

Template for comments and secretariat observations

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MB/NC ¹	Line number (e.g. 17)	Clause/ Subclause (e.g. 3.1)	Paragraph/ Figure/ Table/ (e.g. Table 1)	Type of comment ²	Comments	Proposed change	Observations of the secretariat
		Title		Te	There appears no opportunity to comment on the title however, the title is incorrect. This PAS has a definition of polyolefins only the authors recognise. The title does not consider the fact that the plastic litter must be in the environment for an unqualified amount of time. The title and scope do not consider the precise – in particular humidity and wetness – environment in the test device which is completely arid. This environment is not compared in any way through testing to a real environment. The title must refer to the fact it is products which are going to be in the environment, not materials.	Change title to: Test methods and requirements for plastic products which are exposed to an artificial arid accelerated environment prior to biodegradation on the soil	
		Foreword		Ed	Whilst it is probably a standard clause that the review period is 2 years, it is not applicable in this case as the combined test during of degradation and biodegradation is at least 2 years 14 days	Change review period to 3 years	
		Introduction		Te	<p>The first paragraph is omitting the existence of BS8472, ASTM 6954, UAE 5001 all of which follow almost the exact procedures as proposed in this PAS. The main difference appears to be the language used.</p> <p>The introduction states the focus is on littered plastic packaging but then packaging is hardly mentioned elsewhere in the standard, in fact, much of the standard seems to concentrate on materials rather than end products.</p> <p>The Ellen Macarthur Foundation citation is to an area of their work called the New Plastics Economy, this same body of work called for a ban on additives claiming accelerated biodegradation as proposed in this PAS.</p> <p>Most litter ends up in the river and the oceans, water is not considered in any aspect in the first vital part of the test scheme and only becomes 'relevant' in the soil biodegradation test. Water is</p>	The introduction needs a complete overhaul to consider the content of the PAS and its relevance in the wider environmental context bearing in mind that the environment covered in this PAS hardly exist.	

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					<p>everywhere, it rains, there is dew in the morning in the vast majority of terrestrial environments globally.</p> <p>The introduction talks widely about weathering, alignment with existing work (which it also says is missing) and the impact inferred to be an end to plastic waste in the environment.</p> <p>Little previous work is referenced in this PAS.</p> <p>Waxes are not defined</p> <p>Criteria should be in requirements not in an introduction</p>		
		Introduction		Te	The section on claims is very confusing. It also further suggests that claims can be made regarding performance in the environment when the initial activation of the catalyst in the plastic is done in completely unnatural conditions	<p>Reword to state claims on performance in an actual environment can only be made if outdoor weathering is also undertaken and the results are correlated to the results from the heated chamber test</p> <p>It must also be emphasised here that claims of sic biodegradable in the environment will result in additional litter. No standard should enable littering claims. Make it a requirement of the PAS that no consumer claim should be possible using this standard as a reference directly or via a certification scheme</p>	
		Scope		All	The PAS needs to decide if it is for polyolefins or plastics. If it is for polyolefins then it must change the definition of polyolefins to one which is internationally recognised. There must be a reason that only specific types of plastic are possible to test under this PAS but none is given. Maybe it is because catalyst based additives have not been developed for specific materials yet or that it is undesirable to have certain polymers degrading in the sun/soil due to toxic emissions. In both these cases the product would	Change definition of polyolefin to actual polyolefin (strictly a s3 comment but relevant here) or change polyolefin to plastics	

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					surely fail the PAS but pre-empting failure is not a reason for exclusion		
		Scope		All	<p>The scope puts biodegradability at the centre whilst giving the perception that the weathering is undertaken in conditions which whilst simulated represent a real environment. This gives a false impression relative to the outcomes of the laboratory tests.</p> <p>The potential impact of bringing these new materials into the market without any prior knowledge regarding their potential for mechanical, chemical or organic recycling is huge. This must be assessed and included in all business to business claims made against this PAS.</p>	<p>This PAS specifies test methods and requirements for plastic end products which are subjected to abiotic, biotic (soil) and toxicity laboratory tests in a consecutive flow.</p> <p>This PAS specifies a test method for outdoor weathering which shall be used to validate and correlate the results from the laboratory abiotic test.</p> <p>NOTE: Outdoor weathering tests are limited by geography and seasonality. The end market for the product should be considered when choosing the location for this test.</p> <p>This PAS specifies requirements for business to business claims. No business to consumer claim shall be made with reference to this PAS or results from testing according to this PAS.</p> <p>This PAS does not cover:</p> <ul style="list-style-type: none"> • Biodegradation in freshwater, marine, deserts, sand dunes, beaches, landfill, anaerobic, oligotrophic, psychrophilic, thermophilic or any area with low soil health environments • The ecological and environmental physical impact of the plastic products under assessment before “wax” formation is completed • The biodegradation, ecological or environmental impact of any microplastics released through non weathering processes such as abrasion NOTE: such microplastics rapidly enter aquatic environments 	

