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Reclamation of waste water

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ABSTRACT

Water is a precious natural resource without which life cannot exist. As it is available in fixed quantum thus reclamation of this natural resource is very essential to meet the requirement of continuously increasing population. Without effective planning and management per capita availability of utilizable water is going down. The increasing gap between water available to water require, highlight the importance of waste water reclamation. Reclamation of waste water is not only includes the sewage reclamation but also done for domestic waste water and industrial waste water. Effluents discharged by the industrial and domestic applicants is reclaim to produce an environmently safe water for living being and reuse for non potable application. Water reclamation is also a very effective tool in controlling the water pollution and conservation. In view f above the present study was taken up to reclaim the waste water of textile plants and making it useful for non potable purpose.

Key Words: Reclamation, Zero water discharge, Ground water recharge.

INTRODUCTION

Water scarcity makes industrial waste water reuse necessary, especially in those industries characterized by both high water consumptions and extreamly polluted effluents as textile industries. Waste water reclamation is a process of removing contaminants from waste water. It includes physical, chemical and biological processes to remove physical, chemical and biological contaminents. Reuse of waste water represents an economical and ecological challenge for the textile sector.

Textile industry is one of the oldest and largest sectors in india and pointed attention is being directed towards pollution of water. The effluents consist of high TDS, chloride, conductivity, and COD due to the use of different type of chemicals including various dyes .

MATERIALS AND METHODS

Two sample of waste water have been collected from the textile mini plant where the washing and dyeing of raw material have been done .Presence of various types of dyes & chemicals make the textile effluent coloured and highly alkaline. To treat such type of effluent, conventional and cost effective treatment methods are acid neutralization, flocculation and adsorption. Textile industries contribute considerable amount of effluent of varying characteristics the effluent carries colour, dissolved solids and various organic and inorganic substances.

TABLE-1 Characteristics of the effluents used in the study

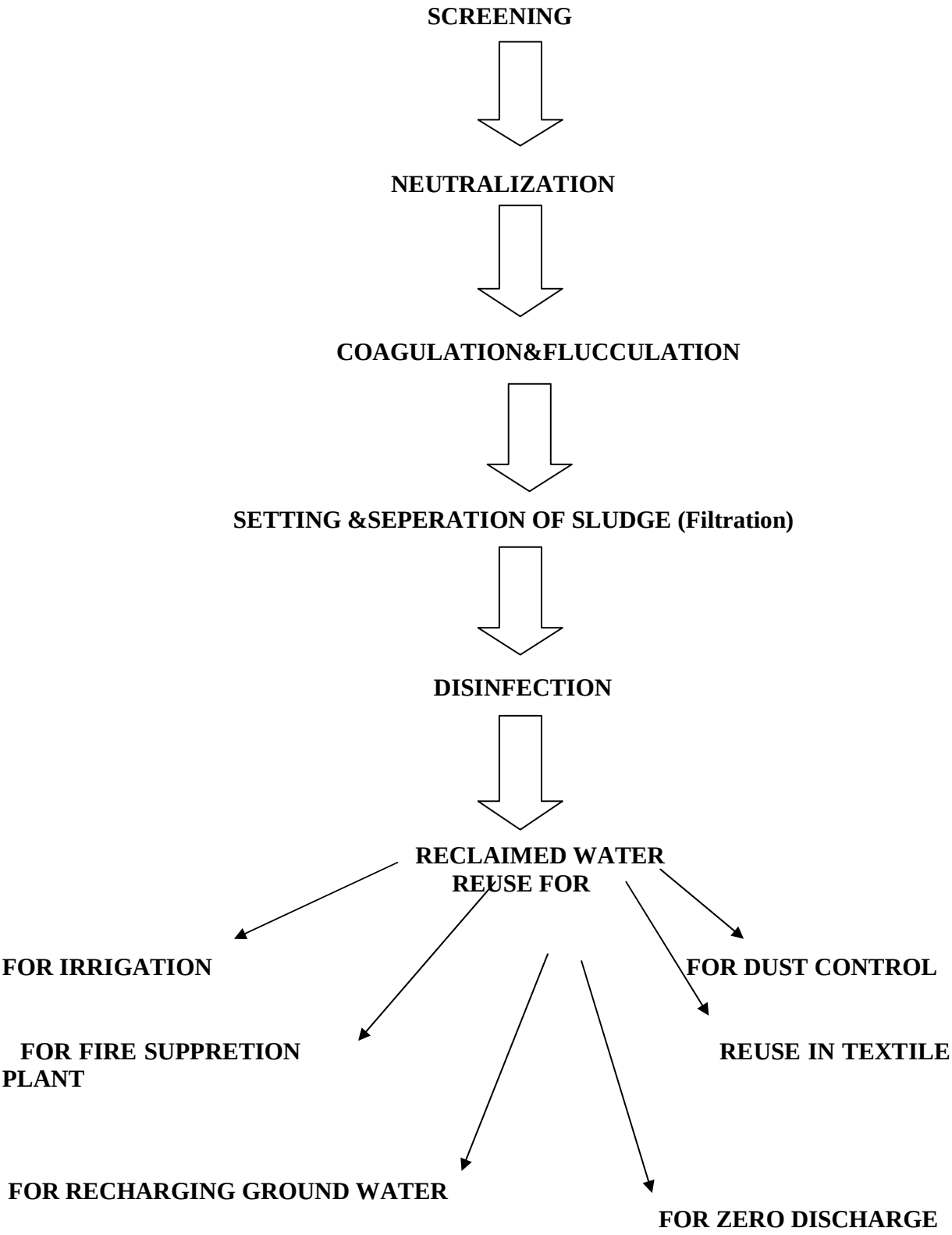
SNo.	Parameters	Sample-1(S_1)	Sample-2(S_2)
1	pH	9.1-10.5	10.1-11.9
2	Conductivity (µsiemen /metre)	650-450	850-990
3	Chloride (mg/lit)	250-500	300-500
4	Alkalinity (mg/lit)	987-1200	1157-1430
5	COD (mg/lit)	6340-5530	8700-9680
6	TDS (mg/lit)	1500-2300	1700-2100
7	TSS (mg/lit)	300-1000	340-1200

