

12/10/2021

REA response to Defra questions on kitchen caddy / food waste bin liner options

1. Introduction

In early October 2021, Defra asked the REA to research and feedback AD and in-vessel composting (IVC) facility operator feedback regarding feasibility, practicalities and experiences with managing different types of caddy liners/bags that have been used for collecting food waste. This was to inform Defra’s work as part of their response to their consultation on improving consistency in collecting household and business wastes.

2. Methodology

The REA emailed questions (see Annex A) to operators on the APHA’s most recent list of AD processes (including AD-MBT processes) located in England with approval to treat animal by-products. The REA also emailed questions (see Annex B) to operators on the APHA’s most recent list of In-Vessel Composting (IVC) processes (including IVC-MBT processes) located in England with approval to treat animal by-products.

REA collated and analysed respondents’ answers and separately summarised AD and IVC operators’ responses below. In the context of this survey, a respondent means a response about a process at a single facility. Some operators manage more than one facility so in this document we refer in some places to respondents (processes represented) and in others to operators (businesses represented).

Below the REA has provided summaries of AD and IVC operator responses and included anonymised comments from individual operators that cover numerous of the points they made. The REA has supplied operators’ collated, anonymised responses with basic response statistics to Defra in a separate Excel document.

3. Summary of responses

There are 74 AD plants and 32 IVC processes in England approved by APHA for treating food waste and we got responses from 32 AD plants (42% of those contacted for information) and 13 IVC plants (41% of those contacted for information).

3.1 AD operators’ responses and summary

Number of AD (for source-separated biodegradable wastes) & AD-MBT processes on APHA's England list, regardless of ABP type for which the process is approved:	74
Number of AD processes on APHA's England list emailed or called by REA:	72
Number of such processes that declined to answer questions:	1
Number of such processes for which REA received responses*:	32
Number of operator confirmed process closures since obtaining ABPR approval:	0

12/10/2021

Number of responding English, ABP-approved AD processes not treating animal derived food waste nor intending to:	1
Number of responding English, ABP-approved AD processes treating animal derived food waste:	31
Responding English, ABPR-approved AD processes treating animal derived food waste, as a % of operational ABPR-approved English AD processes:	42%

* We believe none of them are likely to be AD-MBT processes (for residual wastes) but a specific question to check this was not asked.

3.1.1 Summary about compostable plastic liners

All AD facilities for which REA received responses treat animal-derived food wastes. Nearly 55% of them were said to be capable of processing compostable caddy liners, 29% not capable of processing them and nearly 10 % were said to depackage, i.e. front-end remove liners. However, operators differed in their interpretation of ‘processing’, e.g. manage them by front-end removing them and sending to EfW or landfill facilities or feed them into their digestion process, aim to biodegrade them and manage any residues. Therefore, without further analysis of individual responses and perhaps seeking clarification, there are significant uncertainties about the statistics for answers to the question about capability to process.

Responses showed that very few (just under 10%) of processes would be likely to install an autoclave or other front-end waste treatment machinery in the scenario where local governments supplied compostable plastic caddy liners to households. Amongst the 77% of processes for which no further installation was envisaged, some reported already having depackagers and others reported already having shredders (the latter being part of pre-treatment steps that enable compostable plastic caddy liner and other biowaste feed into the digestion phase).

In the compostable plastic caddy liner supply scenario, respondents thought nearly 84% of their processes would not add on an aerobic maturation phase for dewatered digestates, while nearly 10% thought possibly they would. In the same caddy liner supply scenario, respondents for nearly 6.5% of the processes said yes they would be likely to dewater digestate solids then co-compost them with other biodegradable wastes or materials, while respondents for nearly 6.5% of the processes said they possibly would be likely to do this.

Respondents for nearly 71% of the AD processes said they do not have a within-business IVC facility - for biodegrading compostable caddy liners front-end removed from their AD facilities - while for six out of the seven AD processes who responded that they do have a within-business IVC, the operator managing those six said there were issues with using their IVCs ‘including inconvenient locations and capacity’.

Beyond their own businesses, respondents for 10% of the AD processes said they were aware of an IVC facility contact who they believed would be likely to accept such liners, while nearly 84% were not aware of such IVC facility contacts.

