**MILANCO INDUSTRIAL CHEMICALS**

**WASTE TREATMENT SEPARATION TECHNOLOGY**

Let's talk a little about where Liquid Solids Separation technology can be used and the technology itself.

## *TECHNIQUES FOR REMOVING UNDISSOLVED CONTAMINANTS FROM WATER*

The following example illustrates some basic ways our prospects separate contaminants from water.

Imagine adding instant hot chocolate mix and marshmallows to a cup of hot water. Some solids are readily dissolved and some are not. Momentarily stir the imaginary contents then let the cup stand.

The marshmallows float to the surface of the mixture. Flotation is one way to achieve separation of undissolved solids settle to the bottom of the cup. Settling or sedimentation is another way of separating undissolved solids from a liquid.

Pour the hot chocolate through a coffee filter. Filtration is yet another way of separating undissolved solids from a liquid.

Industry uses flotation, sedimentation and filtration to separate undissolved contaminants from volumes of dirtied water.

**Milanco** waste water treatment products help these techniques work better.

## *TECHNIQUES FOR REMOVING DISSOLVED CONTAMINANTS*

But what about dissolved solids? If we had removed all of the undissolved solids in our imaginary cup of instant hot chocolate, it would still taste more like hot chocolate than water. We know that there are some dissolved solids still in the water.

There are techniques for removing dissolved contaminants from dirtied water. Sometimes dissolved solids can change to their undissolved form and be removed as described above. This is called precipitation and it can render the contaminant harmless.

Some dissolved solids and other forms of contamination can be removed from the water only by biologically changing them to a harmless state. Municipal treatment plants usually perform this service because it's too costly and impractical for each industrial generator to do it.

***BASIC TECHNOLOGY***
***PRECIPITATION-COAGULATION-FLOCCULATION-CLARIFICATION***

There are basic technical explanations of the physical and chemical elements that you will be exposed to.

Our chemical objective is to enhance the separation and removal of undesirable suspended solids from water. The industrial plant must have a system that, at some stage, allows those suspended solids to be separated by flotation, sedimentation, or filtration. Usually these techniques clarify the water.

Problem solids may initially be dissolved or undissolved in the water. However, they can be removed only if they are in their undissolved state as particulates or suspended solids. Treated water clarity might tell us how effectively the chemicals are working, but only lab analysis can tell us levels at which contaminants remain.

Let's generalize the **Milanco** technical approach:

"Chemicals for precipitation, coagulation and flocculation greatly enhance the clarification of suspended solids-laden waters in sedimentation or flotation systems."

- Precipitation
- Coagulation
- Flocculation
- Separation
- Clarification

But what do these terms mean? Let's explore them a little more in depth to get a feel for just what it is that we have and what we are trying to achieve.

## PRECIPITATION

Dissolved solids can change to their undissolved form in a process called *precipitation*. The precipitated, undissolved solids are called particulates or suspended solids.

Water in which all the solids are dissolved will appear to be clear. The appearance of the solution of partially or totally precipitated, undissolved solids will vary. It could be slightly hazy to milk white/chocolate in clarity and have a water-thin to milkshake-thick consistency. Particulates can be any color.

Why would dissolved solids change to their undissolved state? What causes *precipitation* to occur?

For our purposes, the addition of a chemical precipitant like sodium hydroxide, lime, or sulfuric acid, will change the pH of a solution of dissolved solids. Simultaneously, a reaction which yields the undissolved form of the solids occurs.

## COAGULATION

Some solids, like sand and gravel, will settle very quickly in water. And some, like the marshmallows in our cocoa example, float readily. In general, solids heavier or denser than water sink in it and solids lighter than water float in it. (You may be aware that specific gravity is a measure of relative densities.)

But, solids with densities close to that of water remain in suspension. It may take hours, days, and even years for some types of solids to separate from the water. If they would come together or *coagulate* into a larger mass, that mass would separate more rapidly in the water.

A simple explanation addresses this phenomenon. Certain particulates have a predominance of negative surface charges. Think of the adage, "opposites attract and likes repel". Like similar ends of a magnet, solids with like charges repel each other and resist coming together or coagulating.

Chemicals can be used to cause *coagulation*. The molecules of these chemical coagulants have a predominance of surface charges opposite those of the particulates that we would like coagulate.

When these chemical coagulants are introduced into water, they provide opposite charges that neutralize or destabilize the problematic charges. Opposites attract and *coagulation* takes place.

In comparison with the very fine suspension of precipitated solids, coagulated formations are a more readily distinguished pinpoint size. Technically we call them ***pinfloc***.

## FLOCCULATION

Though solids in coagulated masses or ***pinfloc*** precipitated solids are seen in the water, a final step is needed to make the mass even larger and subsequently faster in separating.

This final step, *flocculation*, is caused by introducing a long-chained polymer molecule to which numbers of pinflocs can attach. This molecule again has a predominance of charges on its tips, but these charges are opposite those of the coagulating chemicals.

The polymer *flocculant* will gather enough pinflocs together to form increasingly larger masses like large snowflakes. The buzz phrase here is that the floc grows.

## A PERSPECTIVE ON CHARGES

The terms **anionic** and **cationic** describe the *molecular charges* that were discussed. These charges are negative and positive, respectively. The only way to practically determine the charges on problematic solids is to conduct jar tests with the actual samples to be treated. The ***pinfloc*** particle that forms when the pH is adjusted or when a chemical coagulant is added to help separate the contaminants from the water, will have a charge. At least 90 percent of the time, cationic products help form ***pinfloc*** and anionic polymers achieve *flocculation* and clarity.

## SUMMATION

These are basic technical explanations of the physical and chemical elements that you will be exposed to. Let's review what we just covered.

Our chemical objective is to facilitate the removal of undesirable suspended solids from liquid, normally water. The industry must have a system that, at some stage, allows the suspended solids to be separated by flotation, sedimentation, or filtration.

Problematic solids initially may be dissolved or undissolved in the water. However, they can be removed only if they are in their undissolved state...suspended solids.

Waste water technology encompasses four basic steps that must occur before the contaminants in a fluid can be removed:

## PRECIPITATION

Solids change from dissolved to undissolved, particulate state, becoming visible suspended solids. This is accomplished by simple pH adjustment which causes the contaminants to precipitate out of the solution. There may be particles in the fluid that are large enough to remove as they are, too.

## COAGULATION

The addition of a chemistry that has favorably charged sites that neutralizes the resistance of very tiny suspended solids to being agglomerated (or stuck together). The result is formation of distinguishable ***pinfloc*** particles.

## FLOCCULATION

The addition of a long-chained polymer molecule attracts the ***pinfloc*** into much larger snowflake-like formations. These particles must be stable enough to not fall apart once they are formed. The next process will physically concentrate the solids for removal from the liquid.

## SEPARATION / CLARIFICATION

When enough of the ***pinfloc*** masses have been pulled together into a large snowflake-like mass, the ***floc*** formed will settle or float. These particles that have a higher density than water can be removed by sinking the particles. The particles that have a lower density than water can be floated to the top of a tank and skimmed off. These settled or floated masses are then removed as sludge skim and the clarified water discharged to the sewer or reused. Sometimes an additional filtering step may be in place to remove the trace solids that remain.

Most treatment facilities will have an additional dewatering step to dry the sludge. This step can use a filter press, a centrifuge, or a sludge dryer. This is usually done to reduce disposal costs, or recycling costs, depending on the final destination of the sludge.