Pump sealing water and felt shower water from white water by use of new filter technology

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ABSTRACT

A new continuous sand filter technology, the DynaSand Filter, makes it possible to clean white water to such high quality that it can be reused as e.g. pump sealing water aad felt shower water.

Advantages of new technology are :

- lower water consumption,
- reduces waste water flow and thereby pollution
- saves energy.
- possible to reuse fibers and fillers

The DynaSand Filter is a continuously operating sand filter in which the sand bed is cleaned by internal recycling. This means that the filter has never to be shut down for backwashing and that it will accept a high suspended solids content in the feed.

Plants using the DynaSand Filter for production of pump sealing water, screen cleaning water and felt shower water from white water are in operation since more than seven years.

As an example Metsalliton's Kirleniemi Plant has been able to reduce water consumption from 15 to 20 m^3/ton paper to below 10 m^3/ton paper produced.

Environmental concerns and restrictions have forced the pulp and paper industry to reduce the water consumption per ton of paper resp. pulp produced.

The rising cost of energy has made it economically more interesting to conserve energy within the plants.

One means to achieve both these objectives is to treat the white water from the paper machine to such a quality that it can be reused in the plant. Possible applications are as e.g. pump sealirg water, cleaning water for wire screens and felt shower water.

Reuse of white water as wire cleaning water or felt shower water are typical applications where both the environmental and energy savings objectives can be met. By reusing the water the environmental load from the plant is reduced and warm water (50°C-55°C) is recirculated to the paper machine, saving energy which would otherwise be needed for heating of water.

THE DYNASAND FILTER

The Dynasand Filter is a continuous upflow filter. The principle of operation is shown in fig. 1.

The sand is continuously cleaned while the filter is in operation. The dirtiest sand is continously taken out of sand bed, washed and returned top the clean part of the sand bed. This means that the filter does not have to be taken out of operation for backwashing.

The feed is introduced into the lower part of the filter bed through riser tubes which discharge under a distribution hood moving downwards. Most of the suspended solids in the feed will be found in the lower

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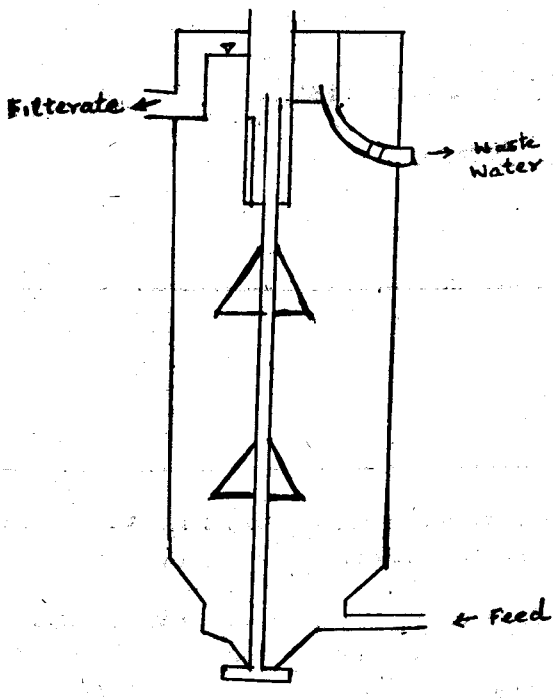

The Dyna Sand Filter

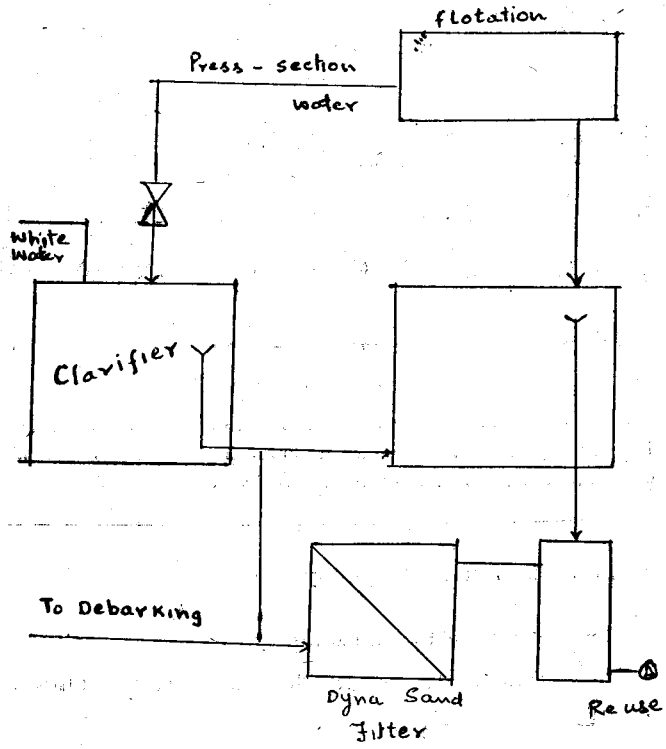

FIG-2
Water recovery System at Metsalliton Teollisus Plant

part of the filter. The sand bed is kept in a slow downward motion by an air lift pump taking out dirty sand from close to the bottom of the filter tank. In the air lift pump the sand is subjected to a thorough mechanical aditation in the action of the air bubble and the dirt is separated from the grains of sand.

The dirt is finally rinsed away from the sand in the sand washer which is placed concentrically around the upper part of the air lift pump. The clean sand is returned to the top of the filter bed. Reject water is continously taken out from the sand washer. The filtrate leaves the filter as an overflow.