Operators representing 3 AD processes believed that the removed compostable plastic liners would be unlikely to be accepted by IVC operators due to the presence of other contaminants

12/10/2021

which could cause quality issues for the composting sites. There were issues raised about the location and available capacity of IVC facilities who may be able to process removed compostable plastic liners.

3.1.2 Summary about polyethylene liners

Operators' responses for just over 77% of AD processes were summarised as polyethylene caddy liners not causing difficulties for the process to meet PAS 110. Nearly all indicated no digestate quality failures because of polyethylene liners but many reported using post-digestion / back-end screens (the range of apertures used amongst operators reported as 0.25 to 2 mm), one reporting changing front-end treatment to manage this kind of contamination, another reporting using two in-series strain presses in after their post-digestion screen, and another having installed extra filters and spoken to factory suppliers and trained their own staff on reducing polyethylene to a minimum.

Many respondents were not specific about which of their digestate output types meet PAS 110: one stated their separated liquor digestate complies while another reported that 50 to 70% of the time their separated fibre digestate is close to or above the PAS 110 limit for plastics due to the contamination from polyethylene liners and has taken on-site measures to manage polyethylene liners.

3.1.3 Summary about paper liners

Respondents for nearly 52% of the AD processes indicated they currently treat paper bags/caddy liners. It seems likely that 'paper bags/caddy liners' in at least some cases are accepted as part of packaged food waste streams; one operator responded that 'all varieties of packaged waste [are] delivered and processed at the site' and that paper bags 'appear to shred easily and breakdown very well through the digestion process with little or no traces in the resultant digestate'.

There were mixed responses about past success with treating paper bags/caddy liners, the additional technologies needed to enable such treatment and the associated costs, and how easily paper breaks down in the AD process. Respondents for nearly 42% of the AD processes had successfully treated them and just over 48% of the represented AD processes were said not to need any additional technology fitted in order to treat paper liners. 38% of respondents do not currently treat paper liners and 32% have never successfully treated paper liners. A number of operators suggested shredding would help facilitate the digestion of paper liners and some stated that paper liners are removed by depackaging and do not enter their digesters.

Respondents for just over 61% of the AD processes said their facilities would be able to handle newspaper (some specifically stating glossy magazines are unsuitable), nearly 23% indicated or said that would be possible (with a caveat about ratio expressed by one operator) and just over 3% said no. A few operators raised concerns about elements and substances in newspaper inks and pigments that can inhibit digestion; one said they would need to pre-treat newspaper and another that their depackaging machine can't handle paper. Positive feedback about newspaper included an operator's belief this is the best material to line caddies with, another's that newspaper is a better option than compostable plastic liners, with another saying 'we often get waste with newspaper used to line food caddies from some kerbside collections and can handle this easily'.

12/10/2021

3.1.4 Individual comments from AD operators

- One operator referred to a specific hydraulically operated separation press that separates waste into fermentable and non-fermentable fractions. This operator would install it for front-end management of liners and packaging if they had the space. REA has supplied information about that machine to Defra in its anonymised, collated answers Excel document.
- One operator said they would invest in front end treatment for compostable plastic liners but would need a 2 to 3 year agreement to justify the investment.
- One AD operator estimated an upgrade to process compostable plastics would cost £180,000 up front plus an additional £180 per tonne. They also estimate the cost of additional machinery (shredder, conveyor and controls etc) to process paper liners would be £180,000.
- One operator supported the use of polyethylene liners as depackaging means these don't cause an issue and encourages food waste recycling participation.
- One operator stated that polyethylene liners meant they were often near or above the PAS110 limits for plastics.
- One operator stated that an autoclave would be ideal to enable feeding of compostable plastic liners into the digester but they are expensive.
- One operator stated that any aerobic maturation would have to be carried out off-site.
- One operator (with multiple sites) suggested they would need to limit the amount of paper liners processed at any one time to enable them to be treated through their process.
- One operator raised concerns about paper liners having a low gas yield potential and causing problems with the back end screen.
- At their wet-AD facilities in a UK country other than England, one operator is feeding in compostable liners and outputs including separated fibre digestate with compostable liner residue (they did not specify the fate of that output). This operator has multiple wet-AD and open windrow composting facilities in the UK and they would like to feed ABPR-treated, pathogen-test compliant, dewatered digestate and residues of digestion-treated compostable plastic liners through their open-air windrow composting processes. They report this is not permitted by the APHA. (REA comment: we think this should be feasible if they've met the ABP requirements. We will discuss it further with the operator and, if needed, the APHA). They also state the current front end depackaging and back end screens are a high cost and a change to polyethylene liners would significantly increase this. This operator said the cost of paper liners was prohibitive to local authorities.
- One operator felt they may need to add more liquid if paper liners were accepted to keep the dry matter at pumpable rate and 'this will cost more operationally to obtain and reduces our tonnages in allowed against our permit' [REA interprets this as the tonnage of other higher biogas-per-tonne yielding biowastes that would be 'displaced' by

