochemical processes. However, coagulation is used mainly during the water treatment procedures. Coagulation could be achieved simply by adding a coagulant to the medium. This causes the clumping of particles. In respects to the chemistry of this procedure, adding a coagulant destabilizes the particle's charges. This is achieved by adding a coagulant that possesses an opposite charge to that of the suspended solids.

This neutralizes the charge on different particles which are nonsettling which includes clay and other organic substances suspended in water that increases the turbidity water. Coagulants include inorganic salts of aluminum or iron. Examples are aluminum sulfate, aluminum chloride, alum and ferric sulfate. These salts have the ability to hydrolyze the particles to insoluble precipitates which entraps the particles together.



Figure 01: Coagulation in Water Treatment

Once the coagulants are added and the charges of the particles are neutralized, it allows the particles to interact with each other and stick together. These joined particles are referred to as microflocs. But these particles are not visible to the naked eye. This step is followed by flocculation.

What is Flocculation?

Flocculation involves the formation of flocs. This is mainly achieved through the physical and mechanical process that is involved with the already coagulated clumps to join together. This results in the formation of large masses of flocs which initially appear as a cloud and then converted into a precipitate. Flocculation is an important step in water treatment procedures which is always followed by coagulation step.

During the flocculation procedure, the solution which is coagulated already is mixed gently. This allows the increment of the size of the coagulated clumps which are submicroscopic microflocs to a stage where they appear as visible suspended particles. Therefore the large clumps or the large precipitate could be easily separated and removed from the medium. The slow mixing procedure of flocculation allows the contact of microflocs with each other which induces inter-microfloc collisions.

These collisions induce the formation of bonds between microflocs and results in the formation of larger particles which are visible. When mixing continues, the floc size gradually increases. This process is assisted by the addition of organic polymers that possess high molecular weight. These are also referred to as coagulant aids. The addition of organic polymers results in different aspects. This allows the bridging and strengthening the floc which increases the weight of floc while also increasing the rate of settling.

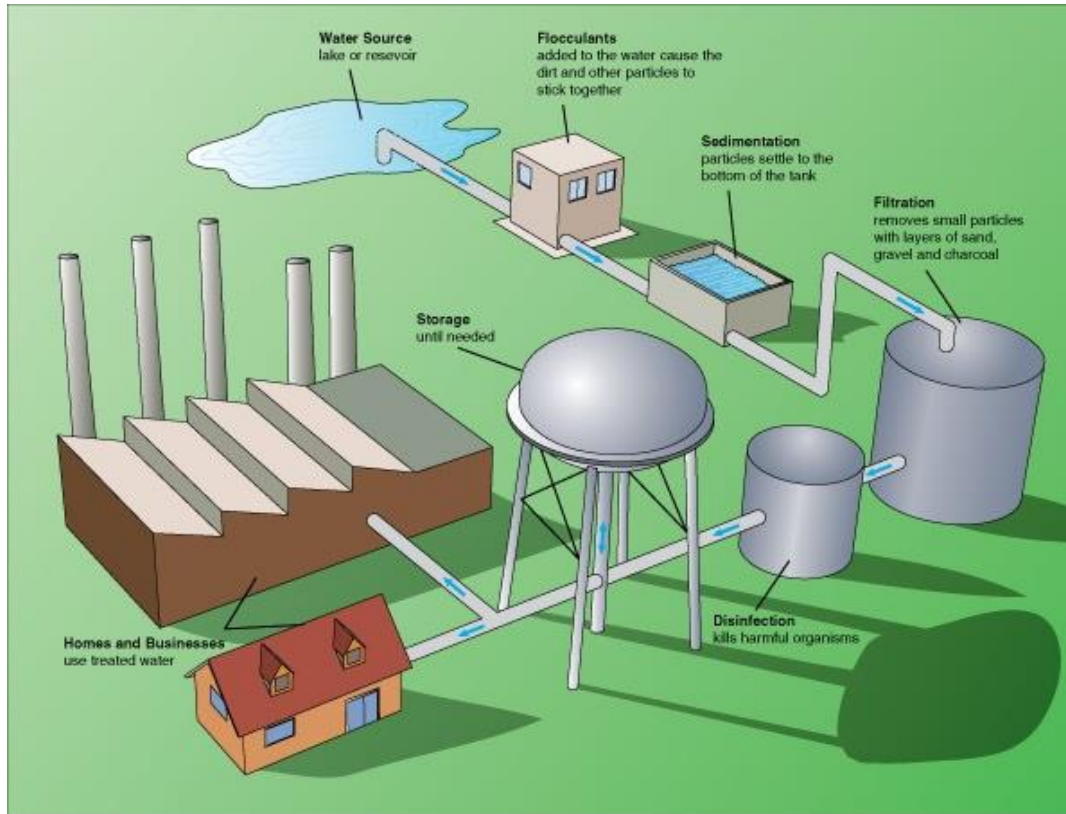


Figure 02: Drinking Water Purification Process

Flocculation is completed once the floc reaches its optimum strength and size. This usually takes an hour depending on the size of the medium. Once flocculation is completed, the water is eligible to undergo separation processes.

What are the Similarities Between Coagulation and Flocculation in Water Treatment?

- Coagulation and flocculation are two main and important steps in drinking and wastewater treatment.
- Both processes involve the union of different suspended particles together.

What is the Difference Between Coagulation and Flocculation in Water Treatment?

Coagulation vs Flocculation in Water Treatment	
Coagulation is an important step in water treatment which involves the addition of a coagulant to enhance the clotting of suspended particles in water.	Flocculation is another important step in water treatment which involves the formation of visible flocs by mechanical or physical mixing.
Process Type	
Coagulation is a chemical process.	Flocculation is a physical process.

Added Compounds	
Coagulants such as inorganic salts of aluminum or iron that neutralize the suspended particles are added during coagulation.	Flocculant such as an organic polymer that is added which involves bridging and strengthening the flocs that also increase the weight of the flocs and also increase the rate of settling.
Physical Mixing	
Coagulation does not involve physical mixing process.	Flocculation involves physical mixing.

Summary - Coagulation vs Flocculation in Water Treatment

Treatment of water is a very sensitive and important process. It requires the presence of both physical and chemical processes. Coagulation and flocculation steps are important aspects in the context of drinking and wastewater treatment since it allows the separation of suspended particles present in water effectively. Coagulation is a chemical process and flocculation is a physical process, In coagulation, the process involves the utilization of a coagulant that has the ability to destabilize the charged particles which are not settleable whilst flocculation involves a similar destabilization process that is achieved through physical mixing and by adding organic polymers. This is the difference between coagulation and flocculation.

Reference

- 1.“Flocculants & Coagulants.” ChemTreat. [Available here](#)
- 2.“Coagulation-Flocculation.” Coagulation-Flocculation | SSWM. [Available here](#)

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- 1.'The coagulation and filtration processes at a drinking water treatment plant. (14868618507)' By USEPA Environmental-Protection-Agency . (Public Domain) via [Commons Wikimedia](#)
- 2.'Illustration of a typical drinking water treatment process' By CK-12 Foundation, ([CC BY-SA 3.0](#)) via [Commons Wikimedia](#)

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