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TREATMENT TECHNOLOGY USED FOR GENERATED WASTEWATER FROM WATER JET LOOMS

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ABSTRACT:

In coming years looking to potential in textile industries number of water jet looms bearing industries are going to increase rapidly. These Industrial units are small scale units so that they have not appropriate space and cost constraints in terms of operating for Environment Management Systems. These units are found to be mushrooming mostly in private industrial estates, which do not have any common infrastructure or permissions specific for the industries. In Surat city which is hub of textile market, as per today's scenario there are approximately 600 nos of units of water jet looms. Out of them approx. 550 no's of units are located outside of the GIDC having their own ETP with system to achieve ZLD or sending to CETP. During the survey of project we found that these water jet units are not comply to achieve the ZLD and directly discharging the untreated industrial wastewater of COD ranging from 500 -700 mg/l. The electric evaporator system is found to non-operational along with the primary ETP during random monitoring by the GPCB. Thus looking to the need of formulating a policy for upcoming and existing water jet industries a policy is needed. The discussions of green technologies as alternatives of conventional approaches to treat the wastewater generated from water jet looms and archive the norms with fresh water used for water jet looms.

Introduction:

Water is very important elements that are involved in human life for good health. In view of growing awareness of pollution problems, dispersal of organic contamination in the environment is becoming a matter of concern. Ever increasing use of chemical and related compounds in each and every field of industry and ever agriculture summons an urgent need of method for their effective removal from water and wastewater.

Increased population and modernized civilization trend gave rise to blooming of textile sectors in India. An estimate shows that textiles account for 14% of India's industrial production and around 27% of its export earnings. India is the second largest producer of cotton yarn and silk and third largest producer of cotton and cellulose fiber. The total production of yarn during the year 2003–2004 was 3051 kt. There are about 10,000 garment manufacturers and 2100 bleaching and dyeing industries in India.

One of the basic requirements of a human being is Water. Globalization, un-controlled population and other factors are creating shortage of pure water and the issue is a concern for many countries.

Thus, it becomes imperative to think about water purification using effective and inexpensive techniques and its reusability.

Water is used as an important utility in operation of water jet loom. The quality of water is very important for smooth operation of the looms. As per the project specification the water used for water jet looms shall have dissolved impurities i.e. Total Dissolved Solid (TDS) of less than 200 – 250 mg/lit & organic matter in negligible concentration.

During the process of waving synthetic fabric using a water jet looms synthetic oil applied to synthetic threads is removed due to friction of water & fiber and ultimately water collected in looms & led to collection sump. The water contains soluble oil, free oil, small pieces of broken fiber & dirt & it's now termed as effluent.

Reuse of wastewater is an economical alternative to reduce fresh water use. To establish the possibility of wastewater treatment & its reuse.

Need of the study:

- To reduce ground water depletion & fresh water scarcity
- To prevent water pollution & ground water contaminations
- Cost effective wastewater treatment
- To reduce the generation of toxic sludge which dispose the landfill
- To prevent soil contamination
- Increase the industrialization & to manage large amountsof wastewater generation
- Impart color to the receiving ecosystem and create aesthetic problem
- Limit the re-oxygenation capacity of the receiving water and prevent transmission of sunlight which in turn disturbs the photosynthetic activities of benthic plants in the aquatic system
- Control to overall Color, COD, BOD, SS, and TDS etc. in the receiving ecosystems.

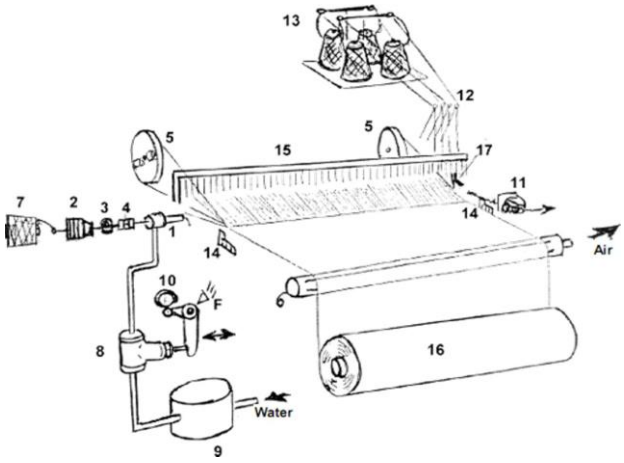
Objectives of the study:

- To reduce the fresh water demand in industries
- To reduce cost for wastewater treatment for individual industry
- Reuse of treated water and to meet the need of amount & criteria of treated water for reuse in industries.
- To increase the efficiency cum capacity of wastewater treatment
- To reduce the soil pollution and also water pollution
- To reduce the ground water contamination.
- Wastewater treatment without effect of health hazard.
- To reduce the corrosion rate in water jet loom machines and not to obstacle industrial development.