12/10/2021

paper bags/liners due to the tonnage limit set in the permit to operate]. They also felt liners in general are problematic, they block screens, get intertwined with the fibrous portion of digestate, reduce digestate quality and increase operational costs. They felt the lesser of the two evils is compostable liners.

- One operator stated they had issues with processing paper liners (front end packaging removal and reduction in AD efficiency) and would be unwilling to accept paper liners or newspaper.
- One operator with multiple wet-AD facilities and some IVCs has depackaging equipment on their sites that removes all types of contamination including liners and it is unable to distinguish between different materials. Further work is needed to understand if sorting technologies would be able to separate types of waste packaging. (REA comment: we believe UCL is researching this as part of their current R&D project on 'Compostable plastics: unlocking existing barriers to systems change'). The operator raised questions about the suitability of BS EN 13432 (for compostable packaging, regardless of material type from which the packaging is made) for AD, including the lower digestion temperature they operate at than the disintegration test temperature specified in the standard and whether compostable plastic liners would disintegrate fast enough given that the maximum time the standard allows - for the minimum level of sample disintegration to be reached - is longer than the operator's digestion treatment timescale. (REA comment: we will discuss further with them the details of this standard). They also stated they would need physical, chemical or biological pre-treatment to enable them to accept paper liners or newspaper. Further literature reviews and / or trials would be needed to determine the cost of adding pre-treatment so that paper could be converted to biogas within AD. The addition of a composting phase was thought to be impractical due to significant capital investment requirements (estimated £8 to 9 M for IVC and £4 to 5 M for open-air windrow composting), lack of suitable space on existing sites, planning and permitting constraints and potential for emissions (odour, noise and dust). They have found that an autoclave is unsustainable to operate under the current food waste market conditions due to the greater amount of time required for processing compostable liners (and compostable packaging), leading to increased operational expenditure. Dewatering the digestate would also incur additional operatorial costs and would need to be trialled to better understand the costs.

3.2 IVC operators' responses and summary

Number of IVC & composting-MBT processes on APHA's England list, regardless of ABP type for which the process is approved:	32
Number of IVC processes on APHA's England list emailed or called by REA:	31
Number of such processes that declined to answer questions:	1
Number of such processes for which REA received responses*:	14

12/10/2021

Number of operator confirmed process closures since obtaining ABPR approval:	1
Number of responding English, ABP-approved IVC processes not treating animal derived food waste nor intending to:	1
Number of responding English, ABP-approved IVC processes treating animal derived food waste:	13
Responding English, ABPR-approved IVC processes treating animal derived food waste, as a % of operational ABPR-approved English IVC processes:	41%

* The REA believe none of them are likely to be IVC-MBT processes (for residual wastes) but a specific question to check this was not asked.

Respondents for nearly 93% of IVC facilities currently treat animal-derived food waste. In the scenario where local authorities supply compostable plastic liners to householders, at nearly 43% of the facilities represented they indicated they would accept front-end removed compostable plastic liners from AD plants, at just over 14% of the facilities represented they would accept dewatered fibre digestate with compostable plastic liner residues while this would not be accepted at nearly 36% of the facilities represented. Some expressed concerns about high contamination rates and whether the Environment Agency would differentiate between compostable and non-compostable liners.

Respondents for 50% of IVC facilities currently treat paper bags/caddy liners. Reasons given by others who had previously tested treatment of paper bags/caddy liners but had since stopped included the local authority discontinuing paper bags/caddy liners due to high costs, and concerns over contamination. Most respondents expressed one or more concerns about or connected with newspaper; these included inappropriate inclusion of glossy magazines, the impact of heavy ink loads, compatibility with PAS100 certification and an inevitable return of plastic bags.

