

Dear Water Warriors,

Green Chemistry is a dream. Chemicals may have their risk but are very important to our objectives and thus friend of a process designer to achieve treatment objectives.

Boilers and other heat transfer equipment need protection from the wrath of Pure water; Hungry to eat anything. Knowledge of Langlier Saturation Index thus essential to know it's mood.



This issue of 'Waughter', we detail the Chemistry Integration with Mechanical know-how.

**Nidhi Jain**  
**Editor Waughter**

## Q. What is Role of Chemicals ?

Wastewater treatment involves several stages including processes that are mechanical (physical)-based, biological-based, chemical-based, as well as membrane (filtration) processes.

'Chemical treatment' is an umbrella term that refers to a number of different ways of treating wastewater process, and the chemicals used in wastewater treatment vary from method to method.

Chemicals are wonderful !! they **add value** to the CAPABILITY of a water treatment engineer and therefore this competence is a must in the armoury of all water and wastewater professionals.



In this edition we cover up the Internal Conditioning and role of Chemicals in water management which include following points:

**Q. Why Internal Conditioning?**

**Q. Role of LSI**

**Q. Antiscalant Significance in RO**

**Q. Need of SMBS in RO Operation**

**Q. Flocculant Role & Use**

**Q. Cooling Water Treatment**

**Q. Boiler Water Treatment**

**Q. Handling Polyacrylamide**

## Why Internal Conditioning ?

Internal treatment or conditioning is the conditioning of impurities within the system.

An internal treatment is accomplished by adding a proper chemical to feed water for below mentioned process like :

To precipitate the scale forming impurities in the form of sludges, which can be removed by blow-down operation.

After precipitation it also convert them into compounds, which will stay in dissolved form in water and thus do not cause any harm.





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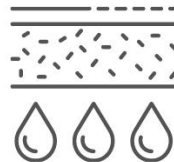
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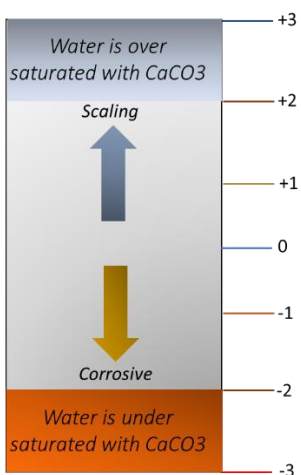
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## Role of LSI

It is an approx. measure degree of Saturation of Calcium Carbonate in water. It predicts the nature of water as scaling or corrosion. It is calculated using pH, Alkalinity, Hardness, TDS & Temperature. The LSI Calculator is available at “Waughter” app <https://waughter-c5f51.web.app/>



Langelier Saturation Index (LSI) is a set of water parameters that provide stability to the water by being used as an indicator of the corrosivity of the feed water.

LSI is calculated as  $LSI = pH_a - pH_s$

Where,  $pH_a$  is the actual pH, and  $pH_s$  is the pH of the sample water.

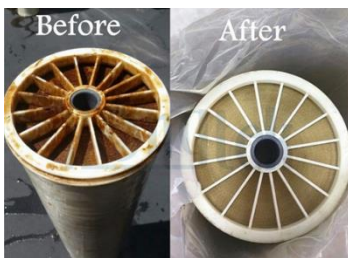
The result is an index of the tendency of calcium carbonate to deposit or dissolve.

If the LSI is positive, calcium carbonate tends to deposit.

If the LSI is negative, effluent is termed as corrosive.

## Antiscalant Significance in RO

Antiscalant chemicals are used in RO to prevent the scaling & Fe, SiO<sub>2</sub> fouling of the RO membranes.



Scaling in RO may consist of mineral fouling such as calcium sulphate, calcium carbonate, barium sulphate, silica, calcium fluoride, and strontium sulphate.

The Antiscalant dosing should be done before reaching the RO membranes to break up sulphate precipitates, calcium carbonate, and other mineral fouling.

It is the preferred pre-treatment method for water systems due to its unmatched effectiveness in reducing membrane fouling.

Antiscalant chemical is used to process very poor-quality feed water at very high rates of recovery.

Antiscalant dose shall be lower for higher recovery and as a rule of thumb feed in ppm shall be such that 20 ppm antiscalant is available in reject.

## What is the need of SMBS in RO?

SMBS is a chemical compound with the chemical formula Na<sub>2</sub>S<sub>2</sub>O<sub>5</sub> that has a reduction ability. Thus, it is used to remove residual chlorine in water/wastewater and industrial applications.