Treatment of the textile effluent normally involves neutralization, coagulation followed by biological treatment. This treatment involves large amount of acid/ alkali, coagulants and energy. Before the neutralization ,screening of the sample is must be done.

Screening-
Waste liquor is subjected to primary filtration, in which removal of gross solids, such as waste threads, fabric pieces, lint's, etc, takes place.

Neutralization-
The effluent is pumped to a tank in which it is neutralized by acid or alkali dozing. The tank has an automatic dosing controller which at automatically control the dose of acid or alkali to maintain the required pH . If the sample is alkaline than the an acid is used for neutralization and vice versa. After the neutralization coagulation of the sample takes place.

Co-agulation
Coagulation is the destabilization of colloids by neutralizing the forces that keep them apart. Cationic coagulants provide positive electric charges to reduce the negative charge (zeta potential) of the colloids. As a result, the particles collide to form larger particles (flocks).Coagulation, thus, implies formation of smaller compact aggregates. Rapid mixing is required to disperse the coagulant throughout the liquid.Through coagulation, water treatment plants can remove the waste particles in water and further treat it to be usable again. Treated water is also less harmful when returned to the natural environment.


SCREENING
NEUTRALIZATION
COAGULATION&FLUCCULATION
SETTING &SEPERATION OF SLUDGE (Filtration)
DISINFECTION
RECLAIMED WATER
REUSE FOR
FOR IRRIGATION
FOR DUST CONTROL
FOR FIRE SUPPRETION
PLANT
REUSE IN TEXTILE
FOR RECHARGING GROUND WATER
FOR ZERO DISCHARGE

After the neutralization the effluent is pumped to the co-agulation tank. Effluents are heterogeneous in nature.In water, those particulates with the same charge are suspended into a colloid (a mixture with properties between a fine suspension and a solution). The repulsion process--the physical property of particles with the same charge (i.e., negative and negative) repelling each other--stops the particulates from combining into a settled form. Coagulation water treatment applies chemicals to assist water particulates in combining together.

When particulates are aggregated, they can be more easily removed from the treated water. Chemical coagulation is an important unit process in water treatment for the removal of turbidity. Its application in water treatment is followed by sedimentation and filtration.

An important chemical reaction takes place during coagulation-

$$Al_2(SO_4)18H_2O + 3Ca(HCO_3)_2 \longrightarrow 3CaSO_4 + 2Al(OH)_3 + 6CO_2 + 18H_2O$$

$$Al_2(SO_4)18H_2O + 3Mg(HCO_3)_2 \longrightarrow 3MgSO_4 + 2Al(OH)_3 + 6CO_2 + 18H_2O$$

As coagulant pH range of aluminium sulphate is 4.7 . Soda ash (Na_2CO_3) and lime stone are used as coagulant aids which improves the result when they are used with coagulants. Various types of coagulants are being used to condition water before sedimentation and filtration. The most widely used coagulants are:

- Aluminum sulphate{Alum }
- Ferrous sulphate
- Silicon derivatives
- Synthetic organic polymers
- Poly aluminum chloride {PAC}
- Sodium aluminate
- Lime

The next step is a process called flocculation. Polymers adsorb onto the particulates, causing them to combine together into clumps or aggregates called "flocs." The difference between coagulation and flocculation is that the former neutralizes the charges of the particulates and the latter causes the flocs to be formed through the formation of polymer bridges between the particulates. Even, after these chemicals are used to treat water. The water will progress through other steps, including filtration and disinfecting .After co-agulation biological treatment is necessary to remove the pathogens.