3.2.1 Individual comments from IVC operators

- One operator expressed concerns over accepting front-end removed compostable liners or dewatered fibre digestate with compostable liner residue from AD plants due to the potential for high levels of non-biodegradable contamination. They also thought the Compost Quality Protocol would not allow them to accept front-end removed compostable liners and/or dewatered fibre digestate with compostable liner residue in it. (REA comment: we have checked the Compost QP allows both to be accepted and will discuss this with the operator). They also felt that paper liners take too long to break down and along with newspaper, represent an increased contamination risk.
- One operator with multiple IVC processes stated that polyethylene liners do not prevent their IVC processes from meeting PAS 100 but managing this contamination 'requires a lot of effort'.

12/10/2021

- One operator avoids accepting caddy liners due to a short composting process (6 weeks) and finds they don't always break down in time. (They were not specific about the type of liners and REA interpret this as all liner types).
- One operator would accept newspaper but didn't feel it was a good solution as polyethylene liners would inevitably return as an issue.
- One operator was concerned about accepting dewatered digestate fibre due to the risk of increased ammonia emissions. They wouldn't accept newspaper due to high contamination concerns.
- One operator with multiple facilities would not accept newspaper as facilities are PAS100 compliant.
- One operator with multiple facilities stated that when processing paper liners, their composting process is shorter than the time taken to compost the paper liners so they are screened out at the end of the process.

3.3 Response from an engineering consultancy with experience in AD sector

Due to the relevance of autoclaves as a pre-treatment option for compostable plastic (and paper) liners, the REA asked this consultancy about their experience with autoclave-to-AD projects.

Qu 1: What were AD operators' reasons for autoclave installation?

Answer: increased biogas yield, improved separation of contaminants, destruction of some floating contaminants & to support local industry.

Qu 2: Were they all retrofit projects?

Answer: These were new build. Autoclave pre-treatment has proved challenging when part of the original design concept, a retrofit scenario is likely to bring further difficulties.

Qu 3: Are those autoclaves operating at AD plants whose waste inputs include animal-derived food wastes?

Answer: Yes, all regulated under ABPR.

Qu 4: Are there any figures you could disclose that would give us and Defra better sight of installation, capital and operational costs associated with autoclaves?

Answer: We can provide the following indicative anonymised details:

- 100 ktpa nominal plant capacity. Two autoclaves. M&E cost: Euro 7 million installed (2018). No maintenance cost data available.
- 65 ktpa nominal plant capacity. Single autoclave. M&E cost: GBP 8 million (2016). Maintenance costs: around £67,000/year (2020).

12/10/2021

This consultancy has previously commented to the REA that ‘...it will not be simple (or necessarily viable) to retrofit autoclave technology at the **majority** of food waste AD plants. The additional requirements for high pressure and temperature steam generation and handling systems, space and odour control requirements are significant. Biomethane plants may not have an excess of waste heat available for autoclaving’.

During this survey period REA asked: was the ‘majority’ you referred to your estimate?

Answer: Yes, this is our feeling based on the food waste plants we know, presuming that this is a representative sample.

This consultancy has previously commented to the REA that autoclaves have implications for ABPR compliance and during this survey period asked whether the implications were for retrofitted autoclaves and/or whether there are particular implications that need to be considered at design stage for new plants when planning operational compliance with ABPR.

Answer: Yes, if the autoclave(s) were to replace the sanitisation system, revalidation would be required. Autoclaves, being pressure systems, require statutory inspections, so some plants might want to keep the old pasteurisers as a back-up but in this case the pipework configuration would need careful attention, since there must be no possible route to bypass the sanitisation step.

This consultancy has previously commented to the REA that ‘compostable plastic liners, have the potential to damage the AD process if not removed in pre-treatment (i.e. floating layers in tanks..’. During this survey period the REA asked whether any AD operators have said to the consultancy that they’ve experienced a floating layer in practice, specifically where only compostable plastic liners are fed in or the waste supplier’s policy is that only compostable plastic liners should be used for caddy/food bin lining?

