BOD, COD and TOC Monitoring in Pulp & Paper Wastewater



Introduction

The pulp and paper production process is a water-intensive process that also generates a large amount of wastewater characterised by a high concentration of suspended solids (SS), COD, TOC and biochemical oxygen demand (BOD).

The volume and pollution load of the generated wastewater depends upon several factors. Various raw materials and chemicals are added to the process of manufacturing different types of paper. The wastewater discharged can have a negative impact on aquatic and land ecosystems and possibly result in fines.

While water reuse and recycling programs are part of the solution, accurate lab and in-process measurements of TSS, COD, BOD and TOC levels allow for treatment prior to discharge. The time needed to perform each test can vary from a few minutes to several days.

Organic Matter Analysis

Biochemical Oxygen Demand

BOD is the amount of oxygen used during the biological breakdown of organic material i.e. the quantity of oxygen removed from rivers and water ways etc. BOD is considered an indirect measure of the organic content of a sample. **➔BOD** measurement is a **5 or 7 day** laboratory process.

Chemical Oxygen Demand

COD is the equivalent amount of oxygen needed to breakdown organic matter using strong oxidising agents. It is an approximation of BOD. **➔CODcr** measurement is a **2 – 2.5 hour** laboratory process.

Total Organic Carbon

TOC is a direct measure of the Carbon content of dissolved and un-dissolved Organic matter present in a sample. **➔TOC** measurement is a 6-10 minute on-line measurement.

Test	Response Time	Accuracy	Interferences	Hazardous Waste Generated
BOD*	5 days	±15%	Nitrite, Sulphides, Chlorides, Iron, Acid	No
COD*	2-3 hours	±8%	Nitrite, Sulphides, Chlorides, Iron, Acid	Yes
TOC**	~6,5 minutes	±3% of reading	None	No

** Information supplied by Instrumentation Testing Association, 2011*
*** BioTector, 2014 - TOC can be correlated to BOD and COD*

TOC Correlation with BOD/COD

TOC analysis, is an alternative to BOD_5 and COD, and TOC is a more cost effective, accurate and timely test with less interferences and also has the capability to be used for process control and real-time monitoring. Stable correlation between parameters can be achieved†.

Sample Taken Out Of:	BOD (mg O_2/L)	COD (mg O_2/L)	TOC (mg C/L)	Ratio of BOD/COD	Ratio of BOD/TOC	Ratio of COD/TOC
Petrochemistry	50	123	35	0.407	1.429	3.514
Chemical Industry	126	456	80	0.276	1.575	5.700
Brewery	1450	2410	890	0.602	1.629	2.708
Paper	1674	25958	5625	0.064	0.298	4.615
Corrugated Paper	398	1090	433	0.365	0.919	2.517
Metal	88	326	79	0.270	1.114	4.127
Food	504	800	272	0.630	1.853	2.941

Wastewater is considered readily biodegradable if it has a BOD:COD ratio greater than 0.4. If the BOD:COD ratio is less than 0.4, biodegradation will proceed very slowly, then it is not possible to treat biologically. If the wastewater of a paper mill is not highly biodegradable it is due to the presence of non-biodegradable compounds like lignin, which create a challenge for treatment.

† There are no fixed correlation factors between the inclusions BOD, COD and TOC.
† The correlation of parameters depends on the composition of the sample (matrix).
† The only way to establish a correlation is to use comparative data over a long period of time.
† Conversion factors established on the basis of long-term comparison will only be valid for the given plant / sample flow under stable matrix conditions.

HACH®

What Hach can offer you as your trusted partner for water analysis?

Laboratory Methods
Measure BOD using BOD Instruments. Measure Suspended Solids with the TSS Portable. Measure COD* and TOC using DR3900 or DR6000 spectrophotometers.

**Dichromate is used to oxidise the organic substances in the method called COD Cr.*

The Next Generation in On-line BOD/COD/TOC Analysis: BioTector
The ideal online TOC Analyser to achieve precise results even for your most challenging applications in wastewater.

Online Sensors and Controllers: Suspended Solids: Solitax sc Sensors
Hach's digital Solitax sc process probes are designed for the accurate determination of turbidity and suspended solids in accordance with DIN EN ISO. Due to a very large measuring range for both turbidity and solids the Solitax sc family offers a broad application spectrum and is ideal for pulp&paper wastewater and sludge treatment applications.

Manage Product Loss and Protect Profits in Pulp and Paper Manufacturing by Monitoring Nutrients and Solids
Plant managers can gain valuable insight into plant operations by tracking product loss over time, which can be done simply by collecting and tracking data in two key areas: Nutrient Optimisation and Solids Management. Please see application note.



Portable TSS



BODTrak



DR3900 Spectrophotometer



DR6000 Spectrophotometer



BioTector B7000i



sc200 Controller



Solitax sc Sensors

DOC040.52.10227.Jul21

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