Basic Details of Water Jet Looms

- **Working Principal -** The water jet loom uses water as a weft insertion medium to generate a frictional traction force on the weft yarn by the jet water flow, so that the weft yarn on the fixed bobbin is introduced into the shed. The water jet loom is characterized by high speed and high unit yield, and is mainly suitable for the production of hydrophobic filament chemical fiber fabric with smooth surface

- **Mechanism & Operate:**



After the insertion has taken place, while the weft is held flat by the threads which are moved by the leno mechanisms 5, the thermal knives 14 enter into action on the launch side to cut the weft, and on the opposite side to trim the fabric. A yarn clamping device 13 holds the weft waste which is cut off by the right-handed thermal knife while rotating gears arrange for its removal (center selvedge).

The water is conveyed by a pump 8, provided with a filter, the piston of which is controlled by a cam 10 producing the phases of water suction from the container 9 and of water supply to nozzle 1.

The sequence of the launch phases is the following:

1. The pump 8 enters into action and the initial water jet serves only to straighten the residual small piece of weft, from nozzle 1 to thermal knife 14.
2. This action, which has a duration time varying from 5 to 30 rotation degrees of the main shaft, depends on the yarn count and is named guide angle.
3. The yarn flight forms a so-called flight angle, leaving clamp 4 open to permit to the pressurized water jet to insert the weft thread into the shed.
4. The clamp opening time varies according to reed width and to loom running speed. On yarn exit from the shed, there is an electrical feeler or an infrared sensor which checks the presence of the weft end and makes the machine to stop in case of absence of the weft.

A drying device removes the humidity absorbed by the fabric, sucking it through grooves produced in the front beam 6 of the machine. A maximum of two weft colors can be inserted (weft mixer).

Characterization of Effluent:

Type of Sampling: Grab Sampling
Sample taken: 4 Nos.

Sr. No.	Parameter	Average Results
1.	pH	6.5
2.	TDS	852 mg/lit
3.	Oil & Grease	96 mg/lit
4.	COD	617 mg/lit
5.	BOD	108 mg/lit
6.	SS	134 mg/lit

Simple Process Steps to treat of effluent in Common Effluent Treatment Plant (CETP):

1. Primary Treatment
2. Secondary Treatment
3. Tertiary Treatment

1. **Primary Treatment**: At the CETP the pretreated (at the factory outlet) wastewater enters the screen chamber, & then collects in the underground collection tank (Equalization Tank). This help in making the effluent homogenous.

2. **Secondary Treatment:** There are 2 steps involved in this treatment (1) Chemical Treatment (2) Biological Treatment

In Chemical Treatment:
The equalized effluent is transferred to the chemical treatment section by set of transfer pump. The pump outlet is measured by the online electromagnetic flow meter.

The chemical treatment section comprises of Flash Mixer, Flocculator & Settler unit. Chemicals to be dosed are prepared in chemical solution tanks & dosed by dosing pumps. During chemical treatment the soluble oily compounds breaks down & separates in the form of flocs & it settles along with Suspended Solids in the settler.

The Chemical Treatment, helps in removing majority of Suspended Solids, Free Oil & a part of Organic contaminates. However, the Antistatic Oil / Sizing Chemical, (which is used on the Fibre, gets removed during the weaving process, & mixes with the water forming an emulsion) is not removed by the Chemical Treatment. The oil being organic in nature, develops microbial growth, during reuse of effluent.

In Biological Treatment:

The biological treatment is the heart of the effluent treatment process. The biological treatment is an Aerobic system & comprises of Aeration Tank, Sludge Recycle Pumps, Air Blowers & Secondary Settler.

Biological process like Aerobic Bioreactor utilizes the soluble oil as food for the controlled development of selected bacteria. Hence, the Aerobic Biological Treatment (Aeration Tank) becomes an essential part of the Treatment & Reuse for effluent.

