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Digestion Process Monitoring Description - BFWRF

Scope

This document provides a framework for anaerobic digestion monitoring at Bristol Food Waste Recycling Facility (BFWRF). It covers how monitoring is conducted, how the results are assessed and where the information is recorded.

Introduction

To ensure stable digester conditions to optimise biogas production, and to demonstrate compliance with the EA permit PP3734LK, PAS110, ADQP and Bio fertiliser Certification Scheme Rules, key process parameters are assessed at a defined frequency (see Table 1) through the use of Amulet, an electronic data recording system which has the advantage of being able to access data from the on-site SCADA (supervisory control and data acquisition), telemetry data from PRISM and data from the Wessex Water laboratory sample system (SCISYS).
Reports can be run in Amulet which combine trends to provide a more comprehensive review of the digestion process and identify any issues more readily.

Sampling and data recording

The BFWRF turbo dissolvers, buffer tank, pasteurisers, anaerobic digesters, post digestion storage tank and centrifuges are routinely sampled and tested for operating parameters (see BFWRF Sampling procedure - GENWMP340 and BFWRF Sample Point Plan - GENWMG185). The data is recorded and graphed in Amulet and periodically monitored.

The responsibility for the sampling rests with the trained SOE Operators. The quality measurements and performance analysis are the responsibility of the Process Manager and Process Scientist.

Historical data found on Amulet, as well as sample results and flows can be used to spot any change in trends and imbalances in the digestion process. This will help maintain a proper biological balance for a stable digestion process.

Table 1 – BFWRF Sampling Frequency

Sample Point	Location	Saltford Frequency	Bristol Lab Frequency	APHA Frequency	PAS110 Frequency	Dry Solids Frequency
Turbo Dissolvers	Room sump	n/a	n/a	n/a	n/a	Daily
Hydrolysis Buffer Tank (**HBT**)	Pasteuriser feed line	Mon, Thu	Mon, Wed, Fri	n/a	n/a	Daily
Pasteuriser 1	Digester feed line	Mon, Thu	Mon, Wed, Fri	n/a	n/a	n/a
Pasteuriser 2	Digester feed line	Mon, Thu	Mon, Wed, Fri	n/a	n/a	n/a
Pasteuriser 3	Digester feed line	Mon, Thu	Mon, Wed, Fri	n/a	n/a	n/a
AD Digester 1	Heat exchanger	Mon, Thu	Mon, Wed, Fri	n/a	n/a	n/a
AD Digester 3	Heat exchanger	Mon, Thu	Mon, Wed, Fri	n/a	n/a	n/a
Post Digestion Storage Tank (**PDST**)	Secondary strain-press buffer tank OR Centrifuge feed line	n/a	n/a	n/a	n/a	Daily
Digestate Cake	Centrifuge shoot	Mon, Thu	Mon, Wed, Fri	Monthly	Quarterly	Daily
Centrate	Centrate Storage Tank	n/a	Mon, Wed, Fri	n/a	n/a	Daily

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Version: 2
Date: 21/01/2025
Reference: WWEL-596138940-5707
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Table 2 – Digestion Monitoring

Key Parameter	How is monitoring conducted	Monitoring Frequency	Allowable ranges	Monitoring system	Controls in place in case of exceedance	Action in response to trigger	Where is the data stored?
% Dry Solids (%DS)	Manual sample	Daily	HBT: 10.5 - 14.5 %DS PDST: 3.0 - 4.0 %DS	Online data trend	Daily checks of lab sample	%DS decrease: increase feedstock %DS increase: add water	Amulet & SCISYS
pH	Manual sample	Mon, Wed, Fri	AD1/3: 7.1 - 7.9	Online data trend	Weekly checks of lab sample	pH decrease: reduce feedstock by 10%. If < 6.5, add alkali chemical	Amulet & SCISYS
Volatile Fatty Acids (VFAs)	Manual sample	Tue, Thu	HBT: 6,000 - 18,000 mg/L AD1/3: 800 - 1,600 mg/L	Online data trend	Twice weekly checks of lab sample	VFA increase: If alkalinity decreases, reduce feed/loading by 20%	Amulet & SCISYS
Alkalinity (Alk)	Manual sample	Tue, Thu	AD1/3: 7,000 - 9,500 mg/L	Online data trend	Twice weekly checks of lab sample	Alk decrease: reduce feed/loading by 20%	Amulet & SCISYS
Alk/VFA ratio	Manual sample	Mon, Wed, Fri	AD1/3: < 0.4	Online data trend	Daily checks of trends	Alk/VFA 0.4 - 0.5: gradually decrease feedstock. If > 0.5 stop feeding.	Amulet calculation
COD	Manual sample	Mon, Wed, Fri	HBT: 12,500 - 19,000 mg/L Centrate: < 7,500 mg/L	Online data trend	Weekly checks of lab sample	Modulate poly usage	Amulet & SCISYS
Process Temperature	On-line	Continuous	AD1/3: ~ 37°C Pasteurisers: > 70°C	Online data trend	Daily reading trends	Low T in AD1/3: turn off pasteuriser heat recovery. For pasteurisers, modulate temperature in line with HACCP CCP*	Amulet
Organic Loading Rate (OLR)	On-line	Daily	May - Oct: > 4.8 Nov - Apr: > 4.3	Online data trend and calculations	Daily checks of trends	Modulate feedstock if lower	Amulet calculation
Ammonia (NH$_3$)	Manual sample	Tue, Thu	HBT: 250 - 750 mg/L AD1/3: 1,400 - 2,600 mg/L	Online data trend	Twice weekly checks of lab sample	Modulate feedstock, reduce OLR, check pH, Alk and VFAs	Amulet & SCISYS
Foam	On-line or Visual level check**	Continuous	AD1/3: < 0.6m	Visual check recorded on log sheet and then escalated	Dose antifoam	Foam level > 0.6m: add 5 - 10 L of antifoam or reduce feedstock by 5%	Hydrostatic level on SCADA & Amulet

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% Methane	On-line gas composition monitor	Continuous	> 60%	Online data trend	Daily reading trends	Modulate feedstock if lower	Online Amulet SCADA
Tank levels	On-line	Daily	HBT: <10m AD1/3: < 7.28m	Online data trend	Daily checks of trends	HBT level 1m higher than previous week: increase digester feed or export out FW. AD1/3 level > 7.28: check strain-press flow	Amulet

* HACCP – Hazard Analysis and Critical Control Point Plan. CCP – Critical Control Point. See **HACCP Plan – BFWRF – GENWMP150**, and **BFWRF HACCP Plan Table** for more information.

** Visual check foam level through inspection windows (access controlled with BIOF131 from Shift Engineers).

Revision history

Issue	Date	Approved by	Description
1	Sep 2024		Anaerobic Digestion Monitoring - GENSOP29 rewritten and expanded to mirror BIOP037 Avonmouth BC Digestion Process Monitoring Description.
2	Jan 2025	Paul Newman	Added daily to Digestate cake and Centrate Dry solids frequency.