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# Plastic contamination in end-of-waste compost and digestate products in England

REAL Compost Certification Scheme and Biofertiliser Certification Scheme

## Executive Summary

Renewable Energy Assurance Limited (REAL) administers both the Compost Certification Scheme (CCS) and Biofertiliser Certification Scheme (BCS). CCS and BCS are the only quality assurance and end-of-waste schemes in the UK providing a framework for the independent assessment and certification of compost and anaerobic digestate, respectively.

This paper has been produced to share recently collected data on plastic contamination in compost and digestate independently certified by REAL to end-of-waste standards in England. The report explains the current testing requirements and plastic limits for compost and digestates and includes statistical analysis of the levels of plastics in quality compost and biofertiliser.

The analysis shows that majority of compost samples (regardless of feedstock type) fall in the 0 (zero) to 0.02% m/m range of plastic contamination. In terms of digestate, physical contamination level is lower in separated liquor compared to whole digestate and separated fibre, and the majority of samples in all digestate types contain 0 to 0.039 kg/t of physical contaminants.

## 1. Background

### 1.1 WHO WE ARE AND WHAT WE DO

Renewable Energy Assurance Limited (REAL) operates the Compost Certification Scheme (CCS) and Biofertiliser Certification Scheme (BCS). CCS and BCS provide assurance to consumers, farmers, food producers, and retailers that quality compost and digestate produced from composting and anaerobic digestion (AD) processes is safe for human, animal, and plant health.

CCS and BCS are the only quality assurance and end-of-waste schemes in the UK providing a framework for the independent assessment and certification of compost and anaerobic digestate, respectively. Through CCS, compost is certified to PAS 100, the Compost Quality Protocol (CQP) or SEPA's Position Statement for end-of-waste status in Scotland, and the CCS Scheme Rules. Through BCS, digestate is certified to PAS 110 the Anaerobic Digestion Quality Protocol (ADQP) or SEPA's Position Statement for end-of-waste status in Scotland, and the BCS Scheme Rules

### 1.2 TESTING REQUIREMENTS AND PLASTIC LIMITS

CCS and BCS testing requirements and plastic limits in England are aligned with the relevant PAS standard requirements.

#### Compost

Compost testing requirements and associated plastic limits are specified in PAS 100:2018. Physical contaminant levels (plastic, glass, metal, stones, and other contaminant materials) are determined using a method involving oven drying, dry sieving, hand picking of contaminants separated by particle size, and gravimetric determination of their % abundance. PAS 100:2018 specifies a physical contaminant upper limit of 0.25% m/m (mass/mass) of which up to 0.12% m/m may be plastic.

#### Digestate

Digestate testing requirements and associated physical contaminant limits are specified in PAS110:2014. Physical contaminants levels are determined using a method involving wet sieving, hand picking of contaminants and gravimetric determination of their % abundance. PAS 110:2014 specifies physical contaminants limits based on nitrogen content as follows:

Table 1 - PAS 110 PCs Limits based on nitrogen content of digestate

Total Nitrogen (kg/t)	less than 1	1 to 1.9	2 to 2.9	3 to 3.9	4 to 4.9	5 to 5.9	6 to 6.9	7 to 7.9	8 to 8.9	9 or more
Physical Contaminants (kg/t)	0.04	0.07	0.11	0.14	0.18	0.22	0.25	0.29	0.32	0.36

### 1.3 DATASET USED FOR THIS PROJECT

The data used for this project spans from 1<sup>st</sup> January 2021 to 30<sup>th</sup> June 2022 and includes the data from certified processes in England. The dataset comprises of samples sent for routine verification (i.e., routine testing to ensure ongoing compliance with Scheme requirements) and re-sample verification (i.e., samples re-tested after failing on routine testing). The CCS dataset used included 850 samples and BCS dataset included 857 samples.

#### Data limitations and corrections for this project:

PAS 110 requires reporting of total PCs in digestate, rather than plastics specifically. However, a partial data set held with separate reporting of plastic shows this is the dominant PC in 98% of digestate samples and the only contaminant in 87% of samples. Therefore, for the purposes of this analysis, all PCs reported in the digestate full dataset were assumed to be plastic.

## 2. Plastic contamination in quality compost

### 2.1 NUMBER AND PERCENTAGE SAMPLE FAILURES BASED ON PLASTIC

Across samples submitted by certified operators for routine verification testing and re-testing the failure rate for plastic contamination was 1.5% (Table 3). Of the 14 samples that failed, six of these were from two processes experiencing repeat failures, and the remaining eight were different processes failing only once.

The analysis suggests a lower sample failure rate for processes taking green waste and ABP feedstock compared to green only waste fed processes. However, it is recognised that there are fewer samples and processes of the former.

