# TO STUDY FLOC GROWTH CHARACTERISTICS


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**Abstract:-In growth of floc in flowing suspension is limited by hydrodynamic forces responsible not only for the formation but also for their destruction. In the different study of optimization of parameter like floc size, grow rate, strength factor, formation time, breakage factor and recovery factor by differentresearcher. The fallowing representation of the pages are on the study of different researchers on their different research on the coagulation and flocculation.**

**Keywords**: Coagulation and flocculation process; jar test; coagulants.

## INTRODUCTION

Raw surface water contains dissolved and particulate Natural Organic Matter,Which deteriorates water quality. To deal with drinking water quality standards and regulations, natural organic matter must be removed from the raw water. The presence of natural organic matter in water by itself is not harmful when it is consumed, however its removal from the water is necessary to avoid materials usedwhich results in formation of disinfection by-products that have adverse effect on human health.In many surface water treatment plants for potable water production, coagulation and flocculation processes are used as an essential step to get rid of NOM.

**coagulation** is a process of removing natural organic matter and colloids by particle destabilization by double layer compression or charge neutralization of colloids and/or NOM within coagulant precipitates Since colloids in water mostly contain negative charges, coagulant with higher positive charge are mostly added to the water to destabilize the NOM and colloids to form aggregates. This step is followed by slow conciliate agitation to form larger aggregates called flocs.

It is practically important to study properties of flocs and factors that impact their strength and structure to obtain efficient removal of organic matter from the water.In this study, floc characteristics and mechanisms affecting floc strength and structure will be assessed.

The commonly used metal coagulants fall into two general categories: those based on aluminium and those based on iron. This paper deals with the aluminium based coagulants, hence these will be described further. The most widely used metal coagulant is probably the aluminium sulphate (“alum”), which has been used for water treatment during the past decades.Pre-hydrolysedcoagulants such as polyaluminumchloride (PACl) have been known for many years (e.g. Bottero et al., 1980) and their use in water treatment has been investigated in many previous studies (Dempsey et

al.,1984; Gray et al., 1995; Matsui et al., 1998; Xiao et al., 2008;

Hussain et al., 2013).It is supplied as powder or in liquid form and its applications include water or waste water treatment.

## LITERATURE REVIEW

Floc parameters

**a**) Floc strength factor and recovery factor

The floc strength factor is a measure of floc strength by exposing the floc to single level of increased shear rate within the containing vessel and comparing the floc size before and after breakage. The floc recovery factor is an indication of the extent to which the floc size recovers during re-growth phase after breakage (Jarvis et al., 2005a; Wang et al., 2009; Zhao et al., 2011a). The floc strength factor is calculated based on the relative decrease in size after breakageby application of a higher shear (i.e., more vigorous mixing), while the recovery factor is calculated based on the floc size to which the floc re-grows after the shear rate slows down to the initial shear (i.e., after the more vigorous mixing is stopped) (Francois,1987). The floc strength factor and recovery factor are dependent on the mixing conditions so thatthey can only be used to compare flocs (from different coagulant and water type) under application of equivalent mixing intensity (Burton, 2009).

Floc strength factor = (d2/d1) X100

Floc recovery Factor = [(d3-d2)/(d2-d1)] X 100

Where d1 is the average steady-state floc size before breakage, d2 is the average size at the end of the breakage phase and d3 is the size after re-growth.

**Floc Size**

Many different measurements have been chosen as the representative characterisation of floc size. A simple measure of floc size is the floc longest dimension. On its own this measurement is of limited use as it only gives an indication of floc size in one dimension. This also allows an indication of the flocheight: width ratio and gives an indication of floc shape. Typically, when referring to floc size a floc equivalent diameter measurement is made

(Cousin and Ganczarcyk, 1998). The use of equivalent diameters allows the particle to be defined as a sphere or circle that is in some way equivalent to the particle. Such a standardised measurement allows a comparison to be made between very irregular forms. However, unless the particle being measured is a sphere, then each of these different diameters will take a different value for the same particle. Rather than an absolute value, equivalent diameters should be used for comparative purposes. For this reason it is important that the choice of equivalent diameter remains the same when comparing floc size.

**Growth rate:-**floc formation process can be departed three regions – lag region, growth region and steady state region. In the lag region, coagulants come to contact and react with but floc growth is so small that floc size does not increase much in this region. The growth region ofcoagulation curves describes the stage where the floc size increases significantly. A steady-state region of constant floc size is reached after a few min slow stirring. This region is generally thought to reflect a balance between floc growth and breakage at a given shear rate. In this study, four parameters were performed to analyze the floc formation process. These parameters included the lag time in the lag region, the grow time and grow rate in the growth region, and the floc size in the steady state region. The lag time and the grow time can be gotten directly from the coagulation curves. The growth rate can be gotten by calculated the data in the growth region. In the growth region, the growth rate, which is noted as the linear portion, reach a constant value. A best-fit line can be

constructed for the ratio curve, from which the grow rate can be determined as:

**Grow rate = Δtime / Δsize**

The floc size was the mean value of floc size obtained over the steady state region.

## Methods for determining floc growth parameters:-

Farrow and warren (1993) have divided some of the methods used for characterizing aggregate particle size into a number of separate categories: Microscopy, Photography and image analysis, Light scattering and Transmitted light. Microscopy is one of the most widely used technique for measuring particle size (Allen, 1997).Aggregate size is estimated by reference to a graduated eye piece gratitude or by placing flocs in cells with background grids or gases of a known size. In some studies, a cover slip is placed over the sample floc as it removes depth of field problems (Cornelissen, 1997; Da matta, 2001).According to Jarvis et al.(2005), microscopy, image analysis, and small angle light scattering (SALS) methods are the most commonly used methods in measuring floc size. Microscopy is one of the commonly used floc sizing methods and carried out by carefully dropping a small sample of the suspension onto a microscope slides and putting it under microscope. Image analysis and photography asses the floc size by capturing the image of flocs in suspension by focusing on a plane at short distance (0.3 – 1 cm) behind the wall of the tank containing the suspension.Light scattering is a particle sizing method where some of the light (emitted from a laser) passed through a suspension is absorbed by the particles in suspension while some of the light is scattered.Another technique that has been used extensively to monitor the size and growth of floc suspensions is the photometric dispersion analyser (PDA). First described by Gregory (1985), the PDA gives a combined measurement of the particle size and frequency for a flocculating suspension.

## Conclusion:-

1)The coagulation experiment using aluminium sulphate and ferric chloride indicated that coagulation process effectively removed turbidity from water sample. The highest turbidity removal efficiency was within 97.4-98.64% and 97.6-98.32%, respectively for alum and ferric chloride over the applied range of turbidity.

2) Continuous dosage of alum caused larger sized of flocscomparing with one time dosage. However the regrowth floc for made by continuous additional dosage where a little smaller than that for made by one time additional dosage.

3) The size distribution of flocs before breakage and after regrowth in same $d_{50}$value was nearly the same so it was definite that the size distribution of flocs was not crucial for the growth or connection of flocs.

4) Microscopy is the most time consuming requiring considerable sample preparation and analysis time in order to achieve.

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