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Application Of Vacuum Evaporation in Plating Industries

Without an evaporator:

In a typical nickel plating plant:

Total salinity of nickel bath	=	400 - 480	g/l
Concentration of nickel metal in Ni bath	=	60 -80	g/litre

Generally, the minimum quantity of water required when we talk about the water needed for rinsing purposes after treatment in the bath, is half the volume of the tank per hour.
That is, for a tank with a volume of 1000 litres, the water required is 500 l/hour.

In a plant of medium dimensions, when we consider two rinsing tanks working 10 hours/day, we would expect to have a water consumption of about 10,000 litres/day for rinsing purposes, which then has to be sent away for treatment using a traditional chemical physical wastewater system, with its demanding requirements regarding space and chemical consumption.

Using an evaporator directly on the plating line, to recover the raw material, recycle the rinsing water and create a situation of zero discharge:

The concept of water consumption using this application of vacuum evaporation has to be totally transformed.
It is no longer important to take into account *either* the volume of the rinsing tanks *or* the volume of water normally used for the rinsing purposes.

Another two factors are fundamental: the drag out of the nickel from the treatment bath to the first rinsing tank, and the number of rinsing tanks present. The higher the number of rinsing tanks, the smaller can be the size of the evaporator installed on the plating line.

Using physical and mathematical formula, we can calculate the value of the nickel metal/salts in each rinsing tank precisely, and we establish the dimensions of the machine which it is necessary to have in order to be able to keep an equilibrium of salinity in the rising tanks, to allow both an efficient rinsing process and a good recovery of the salts.

The concentrate of Ni metal/salts from the evaporator is fed back into the treatment bath after suitable controls, while the distillate enters the cleanest rinsing tank to ensure a continuous supply of pure water for rinsing. This returns to the first rinsing tank through overflow, and there is no water to be sent to the chemical /physical treatment plant. A situation of "zero discharge" is created.

To calculate the type of vacuum evaporator machine necessary using the example cited above, with a drag out of 15 l/hour, and working 24 h/day, we can take into consideration a V-NT 2000 model (capable of treating 2000 litres/day or 83 l/hour) .

If there are only two rinsing tanks:
The equilibrium established in the 1st rinsing tank will be 10.5 g/l Ni metal (61.2 g/l total salinity)
The equilibrium established in the 2nd rinsing tank will be 1.5 g/l Ni metal (9.18 g/l total salinity)

If we add a third rinsing tank:
The equilibrium established in this 3rd tank will be 0.225 g/l Ni metal (1.3 g/l total salinity)

And again with another rinsing tank:
The equilibrium established will be 0.033 g/l Ni metal (0.195 g/l total salinity)

From this data we can deduce that to obtain less salinity in the rinsing tanks it is not necessary to increase the capacity of the evaporator, but to only add one or two more rinsing tanks.
Obviously, when it is not possible to add tanks, the same concentration can be reached by increasing the capacity of the evaporator.

The return of investment for the customer is therefore in:

1) the enormous costs savings for the customer in the management of their chemical/physical wastewater treatment plant
2) the savings on space required for the chem./physical plant
3) the savings on costs in the decreased mass of final pollutants to be taken away by specialised companies.
4) the saving on the purchase costs of the Ni metal and Ni salts
5) the saving on water costs for the rinsing purposes
6) the positive "green" image the company portrays regarding its concern for the environment: the best pollution treatment system is in fact that which does NOT pollute!