Engineering Chemistry

CYC 102

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Overview

- Boiler Corrosion
- Prevention of boiler corrosion
- Oil Contamination in Boiler
- Blowdown
- Summary

Boiler Corrosion

Corrosion in boiler by a chemical or electro-chemical attack by its environment.

Main reasons for corrosion are:

- Low pH of water
- Presence of Dissolved oxygen

Water containing dissolved oxygen when heated in a boiler, free oxygen is evolved, which corrodes the boiler material.

$$4Fe + 6H_2O + 3O_2 \longrightarrow 4Fe(OH)_3$$

Rust

Boiler Corrosion…Contd.

- **Dissolved carbon dioxide**

When water containing bicarbonates is heated, CO_2 is evolved which makes the water acidic (by forming carbonic acid). This leads to intense local corrosion called pitting corrosion

$$Ca(HCO_3)_2 \longrightarrow CaCO_3 + H_2O + CO_2$$

$$CO_2 + H_2O \longrightarrow \underset{\text{carbonic acid}}{H_2CO_3}$$

- Water's alkalinity is too low or too high
- High temperatures and stresses tend to accelerate the corrosion.
- Ammonia and oxygen together attacks copper alloys.

Prevention of boiler corrosion

- **Chemical method**

✓ **Removal of dissolved oxygen – sodium sulphite, hydrazine**

$$\underset{\text{Sodium sulphite}}{Na_2SO_3} + O_2 \longrightarrow \underset{\text{Sodium sulphate}}{2Na_2SO_4}$$

$$\underset{\text{Hydrazine}}{N_2H_4} + O_2 \longrightarrow N_2 + 2H_2O$$

✓ **Removal of dissolved CO_2 – NH_4OH**

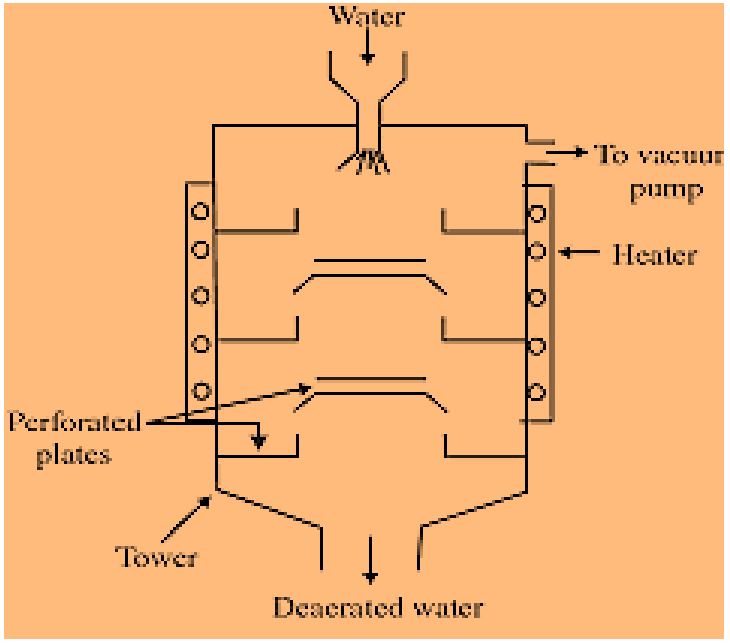
$$\underset{\text{Ammonium hydroxide}}{2NH_4OH} + CO_2 \longrightarrow \underset{\text{Ammonium carbonate}}{(NH_4)_2CO_3} + H_2O$$

Prevention of boiler corrosion…Contd.

- **Mechanical method**

✓ Dissolved oxygen and CO_2 can be removed mechanically by de-aeration method.

✓ Deaerator can reduce oxygen to as low as 0.007 ppm.



Oil Contamination in Boiler

- Coat metal surfaces, cut down heat transfer and produce metal overheating
- Cause sludge to become sticky and adhere to heat transfer surfaces
- Oil can produce foaming and boiler water carryover

✓ Prevention

- ❑ Free oil can be reduced by passing the water through absorbent cartridge filters
- ❑ Emulsified oil is broken down by chemical additives and filtered
- ❑ Special filters are used with aids like diatomaceous earth
- ❑ Flotation method
- ❑ Coalescence method

Blowdown

- Blowdown is the discharge of boiler water containing concentrated suspended and dissolved feedwater solids.
- Blowdown water is replaced with lower solids feedwater, the boiler water is diluted.
- Depends on how much feedwater impurities a given boiler can tolerate.
- Total dissolved solids, suspended solids, alkalinity, silica and iron major factors.

Summary

- Boiler corrosion major boiler feed water problem.
- Carbon dioxide, oxygen, ammines, low pH accelerating factors
- Removed by chemical and mechanical methods
- Oil contamination causes sludge, low conductivity, foaming and carryover.
- Blowdown dilutes the boiler water for low TDS, impurities, alkalinity and silica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Thank You!