Answer: Unfortunately we don’t know any AD plants processing exclusively food waste in compostable liners, we have only seen food waste plants that accept feedstocks from multiple sources. We’re not saying the bags will always cause damage and some plants will be better able to cope with them than others. This comment was based on the presumption that compostable plastic liners behave just like standard plastic bags in anaerobic conditions. Anecdotal evidence of corn starch bags (rated for break down in composting systems) that have been delivered to AD plants don’t break down in AD systems and can bind round rotating equipment and contribute to floating layers in the digesters. Some technology providers may rule out plastic contaminants via their feedstock specifications. We cannot disclose project details due to confidentiality.

During this survey period the REA asked the consultancy: **are there any other pre-treatment options we should consider for compostable plastic liners and/or paper liners?** (REA added that ‘so far some operators have mentioned extra liquid addition for managing paper liners, which [we] categorise as a necessary management implication’.)

12/10/2021

Answer: We expect this would depend on the paper caddy liners. As noted above normal paper breaks down in AD but, should caddy liners be made of an unusually robust grade of paper, then the level of shredding (or other pre-treatment) required may need to be determined.

This consultancy has previously recommended 'AD-suitable paper liners only'. During this survey period the REA asked: did you have any particular specification in mind (e.g. meeting the standard EN 13432; its AD+composting phase criteria as well as 'composting only' criteria?) or are there deficiencies with ordinary plain, paper liners that you're aware of?

Answer: This is a key point... We don't have detailed information but we expect that ordinary paper will break down in AD because in many of the plants we have seen, there is a paper component in the feedstock and this doesn't seem to affect the digestate quality. (Also, toilet paper is the main component of sewage sludge, which is widely treated via AD). Should paper caddy liners be made of an unusually robust grade of paper, then the anaerobic degradability may need to be trialled.

4. REA recommendations

In this report we have provided an overview of and aimed to cover, anonymised, the range of issues directly fed back by operators who answered the survey questions. In most instances we have not offered any REA view or interpretation of this.

Earlier this year we published our policy on liners and re-purposed bags suitable for separate collection of targeted food waste streams from households, businesses and non-domestic premises in England. This was developed with contributions from some of our members and key stakeholder contacts, and has previously been supplied to Defra. We acknowledge there are a number of actions needed in support of the policy.

Key Policy Criterion (please refer to full policy document for all policy criteria - <https://www.r-e-a.net/resources/policy-on-and-liners-and-re-purposed-bags/>):

Non-packaged and user-unpackaged food that is discarded and separately collected – including where co-collected with plant waste – must be presented:

- a) in plastic or paper liners or re-purposed bags (inside the caddy/bin) independently certified compliant with BS EN 13432 or BS EN 14995*;
- b) in a user-made caddy/bin lining made of a re-purposed, paper, non-bag / non-liner item, e.g. newspaper; or
- c) loose inside the bin (also referred to as naked).

* Standards

BS EN 13432:2000, 'Packaging. Requirements for packaging recoverable through composting and biodegradation. Test scheme and evaluation criteria for the final acceptance of packaging.'

BS EN 14995:2006, 'Plastics. Evaluation of compostability. Test scheme and specifications.'

12/10/2021

Both standards include disintegration and biodegradation tests and pass/fail criteria relevant to industrial scale composting conditions, plus tests and pass/fail criteria relevant to ecotoxicity, heavy metals concentrations and compost quality. (As an option, these standards include pass/fail criteria for an item's anaerobic biodegradation – based on biogas production – and its disintegration under a combination of anaerobic digestion then aerobic stabilisation test conditions. Item testing and assessment for its conformance to these AD-relevant criteria has tended not to be pursued to date.)

As final recommendations in this survey report, any paper liners used or intended to be used for food waste collection must be required to have a valid certificate of compliance with a standard accepted by environment protection regulators and industry, the certificate being issued by an independent certification body. (The Quality Protocols for composts and anaerobic digestates require compostable plastic caddy liners to be independently certified compliant with a standard specified in the relevant QP and indications are that the Environment Agency will, in new permits and their permit guidance, take a similar position for packaging and plastics intended to be composted or digested.)