3. Tertiary Treatment:

The clarified effluent from Secondary Settler, is further treated by Media Filters comprising of graded Sand & Activated Carbon. The Tertiary treatment is mainly provided to reduce Suspended Solids & part of organic soluble impurities. The filters are regularly backwashed, using treated effluent to remove entrapped impurities & the backwash is collected in Equalization Tank for further processing.

The outlet of Media Filters is further passed through the polishing micron filter & then chlorinated using Hypochlorite Solution.

The treated effluent is stored in treated effluent collection tank. To make up the losses (about 2%) during effluent treatment Raw Water is used as topping water. In addition, the treated effluent is mixed with Raw Water to compensate the water loss during weaving process.

The treated effluent is supplied to the weaving units by Transfer Pumps as feed water to the Water Jet Looms.

An online Electromagnetic Flow Meter keeps a record of treated effluent supplied.

Note: Sludge generated during the biological & chemical treatment is dewatered using a Filter Press. The filtrate is reprocessed & sludge collected is sent for solid disposal site.

Results:

1. After Primary Treatment (Plain Settling): The wastewater indicates presence of free oil & hence sample taken for

plain settling up to 2 hrs. Settled sample collected & analyzed for Oil & grease.

Sr. No.	Settling Time	O & G (mg/lit)	S.S. (mg/lit)
1	15 minute	90	100
2	30 minute	30	80
3	45 minute	25	80
4	90 minute	25	75

2. Physico Chemical Treatment: The settled samples was subjected to chemical treatment using FeSO4, Fecl3, Alum, and Polyelectrolyte.

Sr. No.	Treat-ment	Dose (ppm)	pH	COD (mg/lit)	TSS (mg/lit)
1	Alum	100	6.4	440	60
2	Fecl3	100	5.0	410	20
3	FeSO4	100	7.0	400	20
Note: Polyelectrolyte added in all above experiment 2 mg/lit					

3. Activated Sludge Process: The effluent after Alum + polyelectrolyte treatment was subjected to Activated sludge process Batch & Continues reactor was operated for 3 weeks. During the trial MLSS in the reactor was maintained at 3000 mg/lit.

Sr. No.	Aeration Time	pH	COD	BOD
1	1st day (20 Hrs)	6.8	378	115
2	2nd Day (20 Hrs)	6.9	165	57
3	3rd Day (Conti. – 8 Hrs)	7.1	118	13
Note: F/M – 0.15 & VSS – 2400 mg/lit maintained				

4. Tertiary Treatment:
   A. Sand Media Filter

Sr. No.	Type of Sample	SS	COD	BOD	pH
1	Composite	<10	118	13	7.0
Note: All values in mg/lit excepted pH and Filtration rate 10 m^3/m^2/Hr.					

   B. Activated Carbon Filter:

Sr. No.	Type of Sample	SS	COD	BOD	pH
1	Composite	<10	117	12	7.0
Note: All values in mg/lit excepted pH and Filtration rate 10 m^3/m^2/Hr					

5. Summary of Results:

Sr No.	Type	pH	O&G	COD	BOD	Color	TDS
1	Inlet	6.5	96	617	185	Milky White	852
2	Outlet	7.0	4.0	115	12	Colou rless	189
Note: All values in mg/lit except pH							

Conclusion:

In recent Scenario, the scarcity of water is a major worldwide problem not only for the textile industry, but also for other industries that are heavily dependent on the high usage of water: a primary ingredient for human existence.

Thus to minimize the operating cost while increasing the machine efficiency at the lowest capital investment, it is suggested to that wastewater generated from water jet looms can very well treated by applying physic chemical, biological and polishing filtration method to achieve desired treated water quality.

Average a single water jet loom machine consumes 2500 to 3000 lit fresh water in operation of a single day and generates 2000 to 2500 lit wastewater per day, which is cumulatively in high quantum as per the numbers of industries are there.

Hence, this treatment & reuse technology can reduce a remarkable water usage without affecting efficient operation and production of industries.

Above specific process of the invention are described. It is to be appreciated that the present invention is not limited to above mention particular implementation, those skilled can make various distortion or process within the scope of the claims, and this does not affect flesh and blood of the present invention.

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