Scientific Reviews
&
Chemical Communications

Sci. Revs. Chem. Commun.: 2(3), 2012, 229-231
ISSN 2277-2669

FULL-SCALE ATTACHED GROWTH PLASTIC MEDIA REACTOR FOR DISTILLERY WASTEWATER TREATMENT : A CASE STUDY

J. P. NAYAK* and RASHMI J. NAYAK

Sandip Institute of Engineering & Management, NASHIK – 422213 (M.S.) INDIA

(*Received : 21.02.2012; Revised : 15.03.2012; Accepted : 21.03.2012*)

ABSTRACT

This Paper presents the method and results of the commissioning study carried out at the two Full scale downflow fixed-film reactor (SMAG) supplied by Reva Enviro Systems Pvt. Ltd., Nagpur To Dhampur Sugar Mills Ltd., Bijnor Distt., U.P. as a primary treatment system for treatment of Distillery wastewater. The capacity of each reactor is 400 m^3/day (i.e. Diameter: 23.5 m, Height : 9.0). The total project cost was around 6.0 crores. This study was carried out by the Author under his project work of M. Tech. (Sponsored by M/s Reva Enviro. Systems P. Ltd.) done from V.N.I.T. (V.R.C.E.) Nagpur.

Key words: SMAG, Spent wash, Immobilization.

INTRODUCTION

The distillery wastewater (i.e. Spent wash) is known as one of the worst polluted waste, having pollutional potential strength (COD : 1,00,000-1,60,000 mg/L, BOD : 35,000-50,000 mg/L, pH : 3.7-4.5). The spent wash, if not treated well, can make the soil infertile (if disposed on land) or render the water unfit for any use (if disposed in river). So, proper treatment of spent wash before disposal is of utmost importance. The present study was carried out on in-vogue Downflow Fixed–Film Reactor technology being used for the primary treatment of spent wash. Downflow Fixed–Film Reactors have been termed as the SMAG reactors (Structured Media Attached Growth Reactors) in the present study.

Process description of SMAG reactor system

The Temperature of the spent wash is high (85-95^{o}C), when it comes out from the distillation column. Its temperature should be brought down to about 38-40^{o}C before supplying it to reactor. For this purpose hot spent wash is pumped via Plate Heat Exchanger (P.H.E.) to the SMAG. The cooled wastewater enters to the SMAG through suitably designed Top circular feed tank. Specially designed P.V.C.-plastic media (modules/boxes) is packed in the SMAG reactor in layers. The main purpose of the provision of the media is to provide large surface area for the immobilization of Acid and Methane forming bacteria and to form a biofilm on each plastic media module. The media is designed & laid in the SMAG reactor in such a way to provide a very large surface area for the bacterial film to grow & immobilize.

Available online at www.sadgurupublications.com
*Author for correspondence; E-mail: jyotiprakash.nayak@siem.org.in

The media has void ratio of about 95% and has specific surface of about 105 m^2/m^3. The content of the tank is kept under constant recirculation through a set of four recirculation pumps. In the tank influent wastewater is mixed with the recirculating reactor content. Recirculation thus helps in the mixing of the reactor content & avoids formation of the low pH spots. Both acidification & methanisation takes place simultaneously in the reactor. The pollutant organic matter (i.e. COD & BOD) is reduced & converted into Biogas rich in Methane (50-60%). The Biogas is compressed and supplied to Boiler for the steam generation purpose. Treated wastewater comes out continuously from the overflow pipelines due to the gas pressure present inside the SMAG reactor. The details of the system are available in the attached diagram.

Media details of SMAG reactor

Media modules are prepared from polyvinyl chloride (P.V.C.) sheets. Usually 11 plain and 10 corrugated sheets are used for preparation of one media module. P.V.C. powder dissolved in cyclohexane solvent is used for adhesion of these media sheets. On as average usually 100 gm of P.V.C. powder and one liter of cyclohexane is required for preparation of one media module.