Table 2 – Sample failure rate by feedstock type

Feedstock Type	Total number of samples	Total number of processes	Sample Failure Rate
Green Waste and ABPs	148	15	0.7%
Green Waste Only	702	100	1.7%
All	850	115	1.5%

Green Waste Only – this includes feedstocks such as civic amenity waste, kerbside collection (garden waste bins), paper/cardboard and untreated wood  
 Green Waste and ABPs – this includes the above feedstocks (Green Waste Only) as well as catering waste including meat and kerbside food waste collections

### 2.2 LEVELS OF PLASTIC IN QUALITY COMPOST (ENGLAND ONLY)

In terms of the level of plastic in compost samples, the analysis shows that majority of samples (regardless of feedstock type) fall in the 0 (zero) to 0.02% m/m range of contamination (Figure 1). This analysis excludes failures as this is not representative of the quality of certified compost going to land. In HACCP settings, in the event of test failures (or production of non-conforming material) the producers would be required to implement corrective actions and re-test the material before it leaves the site or dispatch as non-conforming under waste exemption.

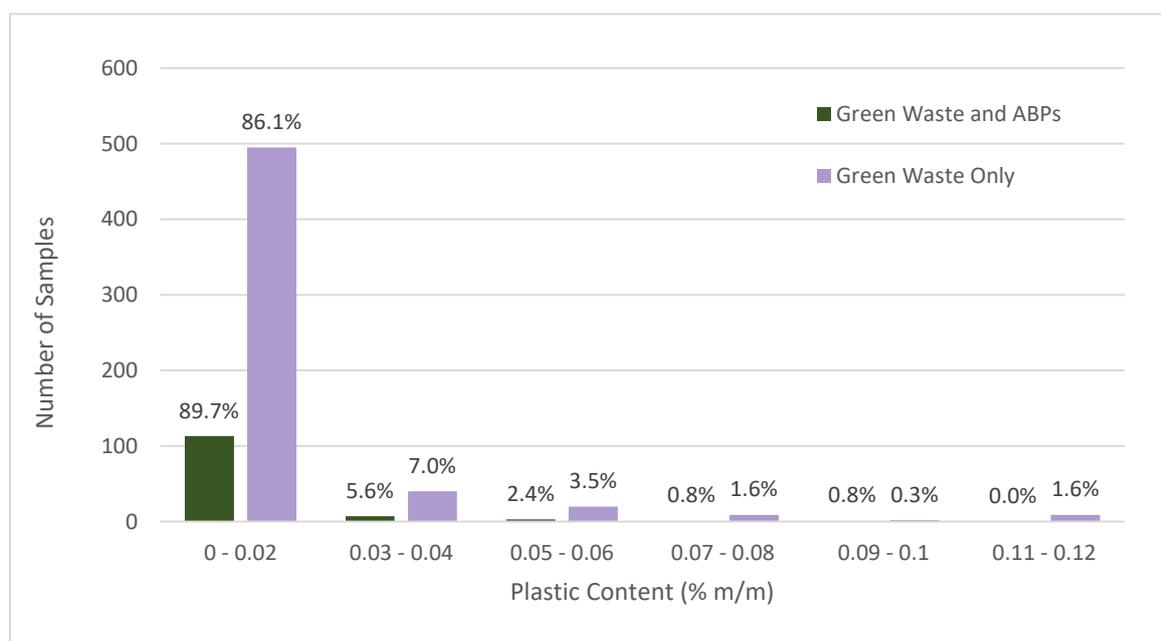


Figure 1 - Plastic content in certified compost across feedstock types

### 3. Plastic contamination in biofertiliser products

#### 3.1 NUMBER AND PERCENTAGE OF SAMPLE FAILURES BASED ON PCS

The failure rate across all samples sent for routine verification or for retests was 1.9%, this is broken down by feedstock type in Table 4 below. In number terms, there were three processes which experienced repeat failures, and seven processes which failed only once.

Table 3 – Sample failure rate by input type

Input Type	Total number of samples	Total number of processes	Sample Failure Rate
Waste	739	60	2.2%
Farm	110	10	0%
Other	8	1	0%

Waste - over 50% waste feedstock e.g., food waste  
 Farm - over 50% agricultural feedstock e.g., manures and crops  
 Other - over 50% non-waste/agricultural feedstock e.g., distillery by-products

All failures were from digestate with waste feedstocks. The majority of these failures were separated fibre digestate (Table 5).

Table 4 - Failure rate by digestate type, within digestate from waste feedstocks

Digestate Type	Number of samples	Number of processes	Sample Failure Rate
WD	561	45	2.0%
SL	138	15	0.0%
SF	40	8	12.5%
<b>Total</b>	<b>739</b>	<b>60</b>	<b>2.2%</b>

WD – whole digestate; SL – separated liquor; SF – separated fibre

#### 3.2 LEVELS OF PCS IN DIGESTATE (ENGLAND ONLY)

The following table shows the mean PC value by digestate type (Table 6). As shown, PC contamination is lower in SL compared to WD and SF. Digestate sample failures are excluded as not considered of the quality of certified digestate going to land.

Table 5 - Nitrogen and PCs content by digestate type

Digestate type	Nitrogen Mean (kg/t)	PCs Mean (kg/t)
WD	6.1	0.019
SL	5.8	0.008
SF	8.3	0.031

The majority of samples in all digestate types contain 0 to 0.039 kg/t of physical contaminants (Figure 2). Separated Fibre has the highest proportion of samples (12.1%) with > 0.2 kg/t of physical contaminants.