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		2			Add BS EN ISO4892-1 Add reference to ISO outdoor weathering test	Add BS EN ISO4892-1 Add reference to ISO outdoor weathering test	
		3	All	Te	In order for the content of this PAS to be understood by accredited laboratories it must be written in a language they will understand and be comfortable with. The content of the PAS is not novel and the tests and procedures are already applied globally using ISO standard tests. The language of this PAS should not therefore be novel and instead be based on definitions which are already established. The ISO online browsing platform provides all the terms the text requires, wherever possible terms should be taken verbatim from ISO 472 – the plastics terminology standard	Use only definitions from the ISO Online Browser with a preference for those from ISO 472	
		3		New	Add definition of microplastic	Add definition of microplastics according to ISO/TR 21960:2020, 3.9	
		3.1.1		Te	This would be better stated using an established definition with a note added to explain what the % is	Biodegradation SOURCE: ISO 472:2013, 2.1680 NOTE: biodegradation may be expressed as a percentage conversion of the organic carbon content of a product to CO ₂	
		3.1.2			Additives are not inherently biodegradable or classified as such according to international nomenclature or even this PAS	Use definition of additive SOURCE ISO 472:2013	
		3.1.3		Te	The definition relates to products – raw materials, semi-finished and final product (in the market) not solely end products. This PAS should only be applied to end products	Use definition of end product from ISO 22000:2018	
		3.1.4		Te	Term not used in PAS	Delete	
		3.1.5		Te	Term not used in PAS (or English)	Delete	

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		3.1.6		Te	Not necessary, additive already defined under 3.1.2	Delete	
		3.1.7			Constituent is a more relevant term than component which relates to a part you can take away not an integral part. Furthermore, the definition is requiring compliance with a series of test / requirements that are within the test	Use definition of constituent from ISO 22403:2020	
		3.1.8			Fillers are fillers	Use definition from ISO 472	
		3.1.9		Te	Films are globally defined as being <0.25mm not 0.2 and no justification is given	Use definition from ISO 472 or ISO 23559:2011	
		3.1.10		Te	Pigments are pigments	Use definition from ISO 8640	
		3.1.11		Te	The definition describes a thick film since it does not actually consider rigidity.	Use definition from ISO 472	
		3.1.12		Te	Polyolefins are amongst the most widely used polymers in the world and this is not a definition of polyolefin which would be recognised as a polyolefin but is closer to a general (not technically correct) plastics definition	See comment on scope either, use definition of polyolefin from ISO 472 or delete all references to polyolefin, replace with plastic and define plastics according to ISO 472	
		3.1.13		Te	Please use correct language, it is not uv-weathering but accelerated artificial weathering	Use definition of artificial accelerated weathering from ISO 4892-1	
		3.1.14		Te	No explanation of the adaption is provided, in any case there is current no outdoor weathering testing so 3.1.13 will suffice	Delete	
		3.2.2		Te	PS and PVC are not polyolefins. This is a British PAS and should therefore be respectful of the UK thinking. The WRAP Plastic Pact, of which the sponsor is a member is requiring its members to eliminate PS and PVC from their packaging portfolios	Delete PS and PVC	
		4		Te	This whole clause contains a number of references which do not correspond with those in the Annexes. It also permits the use of ISO or ASTM tests when these tests are not equivalent.	Check against the Annexes and use the correct ISO reference tests only	

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					This is a BSI PAS, whilst it is not absolutely necessary is it more than appropriate to use standards which have been adopted by BSI rather than those from a competing standards body		
		4		Te	<p>This clause (and the rest of the PAS) divides products into films and rigids, applies different tests, different exposure lamps, temperatures, cycles, significantly different total irradiance and with no reasoning. The proposed difference between entire testing systems is potentially 1 micron yet the final destination – a specific land based environment is the same.</p> <p>This whole philosophy needs explaining to the user, or simpler still use the same test, same cycle, same irradiance</p>	<p>Unfortunately it is not possible to propose text since the reason for the application of entirely different tests and requirements for essentially the same product destined for the same environment is not known.</p>	
		4		Te	<p>The test methods used, e.g. 4892-2,-3 do so with previously unspecified cycles, exposure rates and so on. The impact of this exposure is then assessed according to other criteria which then become the basis for moving to the next tier of testing. The general guidelines for operating 4892-2,-3 are given in ISO4892-1 which is very clear that where accelerated testing is used as a precursor to something else, then a ring test is necessary. It does not matter that this is “just a PAS”, products which undergo testing according to this PAS are intended to be deployed at commercial scale, globally and this PAS is to assess behaviour in the environment and is proposed as a litter reduction tool.</p> <p>In addition ISO4892-1 emphasises the difficulty of relating artificial accelerated weathering or artificial accelerated radiation exposure to those obtained in actual use conditions.</p> <p>In addition CEN Guide 13 for environmental tests</p>	<p>Require that full ring testing is undertaken and that results show at least adequate performance in all aspects of ring testing.</p> <p>If BSI decides not to require this then the following text must be added to the Scope: ‘The testing and consequential testing applied in this specification has not been subjected to a ring test. A ring test should be carried out and the results evaluated when considering the feasibility of developing this PAS into a British Standard or other more formal standard.’</p>	