Media Module Size : 1220 x 610 x 610 mm

In a SMAG reactor depending upon the volume of the reactor, usually total 10 layers of media modules are provided. The provision of laying of different media module layers inside the reactor is generally kept as per the following Table:

Table 1: Laying of media modules inside the reactor

S. No.	Type of Modules	No. of Layers to be laid of particular module	Place of laying of particular type of module
1	Blue Module	1	Above supporting grid system
2	Green Module	2	Above blue module layer
3	White Module-1	4	Above green module layer
4	White Module-2	3	Above white module-1 layer

The bottommost blue module layer is laid perpendicular to the direction of support, while the rest 9 layers are laid in harring-bond fashion.

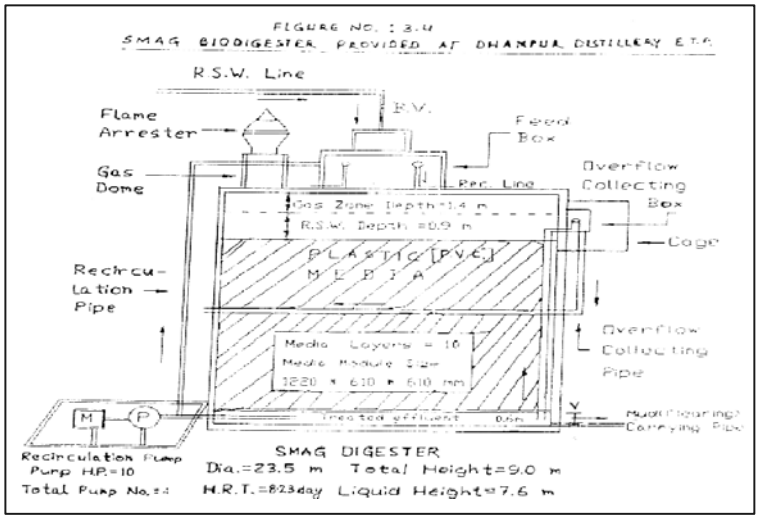

Fig. 1: SMAG Reactor Provided at Dhampur Distillery

Depending upon the size of the reactor, the no. of media modules that can be accommodated varies from 5000-8000. In the each SMAG reactor installed for Dhampur Sugar Mills around 5500-6000 no. of media modules were laid.

SMAG Reactor provided at dhampur distillery

Two SMAG Biodigesters have been provided as a primary treatment system, for the treatment of distillery wastewater at the Dhampur distillery effluent treatment plant. Both the digesters are identical. Each biodigester has been designed for:

1. Daily wastewater flow : 400 m^3/day
2. BOD Removal Efficiency : 80 %
3. COD Removal Efficiency : 65 %
4. Biogas Production : 0.5- 0.56 m^3/kg of COD removed
5. Maximum COD load : 1,00.000 mg/L

Each SMAG Reactor provided has:

1. Diameter : 23.5 m
2. Total Height : 9.0 m
3. Liquid Height : 7.6 m
4. H.R.T. : 8.23 days ,
5. S.R.T. : 168 days

CONCLUSION

1. At full hydraulic loading (i.e. 400 m^3/d) SMAG reactor was giving the desired COD & BOD removal efficiency of the order of the 65% and 85% respectively.
2. The capital investment required, can be recovered in about 1.0 to 1.5 years (i.e. Payback Period) with utilisation of biogas as a fuel, for raising steam in boiler.

REFERENCES

1. J. P. Nayak, ‘A Case Study of Commissioning and Operation of a Full Scale Downflow Fixed Film Reactor for Distillery Wastewater’, M. Tech. (Environmental Engg.) Thesis, VRCE (VNIT), Nagpur (1998).
2. R. C. Bhagwat and C. K. Tiwari, A Proven and Economic Method for Treatment of Distillery Spent Wash, Seminar on Disposal of Sugar Mill & Distillery Effluent, Lucknow (1980).
3. Operation and Maintenance Manual for SMAG Reactor.