METAL INDUSTRIES

BY

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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-odorus 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 $Fe_2(SO_4)_3$, 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