For compostable plastic liners accepted standards are EN 14995 or EN 13432 and for compostable paper liners that's EN 13432. This latter standard's scope is material agnostic, which means that compostable paper liners can be tested as specified in this standard, evaluated for compliance with it and independently certified if they comply.

Our reasons for flagging this include that if paper liners are glued at their seams the glue must enable adequate disintegration of the liner and pass the ecotoxicity (a plant germination and growth) test. Similarly, if any pigments or inks are added to a paper liner, it must not exceed limits set in EN 13432 for potentially toxic elements (aka 'heavy metals').

12/10/2021

Annex A: questions to operators of ABPR approved AD facilities

1. Treating a relevant type of waste

- a. Does your facility treat animal-derived food waste or wastes that include animal-derived food waste?
- b. If not but you plan to begin treating such food waste in future, by when do you expect to begin treating it?

2. Compostable plastic caddy liners

- a. Is your AD facility currently set up to process compostable caddy liners for treatment?
- b. How much will it cost to upgrade your AD facility so that it can process compostable caddy liners or would it not need any upgrading?
- c. If compostable caddy liners are (now or in future) supplied by local government to households: *(please answer each sub-question in 2c).*
 - i. would you be likely to add an autoclave and/or other infrastructure/machinery/equipment for 'front-end' waste treatment? (If yes, please say what you'd install.)
 - ii. would you be likely to add an aerobic maturation phase for dewatered digestate solids?
 - iii. would you be likely to dewater digestate solids then co-compost them with other biodegradable wastes or materials?
 - iv. do you have a 'within business group' IVC facility that could biodegrade compostable caddy liners front-end removed from the AD process?
 - v. are you aware of an IVC facility contact who you believe would be likely to accept such liners (including MBT facilities with a composting phase for treating biodegradable fractions from residual wastes)?

3. Polyethylene caddy liners

Despite stripping (depackaging/screening etc), how common is it currently for plastics pollution from polyethylene bags to provide difficulties for your site to meet PAS standards for digestate output?

(For example, have there been any digestate quality failures due to plastics > 2 mm exceeding the PAS physical contaminants limit, any customer complaints due to plastic in the digestate and what changes, if any, have you made to waste pre-acceptance and/or acceptance criteria and how the waste is treated, including digestate treatment steps?)

4. Paper caddy liners

- a. Do you currently treat paper bags/caddy liners?
- b. Have you successfully treated paper bags/caddy liners in the past and if so, what were the key reasons for stopping that practice?
- c. Would any additional technology need to be fitted to your AD plant(s) in order to treat paper bags/caddy liners? If so what and how costly would this be?
- d. Do paper bags break down easily in AD or are there any problems for plant operators that we should be aware of?
- e. If there are problems, what mitigations can be put in place, if any?

12/10/2021

- f. Would AD facilities be able to handle newspaper if householders were recommended to line naked food waste caddy bins with newspaper?

12/10/2021

Annex B: Questions to operators of ABPR approved IVC facilities

1. Treating a relevant type of waste

- c. Does your facility treat animal-derived food waste or wastes that include animal-derived food waste?
- d. If not but you plan to begin treating such food waste in future, by when do you expect to begin treating it?

2. Compostable plastic caddy liners

If compostable plastic caddy liners are (now or in future) supplied by local government to households, would you be likely to accept:

- a. front-end removed compostable liners from AD plants, and/or
- b. dewatered fibre digestate with compostable liner residues, for composting to biodegrade those residues?
- c. If your answer to 2a and/or 2b is 'No', what changes (anywhere in the system) would enable you to change to accepting them?

Note: we are also asking ABPR-approved AD operators about their facilities' current capabilities and their thoughts about facility development so more of them can wholly process compostable plastic caddy liners at their facilities.

3. Paper caddy liners

- g. Do you currently treat paper bags/caddy liners?
- h. Have you successfully treated paper bags/caddy liners in the past and if so, what were the key reasons for stopping that practice?
- i. Would IVC facilities be able to handle newspaper if householders were recommended to line naked food waste caddy bins with newspaper?

Note: IVC operators were not asked about polyethylene caddy liners because this type of liner is unsuitable for composting and all operators front-end remove them and numerous use other treatment steps later in the composting process to remove pieces of non-compostable plastic and any incompletely composted compostable plastic as best as practically possible.

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