TMT 15® - Precipitating Copper and Nickel from Wastewater

Case Study / Info 38 E

TMT 15® is widely used in various industries that produce wastewater containing heavy metals. The heavy metals are usually removed from the wastewater by precipitation and flocculation.

Individual examples demonstrate the effectiveness of treatment methods in practice, and should give anyone interested enough background to perform tests to check the suitability of TMT 15® for their own particular wastewater composition. We would be happy to provide TMT 15® in sample amounts. Our Application Technology department is also prepared to provide assistance in finding problem solutions.

Electroplating model / Heavy metals are only partially complex dissolved

Electroplating shops deal with a large number of process solutions. In addition to galvanic baths for metal deposition, various pretreatment and after-treatment baths (such as pickling, degreasing, and baths for chromatic treatment and phosphatizing) and strippers may contain complexing agents.
The wastewater from these processes is composed of the used baths (concentrates and semi-concentrates) and their rinse waters.
Different processing principles can be selected for wastewater treatment. One example proceeds as follows:
Rinse waters are circulated through ion exchangers; concentrates and semi-concentrates are treated on a batch basis. In the batch treatment, wastewater's containing cyanides and chromate's are pretreated separately, then combined together and neutralized with lime or caustic soda. The heavy metals largely settle out as hydroxide sludge during this step. However, the wastewater will retain a certain portion of the heavy metal complexes, depending on the proportion of complexing agents so that discharge limits are often exceeded. This is where after-treatment with TMT 15® presents the solution:
Hydroxides that settled out in the neutralization step are separated from the wastewater in a sedimentation tank or baffle plate, or with a filter press. TMT 15® is then added to the clarified water, which is still loaded with heavy metals, in a second treatment step.
By displacing the chelating ligands, TMT 15® leads to the precipitation of heavy metal-TMT-compounds with very low solubility, regenerating the free complexing agents. This process, however, gives rise to highly dispersed precipitates, since only small residual amounts of heavy metals remain after the initial hydroxide precipitation. By the addition of a polyelectrolyte, the sedimentation process can be accelerated considerably, and the flocculated product is easily removed by common settling or filtration procedures.

Wastewater resulting from this procedure, however, must never be allowed to come in contact with hydroxide sludge from the first purification step. The free complexing agents would immediately redissolve the heavy metal ions, thereby reversing the just completed secondary detoxification procedure. This process, therefore, requires two separate sludge-processing units.

Sales & Marketing:
Evonik Industries AG
Rodenbacher Chaussee 4
63457 Hanau
Germany
AI-AK-SK
Phone: +49 6181 59-4107 Fax: +49 6181 59-4266
E-mail: tmt@evonik.com
http://www.tmt15.com

Applied Technology:
Evonik Industries AG
Rodenbacher Chaussee 4
63457 Hanau
Germany
AI-AK-SK-AT
Phone: +49 6181 59-2854 Fax: +49 6181 59-4266
E-mail: tmt@evonik.com
http://www.tmt15.com

Example:
Electroplating model/copper and nickel are only partially complex dissolved

Wastewater from actual printed circuit board manufacture

Treatment process:

1. Preliminary precipitation of hydroxides

- Collect 2 l of wastewater (403 mg Cu/l, 1.1 mg Ni, pH 1.5),

- preneutralize to pH 7 using 42 g of calcium hydroxide (10% CaO),

- adjust to pH 9 using 0.3 ml of 50% caustic soda,

- add 1 ml 0.05% nonionic flocculating aid (such as Praestol 2500),

- sediment for 30 minutes,

- decant the blue-green, coarsely flocculent precipitate.

The supernatant still contains 8.7 mg Cu and less than 0.1 mg Ni/l

2. Post precipitation of the complexed copper

- Collect 1 l of supernatant from the preliminary precipitate (8.7 mg Cu/l, < 0.1 mg Ni, pH 9),

- add 0.2 ml TMT 15® while stirring and maintain 30 minutes of reaction time,

- add 1 ml iron(III) chloride solution (10 g Fe/l),

- add 0.2 ml 0.05% nonionic flocculating aid (such as Praestol 2500),

- sediment for 1 hour,

- separate brown, coarsely flocculent precipitate by filtering.

The filtrate contained less than 0.1 mg Cu and less than 0.1 mg Ni/l

Remarks

TMT 15® requirement: 18 l TMT 15 per kg copper (Cu)
TMT 15® requirement: 20 l TMT 15 per kg nickel (Ni)

The requirement can also be determined using the calculations found at www.tmt15.com.

For copper precipitation, it is usually necessary to adjust the pH value to the range 7–10 after the required chemicals have been added. To some extent, the precipitation result and residual metal content is strongly dependent on the pH value, depending on the type and concentration of complexing agents.

Available examples

TMT Info No.	Heavy metal	Complexing agent	Branch
TMT Info 30	Copper (Cu)	Tetrammine	Printed circuit board Manufacture
TMT Info 31	Copper (Cu)	EDTA complex	Printed circuit board Manufacture
TMT Info 32	Cadmium (Cd)	Tetrammine	Electroplating
TMT Info 33	Silver (Ag)	Thiosulfate complex	Photografic rinse water
TMT Info 34	Silver (Ag)	Thiosulfate complex	Photografic concentrate
TMT Info 35	Mercury (Hg)	Chlorocomplex	Chemical industry
TMT Info 36	Nickel (Ni)	Polyamine complex	Electroplating
TMT Info 37	Lead (Pb)	Cataphoretic electro-deposition of paint	Automotive industry
TMT Info 38	Copper (Cu) & Nickel (Ni)	Actual wastewater	Printed circuit board Manufacture