Sedimentation & Filtration

Sedimentation is the process of removing settleable materials. It is accomplished by decreasing the velocity of flow to lessen the ability of the water to hold the particles in suspension. The particulates that are easy to settle in water are removed through a settling process called sedimentation. Sedimentation is the setting of the ‘floc’ by gravity after the movement of the water molecule has been retarded. As the water flows through a sedimentation basin within a tank, at an extremely slow velocity, suspended material settles toward the bottom of the basin. The water passing out of the tank is relatively clear. Correct basin design keeps the water from flowing directly from inlet to outlet. Additional baffles are sometimes needed to control the flow. Best results are obtained when flow is evenly distributed, properly baffled, and enters the basin

at about 1 foot per minute velocity. The process normally takes between 3 and 6 hours. Sedimentation basis may be separate units or they may be combined with flocculators.

After the sedimentation filtration is required. Filtration is done by different methods like membrane filtration, ultra filtration, nano filtration etc. The quality of reclaimed water is depends upon the method of filtration. After filtration water is treated with disinfecting agent for the removal of micro-Organism.

Disinfection-

Ozone has been used for water disinfection for about 80 years in France, Germany, and other European countries. It is now undergoing a critical evaluation as a possible alternative to chlorine when used alone or in conjunction with other disinfection systems. There is some evidence that it forms smaller amounts of hazardous trihalomethanes (THM) when employed to treat polluted waters or wastewater effluents.

Inter halogen compounds, formed from two different halogens, resemble their parent substances in properties and germicidal characteristics. The inter halogens BrCl, ICl, and IBr have recently been investigated as possible alternative disinfectants for water and wastewater effluents. Added to water, they rapidly hydrolyze to the corresponding hypohalous acids, which are stronger oxidants and disinfectants than hypochlorous acid. For instance, BrCl is hydrolyzed to HCl and HOBr. However, their improved germicidal activity is counterbalanced by the formation of haloforms. The use of chlorine and some of its derivatives will continue as an integral part of the disinfection process in water and wastewater treatment. Alternative disinfecting agents such as chlorine dioxide (Rav-Acha et al. 1985b), UV light (Severin et al. 1984; Scheible 1987), and UV light in conjunction with hydrogen peroxide (Crandall 1986) are being considered. Reactions of chlorine in water that form the basis for its application as a disinfectant and oxidant are as follows:

$$Cl_2 + H_2O \longrightarrow HCl + HOCl$$
$$HOCl \longrightarrow H^+ + OCl^-$$

The products, hypochlorous acid (HOCl) and hypochlorite ions (OCl^-,) are referred to as free available chlorine (FAC). The biocidal activity is attributed chiefly to HOCl, as it is more effective than the OCl^-. In the presence of natural or added ammonium ions, HOCl reacts to form chloramines, known as combined available chlorine (CAC). As a disinfectant FAC is more effective.

RESULTS AND DISCUSSION

Considering the wide range potential for waste water reuse, it may be difficult to set some common quality standards for all types of reuses. Reuse of reclaimed water for non potable purposes only requires lower quality level. It will be the saving in the treatment cost. For dust control and fire suppression quality standards are not required. It is quite difficult to define a general quality standard for textile water reuse for the different requirements of each fiber (silk, cotton, polyester etc). Reclaimed water generally reused for washing and dark colour dyeing process in textile industry. Irrigation reuse is also more advantageous because water quality is

does not matter. Irrigation reuse of waste water for landscape, recreational areas , woodlots, agricultural crops. Reclaim water is also use for zero water discharge and ground water recharge.

Zero water discharge- It means recover usable material such as water and salt from the effluent and minimize the generation of waste so that it can be safely stored on site without the need to discharge into the environment and reused also.

Ground water recharge-Ground water recharge is a hydrological process where water moves down word from surface water to ground water. Recharge can help in moving excess salts that accumulate in the root zone to deeper soil layer.

CONCLUSION

The standard of drinking water was developed for natural ground water and not appropriate for identifying contaminants in reclaimed water. As the quality standards are not determine for the reclaimed water, hence the reclaimed water is used safely only for non potable purpose. Due to the presence of pathogen and other organic compound in reclaimed water can not be used for drinking and other potable purposes. Reuse of reclaimed water for non potable purposes saves potable water for drinking and other domestic use.

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