It is also used as an oxygen scavenger in boiler water treatment. In the food industry, SMBS is used as a preservative.

The most critical role of SMBS is dichlorination. SMBS can be considered an essential chemical for RO processes.



sodium metabisulfite

However, some adverse effects have been also reported for SMBS.

For example, it was reported that under specific conditions, i.e., heavy metals, dissolved oxygen, etc. SMBS degrades RO membranes, or it triggers biofouling when overdosing.

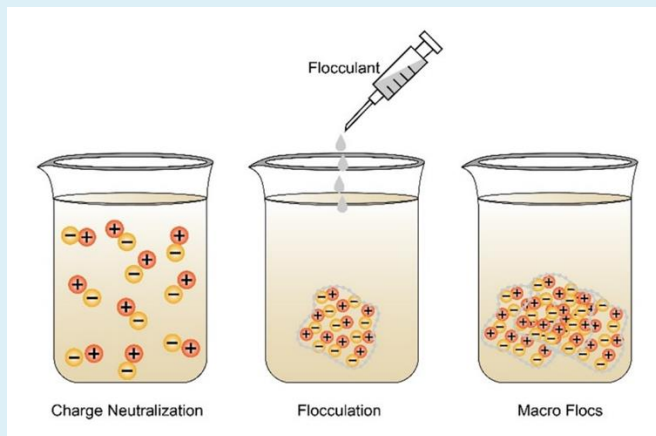
## Flocculant Role & Uses

**Flocculants Bridge the Gaps and make a particle Bigger.**

Flocculation is a water treatment process where solids form larger clusters, or flocs, to be removed from water.

This process can happen spontaneously, or with the help of chemical agents.

In Short, the prime purpose of flocculation is not to directly reduce turbidity or suspended solids, but to prepare the solids for subsequent removal.



Flocculants are divided into inorganic flocculants, organic synthetic polymer flocculants, natural polymer flocculants, and composite flocculants.

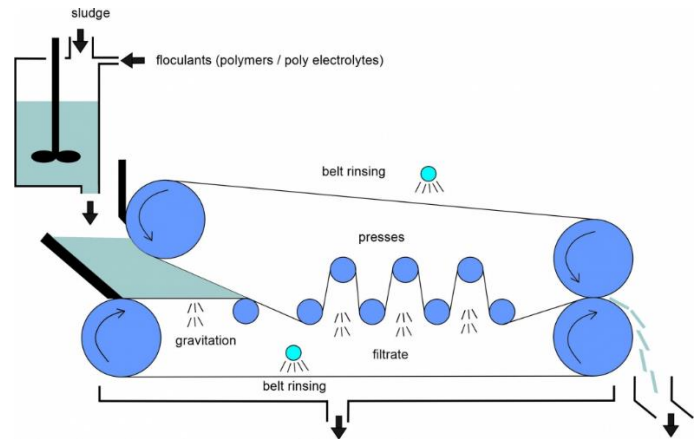
Polyelectrolyte is widely used flocculant for industrial applications. Two main application of Poly is :

1. Solid Liquid Separation in Clarifier
2. Drainage Aid for Centrifuge & Filter Press

Poly is widely used in wastewater treatment plant for process of Solid liquid Separation. Effluent gets mixed with Coagulant and flocculant to form flocs of impurities like TSS, COD etc.

It is also used for dewatering in centrifuge operation and in Filter Press.

Below is diagram of a belt filter press separation of a solid and a liquid from a suspension (a mixture of a liquid with a powdery substance). (Paper Industry)



In many applications, flocculants (polymers / poly electrolytes) are used to cause smaller suspended particles to clump together into larger particles that are also referred to as flakes.

These flakes are easier to separate from the water and are better captured between the relatively coarse filter bands (filter cloth) in a press.

Before dewatering, the suspension (sludge) is “mixed” with the flocculant, so that sludge flakes are formed, which can be easily separated from the water fraction and can be pressed between the filter belts.

