Managing Effluents In Pulp & Paper Industry

Karaila Heli

Uniyal Rakesh

ABSTRACT

A considerable amount of Residual Chemicals and Solid Sludge are generated during Pulp & Paper making process. The efficient handling of these effluents is important in order to meet budget and environmental constraints. The first and foremost way is efficient use of required chemicals, reduced wastage of costly raw materials (Ash & Fibre).Highly efficient equipment and accurate process measurements are the key to achieve this target.

The second and important way to handle effluent is effluent treatment plant in the mill. If we are able to measure amount of solids, chemical content in the wastewater; corrective actions can be taken and environmental norms could be met. Also, the treated water can be re-used within the process. Again, along with efficient equipment, accurate measurements are key to this process.

In this paper we will discuss about the latest measurements available for both of the above approaches.

Keywords: *Consistency, ERIC, Effluent treatment optimization.*

Introduction

Consistency management (Fibre as well as Ash) throughout the mill is important. Be it pulping process or machine, if these parameters could be measured accurately, optimum usage of chemicals can be done and hence lesser effluents. In recycled paper based mills, Ash consistency management (Figure 1) during pulping process is important. Most critical measurement points for Ash in a DIP would be Floatation cells. This would help in knowing Ash content at these locations and hence optimizing chemical dosage as well. For all recycled based mills, online measurement of TOTAL CONSISTENCY in mixing/ machine chest is important due to varying nature of raw material and its inherent Ash. Microwave technology (Figure 2) is best suited for managing consistency in this application.

Valmet Finland
Valmet-Automation Business Line
Ground Floor, DLF Building #10, Tower A, Cyber City, Phase-II, Gurgaon-122 002 (Haryana),India

In a DIP measurements like ERIC & Brightness (Figure 3) are crucial too. Typical locations could be at Pulper Inlet, Floatation stages (for ERIC calculation), bleaching and final pulp.

Coming on to Effluents handling, online measurements of Total Solids, BOD/ COD are important. The industry has a mandate to protect the water environment. In fulfilling this mandate, wastewater treatment plants generate large quantities of residual solids, commonly referred to as sludge. Usually, solids production rates range between 0.2 and 0.3 kg/m3 (0.8 to 1.2 dry tons/MG) of treated wastewater [1]. Reduced BOD of 7 kg creates 0.7 1.2 kg solid material in the wastewater plant [2]. One of the most important task for the wastewater plants is solid removal, The removal is normally defined within the wastewater plant's environmental

(Figure 1, LED & LASER transmitter)

(Figure 2, Microwave Transmitter)

(Figure 3, Brightness/ERIC)

permission. Content of suspended solids in the leaving water is one of the key parameters.[3] The cost for treatment and disposal of sludge in European countries has been estimated to reach, on and average approximately 500 € per ton of dry mass according to the type of treatment and disposal. A further increase is expected in the near future [4]. While treatment of wastewater takes several hours, processing of the sludge generated and preparing it for disposal or beneficial use takes several days or even several weeks and necessitates the use of more complex equipment. That is why sludge management costs 40 to 50% of the total wastewater treatment costs.[1]

Wastewater entering the ETP has some percentage of solids (dissolved and suspended) which have to be first measured and then treated further to extract purified water for re-use. The remaining sludge too needs measurements to calculate solids percentage so that it can be further processed inside the plant. The main cost of sludge handling is incurred by pumping and putting chemicals as well as dewatering process-related electricity and polymer usage. It is important that the transport and burning of dried sludge is done after the dewatering process.

Normally, monitoring of solid amount has been carried out in laboratory. The frequency of the laboratory measurement is normally once per day or a couple of times a week. Because the samples are taken so seldom, added to the fact that the results of the laboratory measurements come with delays, it is not possible to create optimization control applications on the basis of such measurements.

The sludge solid measurements have represented a challenge at the ETP due to contamination. Selecting measurement technology which needs least of maintenance and not effected by the contamination is important. Especially during the dewatering process, the reject water low solids represent a highly challenging issue due to debris and foam.

Microwave based measurement is the latest and proven technology for Total Solids measurements in slurry. LED and LASER based optical measurements have been used in Filtrates containing Low-Solids.

Methods

New technologies to measure “total consistency & ash content in pulp” and “total solids” in the wastewater

Two new technologies that have been utilized. After success in Pulping and machine area, these technologies have been utilized in the wastewater solids measurements since the performance report [5] has been published. These are microwave technology and optical technology that utilizes multiple optical & multiple light sources.

