

MILANCO INDUSTRIAL CHEMICALS

WASTE TREATMENT HEAVY METALS REMOVAL

OVERVIEW

The objective of the operation of most treatment facilities is clear water. More importantly, though, a successful application means clear water that meets environmental standards.

The primary concern of most wastewater treatment operators is compliance with government regulations. Helping system operators meet that objective is a major opportunity for making a sale.

PRECIPITATION

Precipitation involves the change from a dissolved form into an undissolved, particulate form. In order to settle (or float) suspended solids from water they must be precipitated from the dissolved form into the undissolved form.

Two precipitation phenomena are of specific interest in liquid/solids separation systems:

- a) Precipitation of contaminants to be removed from the system, and
- b) Precipitation of inorganic salts of which chemical coagulants are made.

METAL CONTAMINANTS THAT PRECIPITATE IN THEIR HYDROXIDE FORM

If toxic heavy metals like zinc and copper are in the wastewater, those metals must be in their precipitated state before they can be separated from the water. Normally that state is called its hydroxide state. As an example, zinc precipitates as zinc hydroxide.

In the wastewater there is a pH point at which the metal present is best precipitated as a hydroxide. To effect precipitation, the pH of the untreated wastewater is adjusted to and controlled at a preset pH point by adding chemicals.

Calcium hydroxide (lime) and sodium hydroxide (caustic soda) are often used to cause the necessary upward change in pH. Sulfuric acid is often used to change the pH downward. The precipitated metal hydroxide is then coagulated, flocculated and separated from the water.

Our examples depict the metal ion precipitating when the pH of the water is all that changes. (The curves are often referred to as metal solubility curves.)

On the vertical axis the amount of metal that is present is measured in ppm. The horizontal axis shows the pH of the solution.

In Figure 1, as the water pH increases from 6 to 9 pH, the copper metal ion precipitates out as a metal hydroxide. At the bottom point of the curve the metal is as precipitated, insoluble or undissolved as it will become.

Note that the curve starts upward again as the pH is raised from 9 to 12 pH. This shows that the copper metal ion starts to redissolve. Of course a dissolved ion can't be separated out.

Figure 2 illustrates precipitation curves of several heavy metals. Each metal has a different pH at which it is most precipitated or least dissolved.

In a metals removal system pH control points often reflect a compromise with how the metals precipitate and how much metal is present in a particular system. The ultimate control point is the point at which the metals removal is most favorable.

There are chemicals used in some production process waters that may chemically combine with a metal ion and then interfere with that metal's normal precipitation tendencies in the wastewater treatment system. They are called chelants or complexing agents.

PRECIPITATION OF METAL IONS PRESENT IN COAGULATION

Remember our principles: precipitation-coagulation-flocculation.

After the metals have been precipitated out, they sometimes will coagulate on their own.

But, as we described earlier, precipitated solids usually have a predominance of the same surface charges and resist coagulating by themselves.

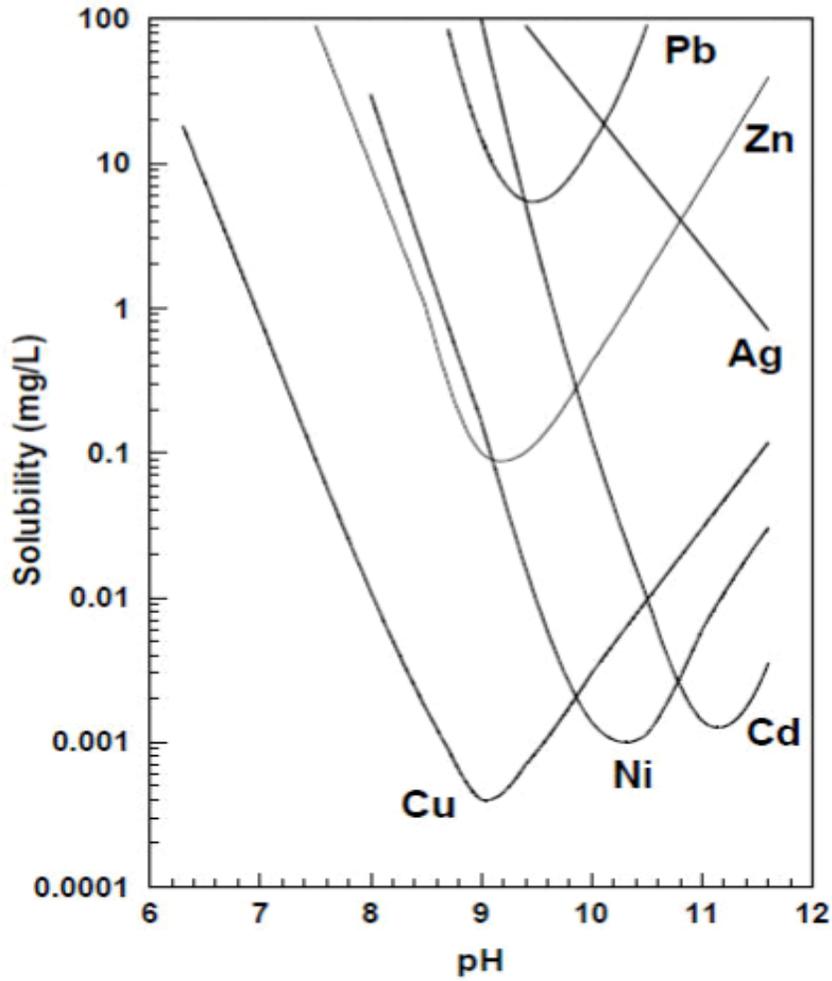
Chemical coagulants may have to be added to facilitate coagulation, flocculation and separation.

Some chemicals that are used to coagulate suspended solids are actually formulated from metals such as iron and aluminum. Those metals must also be precipitated so that they can cause coagulation.

This process also reflects a change of chemical form or change of the metal ion, a technicality beyond the scope of our discussion.

PRECIPITATION CURVES FOR COMMON HEAVY METALS

Figure 1



On the following page, you will find an exhibit depicting the precipitation curves of common heavy metals. This exhibit will serve as an invaluable reference when you are assessing pH controls.

OCCURRENCE OF PRECIPITATION IN A TREATMENT SYSTEM

In a continuous system, you will find precipitation occurring in a tank called the Neutralization of pH Adjustment Tank.

Often, this is the same tank in which coagulation occurs.

Don't be confused. You must address precipitation and coagulation separately even though they occur in the same tank.

Figure 2