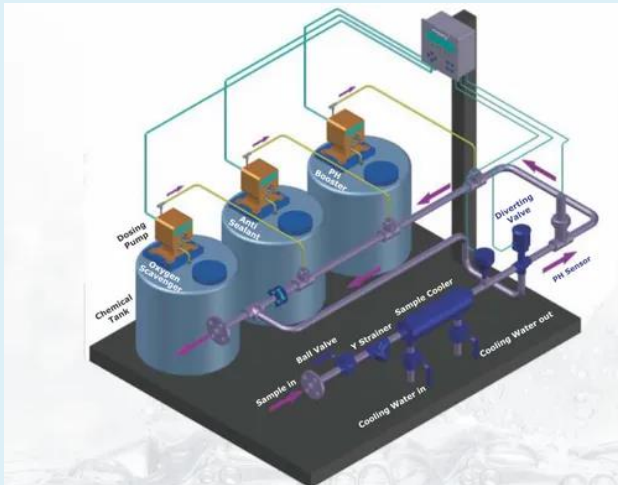
Flocculant is added using a dosing system that is part of the installation.

The flocculated suspension is poured onto the horizontal filter (or sieve) belt. Adjustable guide plates on both sides of the belt ensure that the sludge cannot slip off the belt. This is where the first separation of the sludge and (free) water takes place.

The water released from the sludge, the so-called filtrate, passes through the filter belt under the influence of gravity and is collected in a container.



## Cooling Water Treatment



When microbiological growth, corrosion and deposition occur in industrial cooling water systems, they can lead to flow restrictions, reduced operating efficiency, higher maintenance costs and unscheduled outages.

To help maintain the reliability and performance of industrial cooling water systems chemicals are used in cooling tower.

Some of chemicals that are widely used in Cooling tower are sodium bromide solution in conjunction with sodium hypochlorite, Biocides, Oxidising biocides etc.

Biocides can be divided into 2 main group i.e; oxidising biocides and non-oxidising biocides.

Oxidising biocides simply oxidise microbial cells and will kill most micro-organisms including bacteria, algae, fungi, and yeasts.

Non-oxidising biocides kill microorganisms typically by disrupting the organism's metabolism or damaging the cell wall.



Above picture shows scaling in cooling tower.

## Boiler Water Treatment

The primary purpose of boiler water is to produce high-quality steam, which allows the boiler to transport heat throughout an entire facility.

Water quality is of the utmost importance in proper and safe boiler operations. An improperly treated feedwater system can result in the scaling of the boiler internals, safety equipment and auxiliary piping.

Such corrosion can lead to thermal fatigue, reduced boiler efficiency and ultimately, boiler failure in severe cases.

The two types of treatment for boiler water include external treatment and internal treatment.

With external treatment, the impurities are reduced or removed entirely from the water once the water has been taken outside of the boiler.

Internal treatment of boiler water, process calls for the conditioning of the impurities within the water, which means that the water is softened with softening chemicals like sodium phosphate and soda ash.

The main purpose of internal treatment is to properly reduce hardness, sludge, and scavenge oxygen in the feed water.



## Polyelectrolyte Application

Confirm the best Poly – Cationic, Anionic or Non Ionic for your application along with optimal dosage through the Jar- test.

Prepare the solution with 0.1-0.2% concentration, the neutral water with salt (some TDS) is better.

The product can be evenly spread into the mixing water, increasing the temperature appropriately (less than 60°C) can accelerate the dissolving speed (stirring time is about 40 minutes).

The PAM powder can be packed in a kraft paper bag with an inner plastic bag. 25kg/bag.

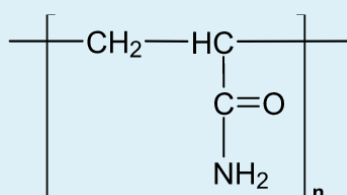
This product is easily absorbent, it should be stored in a cool and dry place after being sealed, the temperature is lower than 35°C.

Avoid spreading PAM on the ground, it becomes slippery after moisture absorption.

We should put the PAM into the stirring and dissolve evenly avoiding caking. the solution should be prepared under a suitable temperature, avoiding long-time mechanical shear. Suggestions stirring speed is about 60 – 200 /min, otherwise, it will lead to degradation, affecting the use result.

The PAM solution should be prepared when using, if the solution can not be used for a long time, its performance will be reduced gradually as water quality situation.

It will destroy the formed flocs if the time is too long to mix the wastewater strongly after adding the PAM solution into the wastewater.



## जल जीवन जननी !!



## Our World is Waughter

The technical knowledge share attempt of Aktion Consultancy and the contents in the magazine shall be qualified by Sanjeev Srivastava our Technology Lead.

Our next edition focuses on: “Waste Water Treatment Plant Design – Potato Chips Manufacturing”

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