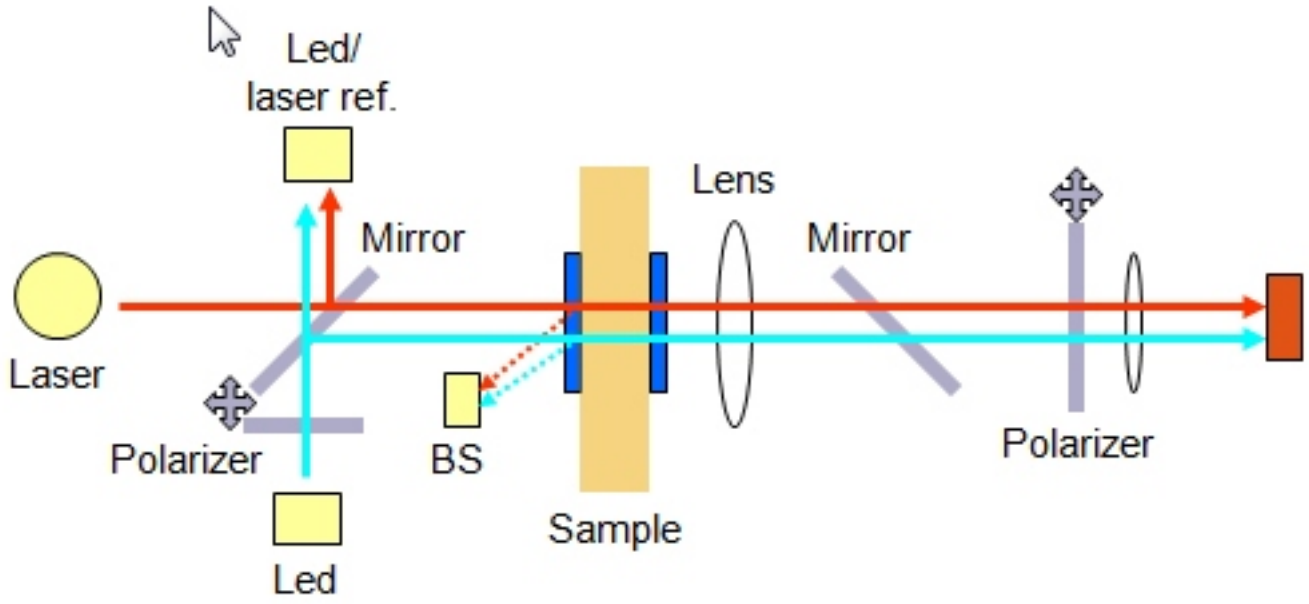


Figure 4: Two light sources (LED) and three (3) signals from each of the light sources