PLANT EXPERIENCES

Metsalliton Teollisuus

Metsalliton's Kirkniemi Plant produces 140.00 tons/year of uncoated magazine paper and 130.000 tons/year of LWC. At the Kirkniemi Plant a Water recovery system according to fig. 2. has been in use since 1982, The objective of the filter plant was to reduce water consumption per ton of paper produced from 15 to 20m³/ton to about 10³m/ton. The water treated in the filter plant was to be reused as pump sealing water and screen cleaning water.

The Dynasand Filter plant has a capacity of 20m³/h. The feed to the filter plant consists of white water taken from a white water clarifier. The temperature of the white water clarifier is approx. 55°C. Polymer is added to white water before it enters the clarifier. Suspended solids in the white water are reduced from 1500-2000 mg/l to 30-50 mg/l by the clarifier. The suspended solids in the water leaving the clarifier consists of approx. 60-70% clay while the rest is fibres. This water is passed directly into the Dynasand filters, where it is subjected to mechanical filteration, which reduces the suspended solids to 5-14 mg/l (as measured on membrane filters 10 microns).

TABLES 1 & 2 indicates the operating results

TABLE—1

	Fresh water	Press water	Clarifier w.w.	After Dynasand
Typical temp. °C	4–17	35–40	55	55
COD mg 0/1	8 (Mn)	300 (Cr)	1500 (Cr)	1500 (Cr)
SS mg/1 (10μ)	5	40	30–50	5–14
pH	6.5–6.8	5.5–6	4 5–5.5	4.5–5.5
Spec. cond mS/m	12	40	80–110	80–110

TABLE—2

Waste water dischargcd into the Lake Lohja October 1983 (Kirkniemi Mills)

Flow	6800 m^3/d	8 4 m^3/t paper
SS	1400 kg/d	1.7 kg/t
BOD_7	3100 kg O_2/d	3.9 kg O_2/t
Production :		
Groundwood	10915 t	352 t/d
Paper	251 6 t	8.11 t

The quality produced in the Dynasand Filters is such that water can be recirculated as pump sealing water or spray water for cleaning the wire screens.

At present the water is used for pump sealing, and as soon as a back up system with 50 °C water is available, the filterate from the Dynasand Filters will also be used for wire screen spray water

As was mentioned before, the objective was to reduce water consumption from 15 to 20 m^3/ton of paper down to 10m^3/t paper produced. The actual result is that water consumption has been reduced to 6 m^3/t paper produced by use of recirculation technique. This means that the Kirkniemi Plant now discharges only 8 m^3/t paper of waste water from the paper mill including the waste water from the mechanical pulp mill and the debarking plant.

USERS EXPERIENCE

According to the original plan the water to be treated was press-section water from the paper machines. Due to relatively low temp of this water (35 - 40°C) very serious microbiological difficulties arose at the filteration plant and in the pipe lines. This problem was attacked by using slimecides. After 6 months of operation and half a dozen-different chemicals it was obvious that something else had to be done to overcome the problem.

The reason behind the idea of treating press-section wa er was that this water is close to fresh water after the suspended solids are removed.

The clarified water in Kirkniemi has always been used as makeup water at the debarking plant. The excess clarified water is discharged as waste water.

This was now modified and this relatively hot (50°C) water was pumped to the sand filters and fresh warm water at the pumps was replaced. The press-section water is now discharged as waste watet after treatment in a flotation unit for fiber recovery.

This has led to a higher white water temperature (55°C) and a lower discharge of BOD. The BOD (Cr) level has risen from 900 to 1,500 mg O_2/1.

After small modifications of the filters the system has been in 100% use since Sept. 1983 and the total waste water amount is 6,000–7,000 m^3/d.

The goal max. 10 m^3/t paper, as a specific water consumption has been reached.

Molnlycke, Papierfabrik Friesland

Papierfabrik Friesland in Bergum, Holland, produces tissue paper. Two tissue-paper machines are operated in the plant.

Since the price of fresh water is comparatively high in Holland, every attempt has been made to decrease the plant's water consumption. This has been done by closing all water systems as much as possible.

As part of this programme, Papierfabrik Fiesland installed one 2 m DynaSand Filter in early 1978 and Since the performance of this first filter was good.

DESCRIPTION OF THE INSTALLATION

A mixture of used wire spray water, used felt spray wire and used vacuum pump sealing water is filtered in a Wargo drum filter. This reduces the fiber content in the mixed water from 300-700 mg/l to 30-80 mg/l.

Part of the filterate from the Wargo filter 40-90m^3 is fed to two 3m^2 DynaSand Filters.

PLANT EXPERIENCES

When the first filter was commissioned it was discovered that the fiber content in the drum filter effluent occasionally by far exceeded the expected 50mg/l went upto 500 mg/l when recorded.

The problem was solved by changing the filter media from sand with grain size 0.8—1.2 mm to sand with grain size 2—3mm. The change in filter media decreased the filters sensitivity towards suspended solids overloadings substantially, so that the DynaSand Filter could handle the occasionally occuring peaks in feed concentration.

The change in filter media did not effect the quality of the sand filter effluent.

After this change in filter media DynaSand Filters have been in continuous operation, producing felt spray water since the two 3 m units were installed in early 1981.

CONCLUSIONS

A method has been described which makes it possible to reuse white water as e.g. pump sealing water, screen cleaning water and felt spray water.
Advantages of the method are:

- lower water consumption
- reduces waste water flow and thereby pollution
- saves energy
- possible to reuse fibers and fillers.

Metsalliton's Kirkniemi Plant has reduced its water consumption per ton of paper produced from 15-20 m^3/t to below 10m^3/t. Warm Water (50-55°C) can be recirculated which means energy savings, and the amount waste water from the plant has been reduced significantly.

At Molnlycke's Holland Plant filtered white water is recirculated as pump sealing water end felt spray water.