ARTICLE

Innovative approach to Zero discharge

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Every production process generates some sort of waste. If possible, the waste generated in one process is reused or recycled in other process. However, this is always not possible, especially in processes that involves use of chemicals or purification of products, where liquid waste is generated containing unused or degraded products or chemicals. Since this waste water termed as industrial effluent causes harm to the environment, it is required to be treated to meet the disposal standards, laid down by various statutory agencies.

Some industrial processes, generate liquid effluents containing high amount of inorganic soluble salts. Conventionally, waste water containing high soluble impurities (dissolved solids) is mixed with other dilute waste water streams, before disposal, to meet disposal standards. In many cases the soluble impurities are precipitated by using chemicals.

To achieve the concept of "Zero Dis charge", the waste water with high dissolved solids is treated using Evaporation/R.O technology where the liquid fraction of the waste water is recovered in the form of water, which may be reused, and the impurities present in the waste water are collected separately as inert solids/concentrate. Eventhough the evaporation/R.O technology provides a proven remedy for treatment of waste water with high dissolved solids, it is used on a limited scale because of:

• High cost of equipments • High cost of energy for its operation • Complex operation requiring skilled manpower and major plant automation.

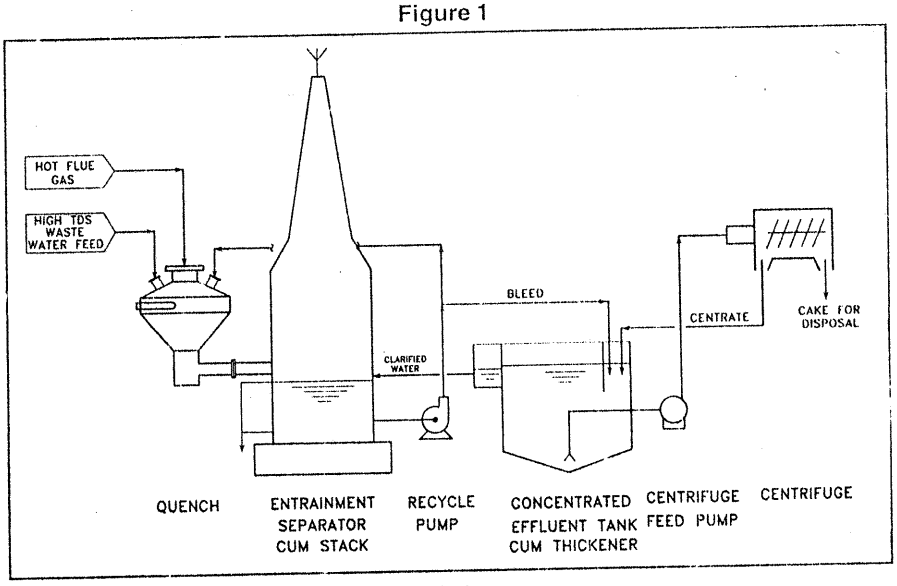
One of Paramount's prestigious client, was very keen for implementing the "Zero Discharge Concept", where a high inorganic salts concentration in waste water stream was the problem area. Paramount had offered different solutions including an evaporation system to treat the high TDS waste water streams. But for various reasons, such as high capital cost, complex operation, difficulty in disposals of concentrate/sludge, implementation of these technologies was difficult.

Technical approach

A new innovative concept of using "**Quench**", a proprietary compact design of our collaborator M/s Andersen 2000 Inc. U.S.A. for evaporating water from waste water containing high level of dissolved solids **(50,000-55,000 ppm)** was proposed. This unique concept was initiated purely based on strong desire to fulfill clients requirement and to optimally utilize the available resources the client had in their complex. Hence when the team of experts from Paramount Limited visited the clients premises, they thought of utilizing the waste heat of the flue gases generated from the power plant. This ultimately gave rise to a new concept to use a "**Quench**" for concentrating the high TDS bearing waste water.

In normal practice, a quench is used to cool the hot gas by having a direct contact water spray to reduce the gas temperature. Water is evaporated and converted to steam. This concept is based on evaporative cooling. The gas is further treated ,as the case may be, depending upon the process. This concept of evaporative cooling was looked at from a different perspective (i.e to evaporate the water using waste heat rather than the conventional concept of cooling the gases with water).

Figure 1



Flow Scheme

Table 1
Comparison of Evaporator System vs. Quench Concept

Sr No.	Features	Evaporator System	Quench System
1.	Type of System	Multiple effect Evaporator using steam as source of Heat	Flue Gas Quenching System to evaporate the water using waste heat in flue gases
2.	Type of Operation	Complicated operation as it requires operation of lot of pumps, reactors and is highly instrumented	Very simple to operate as only four simple equipment needs operation
3.	Operating Personel Requirements	Highly skilled operating staff conversant with process plant operation	Skilled operating staff with normal operating skills
4.	Flexibility W.R.T. To Turn Down and Change in Effluent Characteristics	Less flexibility as plant requires lot of controls due to change in effluent characteristics and turn down	No change in Plant operating parameters are required even if their is a major change in plant capacity and effluent characteristics
5.	Fuel Requirement	Envisages Installation of a new Boiler for meeting system's steam requirement which would use fuel for steam production	Steam Boiler is not required and hence does not envisage burning of fuel
6.	Reliability W.R.T. Continuous Operation	Good	Very High
7.	Turn Down Possible	Up to 30% max.	As low as 10%
8.	Power Requirement	15-17 KW/M3	1.5-1.6 KW/M3
9.	Steam Requirement	300-350 kgs/m3	Not required
10.	Cooling Water Requirement	Yes	No
11.	Space Requirement	More	Less
12.	Quality of End Product (Cake) Generated	Cake with 75-80% solids	Comparable
13.	Any other Salient Feature	High Maintenance Cost due to cleaning requirements of scales formed on tubes	Very low maintenance cost due to less number of equipments which are simple to operate and does not require de-scaling

Since the waste heat in the flue gases from the power plant was anyway wasted to atmosphere without any proper utilization, the concept of evaporation of water from the high TDS bearing waste water, utilizing the quench was thought of (Refer fig-1 for scheme). This would result in concentration of the waste water in the form of slurry, containing suspended solids, generated due to presence of high TDS and evaporation of water, which can be centrifuged to form a disposable cake. The centrate from the centrifuge is sent back to the quenching system for further evaporation. The cooled flue gases with water vapours can be discharged to the atmosphere through a stack.

This concept of quench when formulated in the form of workable scheme looked highly feasible and practical solution for evaporation of waste water to achieve zero discharge goal. **This innovative concept was also presented to the Ministry of Environment and Forest (MOEF) and has been accepted.**

Conclusion

Quench system can be successfully adopted for high TDS bearing waste water containing inorganic salts to achieve zero discharge. This approach also helps to achieve reduction in the initial cost of the plant including extremely low operating cost. The quench system installed of **capacity 225 m³/day would save** almost to the tune of **Rs 120 lakhs per year** compared to **multiple effect evaporator** for comparable service and performance. ❑