Mist Cooling System for Cooling Towers

(***For Medak Bulk-drug Cluster***)

Introduction:

The pharmaceutical industry is one of the fastest growing segments of the Indian economy and has experienced rapid and sustained expansion since the second half of the 20th Century. Indian pharmaceutical manufacturing companies are present at each stage of the production process: APIs; pharmaceutical formulation intermediates (PFIs); and finished dose products (FDPs, the end product). PFIs are the intermediate product between an API and a finished dose. An API is the base ingredient of medicine that is biologically active, and the term bulk active (or bulk drugs/ingredients) is also used. Some Indian companies specialise in one or two of these three stages.

Today, India is one of the world's leading suppliers of generic drugs, which account for approximately 75 per cent of its market by volume16 and revenues of $15 billion in 2014.The country is responsible for around one-fifth of the world's production of generics, which is considerably higher than its share the overall pharmaceuticals market (which stands at approximately 2%).India's Bulk Drugs Manufacturers Association describes the sector's recent growth as "phenomenal" and "one of the highest among the developing countries."Anti infective, which include antibiotics, antivirals and antifungals, are the largest segment on the domestic market, accounting for around one quarter of total turnover.

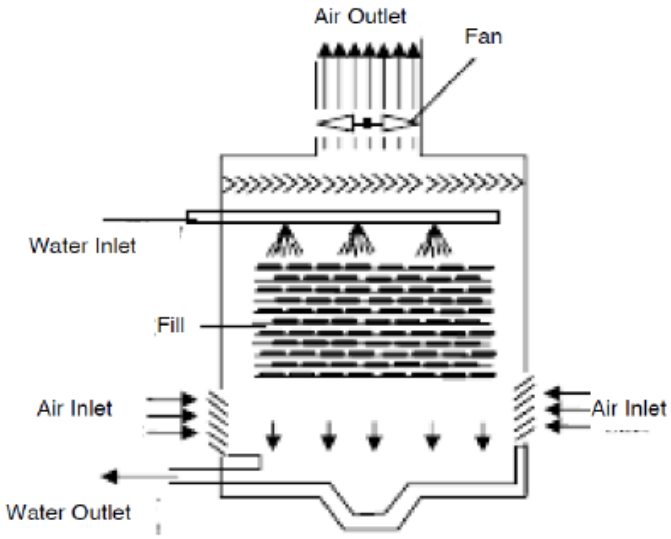
The Indian pharmaceutical industry is highly fragmented, with more than 20,000 registered manufacturing units nationwide. It is also geographically dispersed, production takes place in multiple locations across the country, with the states of Maharashtra, Gujarat, Telangana, Andhra Pradesh, West Bengal and Tamil Nadu all registering a sizeable manufacturing and processing presence. The city of Hyderabad in Telangana state, which was part of Andhra Pradesh until its division into two separate states in 2014, emerged early on as a pole of bulk drug manufacturing. In 1961, Indian Drugs and Pharmaceuticals Limited (IDPL), a government-owned company, was set up under the premiership of Jawaharlal Nehru with a mandate to "free India from dependence on imports and to provide medicines to the millions at affordable prices." Its establishment in Hyderabad (it also has offices in New Delhi and Rishikesh, Uttarakhand state) heralded the emergence and subsequent concentration of the generic drug industry in the city.

According to the Indian Bulk Drug Manufacturer's Association (BDMA) there are 47 units in Medak District. And the electricity is drawn from Telangana State Southern Power Distribution Company Limited (TSSPDCL) and source of coal is from Singareni Collieries Company Limited (SCCL).

Existing Practice:

Chillers are the significant energy consuming utilities in any bulk drug pharmacutical unit. They consume around 40% of the total energy consumption of the unit.They are variety of chillers available in bulk drug units with differnt cooling requirements ranghing from +5 ^{0}C to -40^{0}C. The chiller capacities also range from 100TR to as high as even 600TR.The chilling requiements change from product to product as per their process requirements.