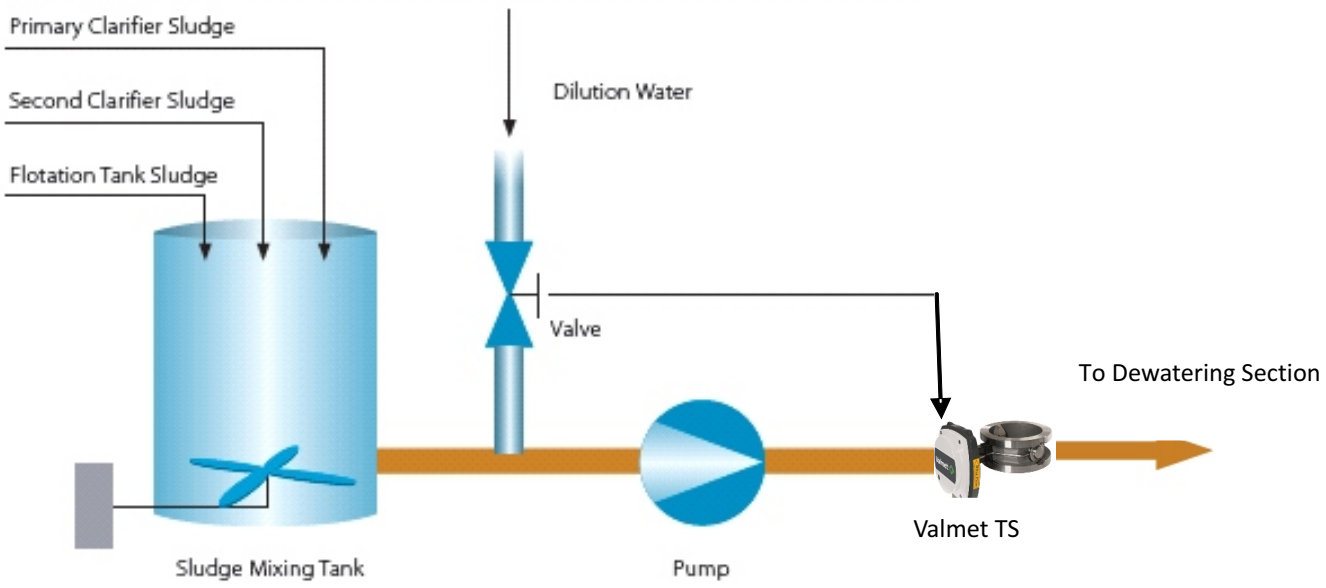
Microwave technology

The transmitter without moving parts (Figure 1) measures the time that electromagnetic waves need to travel through the flowing material. The length of time depends on permittivity, i.e., how the flowing material interacts with the electric field. Permittivity of organic matter is practically constant, whereas the permittivity of pure water differs considerably. Solids-based content can be accurately determined as based on the difference between the two materials. The measurement range of the microwave technology is 0 - 35% for Solids and 0-16% for fibre consistency.

Laser and LED technology

The sample passes through two light sources (laser and LED, Figure 2, 4) when flowing through the measurement cell. From each of the light sources, three signal absorption, scattering and polarization signals are generated. The calibration can utilize 6 signals. The measurement range is 05,000 ppm (00.5%). This measurement is specially designed for low solids whose sample content has a large amount of air and debris. Ash measurement at various process stages of a recycled pulping is also done by same technology with a different calibration.

Figure 5- Schematic at Shandong APRIL mill.



