



METAL INDUSTRIES
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Metal wastes include wastes from

- Refining mills.
- Plating mills and parts
- Washing

They are characterized by their toxicity, relatively low organic matter, and greases

Steel Mill Wastes

Three type of steel manufacturers

- Integrated producers
- Mini steel mills
- Specially steel mills

Integrated Producers

- They use Iron ore and coal and produce many shapes of steel,

Mini mills

- They reprocess scrap steel usually to some low quality products

Specialty steel mills

- They are similar in sizes to mini steel mills but produce more expensive items

Origin of Steel Mill Wastes

- Wastes come mainly from by-product coke, blast furnace, rolling mill and pickling departments
- Wastes contain phenols, ore, coke, lime stone, acids, alkalis, soluble and insoluble oils
- Wastes are treated by, evaporation, benzol extraction, distillation, sedimentation, neutralization, skimming, flotation and aeration

The “by product” coke process

- Coal is heated in the absence of air to produce coke and other products
- Cooking process produces Coke, ammonium sulphate, tar, phenol, light oil, naphthalene and other gases
- Major wastes from preparation of coke product itself come from quench water. Where hot coke is flooded with water
- Coke dust present in this quenching water is called **breeze** and is commonly recovered for water

The blast furnace

- Wet scrubbing of blast furnace gas evolves water laden with flue dust
- Wet scrubbers are down flow water sprays which clean dust from up flowing gases
- Secondary gas washes or electrostatic precipitators are periodically cleaned by flushing with water

The pickling process

- For final finishing steel is immersed in dilute sulphuric acid (15-25% by weight) to remove dirt, grease, iron-oxide scale which accumulates on the metal during fabrication
- Pickling produces wastes called **pickling liquor**. It mainly composed of acids and iron salts of acids
- Acid reacts with iron salts, and forms FeSO_4 .

Characteristics of Steel mill wastes

Characteristic (ppm)	Source of wastes		
	Ammonia Still	Final Cooler	Pure Still
BOD	3974		647
TSS	356	218	125
VSS	153	14	97
Organic and NH3-N	281	105	20
NH3-N	187		10
Phenol	2057		72
Cyanide	110		6.6
pH	8.9		

Blast furnace

•Blast furnace wet-scrubber effluent contains flue-dust solids and contains iron oxide, alumina, silica, carbon, lime and magnesia

It depends upon

- Type of ore used in furnace
- Conditions of the furnace lining
- Quality of coke used
- Number of furnaces in blast
- Amount of air being blown
- Regularity and thoroughness of dumping and flushing of dry dust catches

Pickling process

- Amount of waste per ton of steel depends upon the size and type of plant
- Increase in volume due to steel products when rinsed in water after they leave the pickling tank to remove all traces of acid
- The rinse or wash water eventually becomes quite acidic and must also be discarded.
- H_2SO_4 and $FeSO_4$ are the major contaminants

Treatment of steel mill wastes

- Primary method of treatment of by-product coke plant wastes is to use recovery and removal unit (Phenol recovery).
- By product recovery may be undertaken for profit. Ammonium sulphate, crude tar, naphthalene, coke dust, coal gas, benzene toluene and xylene
- Gravity separators are used to remove free oil from wastes from benzol stills
- Phenol may be removed by either conversion into non-odorous compounds or recovery as crude phenol or sodium phenolate.
- In treating flue dust, sedimentation, followed by thickening clarifier overflow with lime to encourage flocculation. (Removal of iron oxide and silica)
- 90-95% suspended matter settles readily and does so within a one hour period resulting an effluent with 50 ppm SS.
- Primary and secondary thickened sludge's (lime coagulated) are also obtained which can then be lagooned without creating nuisance
- Treatment of pickling liquor is a problem of considerable magnitude. For small steel plant it is not commercially viable and they neutralize it with lime

- Some compound do obtained as by-product from this waste like $\text{Fe}_2(\text{SO}_4)_3$, H_2SO_4 , Fe_3O_4 for polishing or pigments, Iron powder etc.
- Neutralization with lime is costly and time consuming (Slow settling sludge)

Neutralization takes place in 4 steps

- Formation of ferric hydrate with a pH below 4.
- Formation of acid sulphate.
- Formation of ferrous hydrate with a pH between 6-8.
- Formation of normal sulphate.
- Calcium and dolomite lime are least expensive caustic soda and soda ash are most expensive

Areas for change in the pickling waste pollution.

- Improvement in treatment of waste from pickling with H_2SO_4 .
- A new HCl pickling operation.
- A new dry descaling operation.
- New treatment methods for H_2SO_4 pickling include deep well disposal
- HCl pickling differs from H_2SO_4 pickling in a way that HCl readily dissolve all the various oxides of iron in the scale but reacts slowly.
- Dissolved solids in the HCl pickle liquor is far below the extraction concentration and steel is left clean and free of crystal or insoluble lime.
- H_2SO_4 reacts fast with parent metal and blows off oxides on strip. Because of this more scale breaking is required before pickling.



THANKS