As per the process requiement the chillerd water meets the cooling requirement in the reactor as per stupilated time and the return water comes back to the chiller to desiminate the heat at cooling tower. The cooling towers will take the heat from the evaporator and cools the circulating water .In most of the pharma units, the type of cooling towers are natural draft/Induced draught cooling towers. The induced draft cooling towers generally fan motor with a capacity of 7.5HP. In induced draft towers the fans are located at the discharge (at the top) and pull the air through the fins of cooling tower. Air enters the sides of the tower called louvers at low velocity through large openings and passes through the fill, whereas the hot humid air is exhausted to the atmosphere through the ventilator. The approach of the cooling tower which plays major role not only in the effectiveness of the cooling tower but also on the performance of Chillers system. As the outlet water temperature of the cooling tower is away from the web bulb temperature the performance of both cooling tower and chiller will get effected. There will be many cooling towers available in pharma sector both on process and utility side.



Proposed technology:

It is proposed to replace induced draught cooling tower with mist cooling system (MCS). In MCS requires only 70 to 75% of re-circulation water quantity as compared to that required for Cooling Tower (as it won't have any evaporation losses). In MCS system there is no fan used and the water is been sent to patented sprinklers, where it forms mist and there will be slight increase in the head of the circulation pump (depend on the site location). The Mist cooling system will guarantee approach of $2\ ^{0}$c throughout the year. To operate this cooling tower. there is no need of standby required. The comparison between Induced Draft cooling tower (IDCT) ,Fan Less /Jet Cooling Tower & Louver Type Mist Cooling system.

Comparison Table Between Induced Draft Cooling Tower and Mist Cooling System

COMPARISON TABLE BETWEEN INDUCED DRAFT COOLING TOWER AND MIST COMPARISON TABLE BETWEEN INDUCED DRAFT COOLING TOWER AND MIST COOLING SYSTEM			
S.No	**Feature**	**Induced Draft Cooling Tower(IDCT)**	**Louver Type Mist Cooling System**
1	Approach to WBT	4 to 5 Degrees	1 to 2 Degrees
2	Temperature Drop	8 to 10 Degrees	Regular :12 Degrees
3	POWER CONSUMED (Comparison for a 1000 m3/hr circulation flow assuming IDCT's Total Power as 100%)	100 HP : 100% (70 HP : 100% on Pumping & 30 HP : Fan)	70 HP : 70% (70 HP : 100 % on Pumping & HP : Fan)
4	Nozzles	Ordinary Type which Choke frequently	Special whirling type, choke-less design incorporating non-moving parts with 25mm bore opening
5	Water Droplet Size	5mm	Atomized to 5 to 50 Microns
6	Travel Time	Less due to Downward fall only.	Two time travel due to upward & downward travel leads to Double air retention time
7	Fills/Fins	Various types used - prone to scaling, need Periodical changing	absolutely no fills / no fins required
8	Drift Loss	Same	Same
9	Make Up Water	Same	Same due to similar holdup
10	Flexibility	Same	Individual Line Isolation offers Max. flexibility to use capacity as per requirement
11	Standby	Required	Not Required
12	Erection/Delivery	Substantially	Fairly Less

COMPARISON TABLE BETWEEN INDUCED DRAFT COOLING TOWER AND MIST COMPARISON TABLE BETWEEN INDUCED DRAFT COOLING TOWER AND MIST COOLING SYSTEM			
S.No	**Feature**	**Induced Draft Cooling Tower(IDCT)**	**Louver Type Mist Cooling System**
13	Maintenance	Very high due to replacement of fills/ fins/ fan blades etc. Also due to deposition of dust on fills, efficiency reduces with time.	Negligible maintenance due to choke less operation and non-moving parts.
14	Aesthetics	Bulky, Generally most neglected part in a Plant	Appears fresh and dynamic resembling active water like fountain
15	Civil Construction	Heavy Due to static and dynamic load	Simple due to table top construction with static load
16	Total Foot Print	Less	*More by 2 to 4 times IDCT

Table 1: Comparison Table Between Induced Draft Cooling Tower and Mist Cooling System

Energy & Monitoring Saving:

S. No	PARAMETER	COOLING TOWER (INDUCED DRAFT)	LOUVER TYPE MIST COOLING SYSTEM
1	Temperature Drop (ΔT)	4°C	5 TO 6°C
2	Approach to Wet Bulb Temperature (WBT)	3°C	1°C
3	Circulation Water Quantity Required	350 M³/Hr.	350 M³/Hr.
4a	Energy Required (Power Consumed on Pumps)	**Recirculation Pumps :** Capacity: 350 M³/Hr Head: 37 Mtr Total Power: 41.5kWPumps.	**Recirculation Pumps** : Capacity: 350 M³/Hr Head: 32 Mtr Total Power: 41.5 kW
4b	Energy Required (Power Consumed on Fans)	5.5 kW/ hr (7.5 HP X 1 No.)	NIL MCS Does not require Any Fans
5	Total Power Required for circulation & Cooling [4a + 4b]	47 kw	41.5 kW
6	Total energy saved on circulation &cooling	NIL	6 KW
7	Maintenance Cost	Rs. 1.0 lakh/yr(Average)	Negligible
PART - B SAVING ON COMPRESSOR MOTOR OF 420 TR CHILLERS DUE TO LTMCS			
1	Wet Bulb Temperature	25.5°C	25.5°C
2	Chilled Water Temperature in °C	7°C	7°C
3	Supply Temperature from Cooling Tower/LTMCS	28.5°C	26.5°C

S. No	PARAMETER	COOLING TOWER (INDUCED DRAFT)	LOUVER TYPE MIST COOLING SYSTEM
4	Approach to design WBT in °C	3°C	1°C
5	Delta Temperature of chilled water compressor	21.5°C	19.5°C
6	Chilled Water Compressor motor kW for 420TR (0.67 KW/TR)	281 KW/TR	
7	Saved KW due to LTMCS in %	Nil	10%
8	Energy Saved at Compressor Motor in kW	Nil	28.1 kW/TR

Table 2: Energy & Monitoring Saving:

POTENTIAL ENERGY SAVINGS

S,No	Description	Value
1	Total power saving	33.6 kW/Hr.
2	Total Power savings in year	241920 kW/year
3	Total Monetary Savings per year (@Rs 7 /unit)	16.9 Lakhs
4	Investment for MCS system	18.0 lakhs
5	Simple Pay back Period	11 Months

Table 3: POTENTIAL ENERGY SAVINGS

Replication Potential:

Based on the discussion with association and also units it is estimated that the technology has a replication potential of 15 to 20 installation in the medak cluster. Based on the given replication potential the overall project is given as follows:

Replacement of Forced Draft cooling towers with Mist cooling system			
S.No	**Parameter**	**Value**	**Units**
1	Total No of SME Units in the cluster	47	No's
2	Replication Potential of the units in cluster	15	No's
3	Envisaged Annual Energy Savings per Unit	2.42	Lakh kWh
4	Investment Required per Unit	18	Lakhs
5	Envisaged Annual Energy Savings per Cluster (15 No's of Units)	36.3	Lakh kWh
6	Investment Required for Cluster (15 Units)	270	Lakhs
7	Cost of Electricity	7	Rs/kWh
8	Envisaged Annual Monetary Savings for Cluster	254.1	Lakhs
9	Payback Period	12.7	Months

Replacement of Forced Draft cooling towers with Mist cooling system			
S.No	**Parameter**	**Value**	**Units**
10	Savings in MTOE	312.1	MTOE
10	Reduction in CO2 in Cluster	2976	TCO_2

Availability of the technology

The technology is available in India and it is the patented product. They have implemented this technology in India. The manufacturer is Mist Ressonance Engg(P) Ltd based in Pune.

Effect on the Process:

This technology will decrease the approach to as low as 1°C in turn increasing the chiller effectiveness.

Reasons for Unpopularity:

This technology has yet not penetrated in to the SME cluster because of the following reason:

- ✓ Lack of knowledge and not updated with the recent developments.
- ✓ Financial constrain being an MSME.
- ✓ No one has yet demonstrated the results of the technology in MSME unit

Payback Period:

The simple payback period for the technology comes out to be less than a year.

Why the technology has not been implemented so far in the cluster?

SME unit's were not aware of this technology.

Is there any operational risks involved?

No operational risks involved and won't effect the regular operation.

Boundary Conditions/Limitations

This technology needs to be implemented near the cooling tower. The limitation is that it is a patented product.

Vendor Information:

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