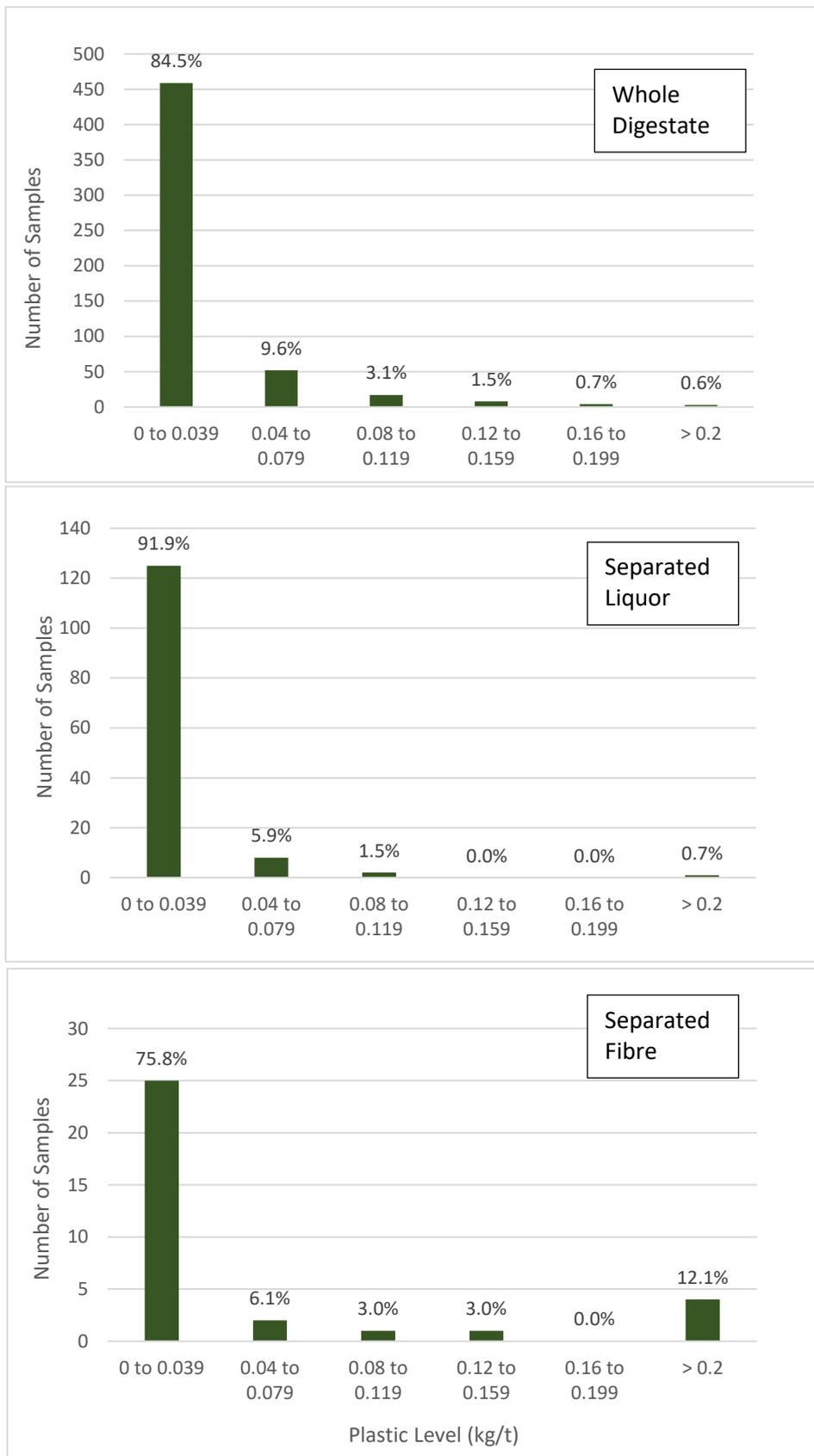


Figure 2 - Plastic content in certified digestate from waste feedstocks

## Notes on data management

REAL collects and retains technical data through our role as the Scheme administrator. Within our online database, we manage data related to all BCS and CCS registered processes. The REAL-approved laboratories upload full PAS100 and PAS110 the results of samples tested for certification purposes to REAL's central database.

On plastic content, the test results include the following:

- CCS: total physical contaminants (PCs) and plastic results
- BCS: total physical contaminants (PCs)

Due to missing or unclear information in the database, some results were omitted.

This data is the property of REAL and may not be reproduced without REAL's express permission.



In 2019 REAL achieved certification of its Quality Management System to the ISO 9001:2015 standard.

The ISO 9001:2015 standard is based on a number of quality management principles including a strong customer focus, the motivation and implication of top management, the process approach and continual improvement. Using ISO 9001 helps ensure that customers get consistent, good-quality products and services, which in turn brings many business benefits.

The seven quality management principles are:

- customer focus
- leadership
- engagement of people
- process approach
- improvement
- evidence-based decision making
- relationship management.



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