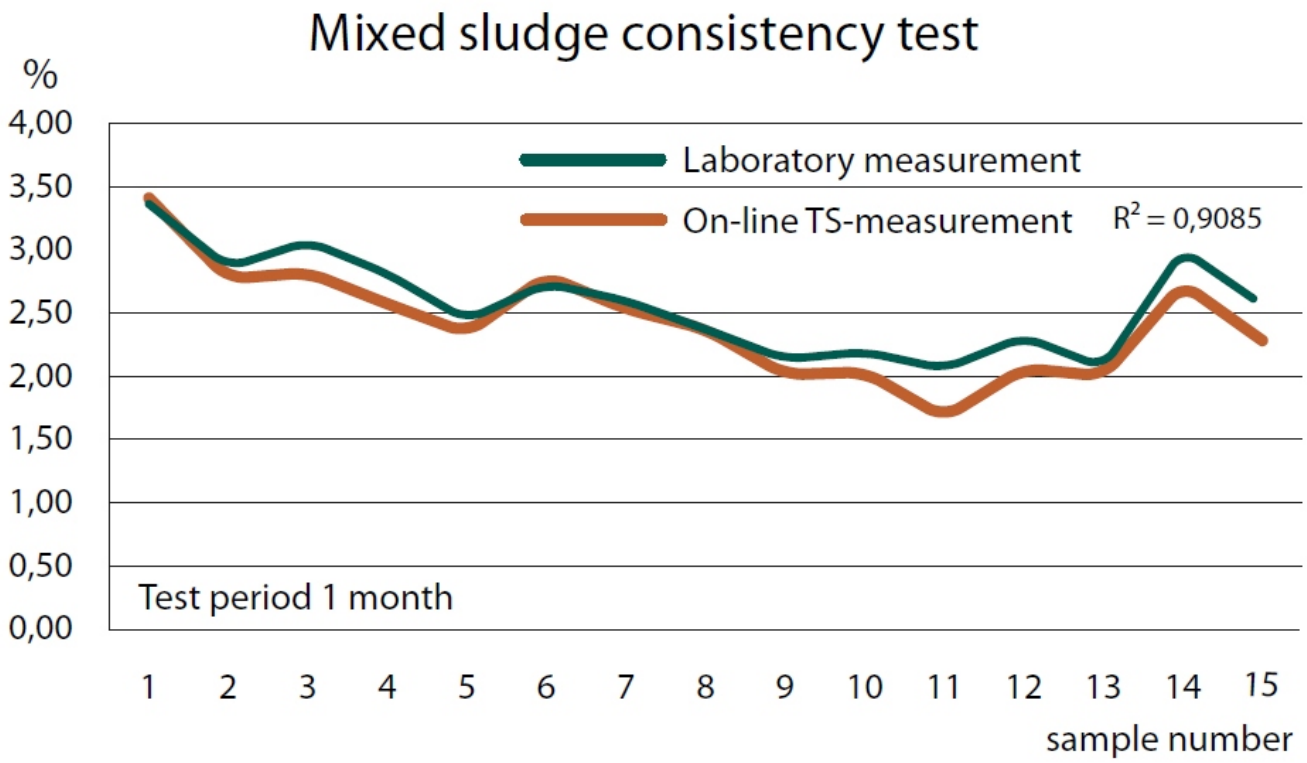


Figure 6: Microwave measurement online vs. laboratory correlation

Case studies

Stora Enso Anjalankoski

Stora Enso's Anjalankoski paper mill and Inkeroinen board mill in Finland form an integrated mill complex. The mills cooperate in raw material and energy supply as well as in power production and wastewater treatment, including the drying and burning of sludge.

The customer has utilized the measurements in the bark sludge, primary and mixed sludge lines

Shandong APRIL SSYMB Pulp & Paper, Rizhao

Shandong APRIL SSYMB pulp and paper Corp. Ltd is at Rizhao, Shandong province. The annual production of plant phase I is 315,000 ton fine wood pulp, and 1,000,000 ton fine wood pulp of plant phase II per year. The plant phase II wood pulp line is the biggest single line right now of the world, the most advanced process technology and the equipment, and the highest environment protection level wood pulp line. The wood pulp plant phase II waste water plant treatment capability is 130,000 ton per day. The waste water is mainly coming from the cooking, washing and screening,bleaching, paper machine and the alkali recycle process segments. The waste waterfrom the different process segments of the wood pulp line is collected by the plant waste water pipe lines and treated at the waste water plant. The normal sludge concentration of the sludge mixing tank outlet is 2%~4%. Valmet TS sludge concentration transmitter is used for the measurement and the control loop. Transmitter is installed at the outlet of the sludge mixing tank (Figure 5). The sludge from the primary clarifier, the second clarifier and the flotation tank is mixed at the sludge mixing tank totally.The mixed sludge is transferred to the remote sludge dewater station. At the sludge dewater station, the mixed sludge is added the polymer. After the press and filterate dewater of the belt press filter, the sludge is treated for the further drying. The final total solids concentration reaches about 40%. It decreases the sludge bulk and water content. It will be more convenient for the sludge storage and the transportation.

Results

Comments from Stora Enso Anjalankoski:

“on-line solids content measurement has enabled us to react to process changes immediately, which is very important in controlling sludge flows. The transmitters have also greatly helped us to select the most suitable polymer chemical,

compared to the earlier practice. During almost one year of operation, we have had no need for calibration or maintenance, which has made a very positive impression on us."

The accuracy of measurement was compared against the laboratory, and the results are shown in Fig. 6 as follows. The result is excellent with R^2=0,9085.

Comment from APRIL mill:

"Valmet TS Sludge Concentration transmitter has been installed over one year. After start-up the measurement is very accurate and effective in optimizing the process. No maintenance is needed."

Conclusions

Online measurements are important monitoring tools for Pulp & Paper process as well as wastewater plants. While their application in process helps to run the process efficiently with lesser effluents; at the same time their application in wastewater treatment plants helps to achieve their cost/budget targets with good quality of purified water at the end of the process. For the wastewater plants, it is important to know the above explained technologies as well as learn new technologies. It is also important to know the accuracy and maintenance requirements of the various technologies in order to calculate the life-cycle costs of these technologies.

References

1. Turovskiy I. and Mathai P. (2006). Wastewater sludge processing, pp. 31 44 Wiley Interscience, 2006

2. http://www.ymparisto.fi/default.asp?node=6601&lan=fi 22.05.2012

3. P. Quevauviller, O. Thomas, A Van der Beken"Wastewater Quality Monitoring and Treatment" pp. 5-55, 2006 John Wiley & Sons, Ltd

4. http://www.iwawaterwiki.org/xwiki/bin/view/Articles/REDUCTIONOFSLUDGEPRODUCTIONINWASTEWATERTREATMENTPLANTS , IWAWaterwiki,org 22.05.2012

5. Instrumentation Testing Association suspended Solids and Turbidity measurements maintenance benchmark study MBS99SS-001 pp.17 - 73 (1999)