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					<p>applies to this PAS.</p> <p>Given the potential scale of deployment and claims based on this PAS not undertaking a extensive ring testing on the basis “this is just a PAS” is unjustifiable. Not only does it demean itself it could easily damage the reputation of BSI</p>		
		4.1		Te	<p>This is where the text of the PAS begins to slip into a half way house combining a specification with a certification scheme. A specification should not contain get out clauses based on previous testing, this is the realm of certification.</p> <p>This section should rather concentrate on full chemical characterisation of the final product including declaration of all constituents including chemical formula.</p> <p>It should also place restrictions on specific substances known or considered to be hazardous</p>	<p>Products shall be fully chemically characterised including full composition and chemical formulae for each constituent</p> <p>Known hazardous substances such as SVHC shall not be intentionally added to the product.</p> <p>Constituents classified as eco-toxic according to CLP shall not be intentionally added to the product</p> <p>Metals and other regulated substances shall be characterised and meet the requirements of Annex A of ISO 18606</p>	
		4.3.1		Te	<p>ISO 4892-1 is the reference standard for sample preparation not 4892-2. The products will be disposed in the environment in their final form and therefore it is not suitable to only test a sample of the product unless the heated chamber cannot accommodate larger sized samples. Most packaging is not a single sheet, e.g. a pouch, in order for the sample to replicate the form it is in the environment the thickness of products which cannot be tested whole must be at least 2 times that of its thickest part / wall. Similarly, it cannot be assumed a pouch will be littered without its lid so lid thickness must also be accounted for.</p>	<p>Change reference for sample preparation to BS EN ISO 4892-1.</p> <p>Replace second sentence:</p> <p>Samples to be tested shall be in their final form where possible. Where this is not possible, the thickest part of the sample shall be tested. Where the sample is a hollow product e.g. a bag or pouch, the minimum thickness shall be at least double that of its thickest part.</p> <p>For end products with removable caps, lids or components, the cap, lid or component shall be in place when tested. In the case where the whole sample cannot be tested the double additional maximum thickness requirement applies to the cap/lid/component plus product</p>	

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		4.3.1.1		Te	For evaluation of test sample compliance with all relevant tests, this PAS must provide clear instructions for working out how much test sample is necessary for all the subsequent tests.	Provide better information on how to calculate the total minimum test material required	
		4.3.1.2		Te	It is implied in this note that the cycles of UV-weathering specified in 4.3.2.1 represent a 'plausible level of real-world environmental stimuli'. However, those specified cycles do not. This test is devoid of water yet water is present in most real world environments.	Add minimum humidity 50% Add spray cycle of 30 mins per 24 hours	
		4.3.2		Te	No justification is given for the use of different tests, cycles, exposure conditions for something which might be minimally thicker	Delete entire clause If this is not accepted and a full explanation of the wide differences is given, the same comments from 4.3.1, 4.3.1.1, 4.3.1.2 apply with the exception of needing a longer water spray cycle, increase water spray cycle to 1 hour	
		4.4.1			Carbonyl index is specified for measuring the degree of oxidation of the polyolefin polymer, and ATR-FTIR is recommended as the technique for capturing the relevant spectra. However, this technique is essentially a surface technique and will only provide information about the top few microns of the polymer object under test. Especially for thicker samples this may not reflect the oxidation level present in the body of the object.	Guidance is needed to ensure that a suitable testing technique reflects the degree of oxidation throughout the object.	
		4.4.2			Molecular weight determination by GPC/SEC is recommended. ASTM D6954 points out that "gel formation is a frequent side reaction in the oxidative degradation of polymers, especially polyolefins", and indeed such gels might be resistant to breakdown in the presence of biodegradable additive packages, and also be resistant to biodegradation. It is not clear that molecular weight determination will necessarily detect the presence of smaller	Guidance is needed relating to gel formation and measurement.	

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					quantities of such gels.		
		4		Te	Add new clause requiring outdoor weathering to be undertaken. It is not significantly expensive. Given the 14 day max exposure time the authors must be predicting that “waxes” are fully developed in a relatively short time, there thus appears no reason not to undertake an outdoor test. Given that no one knows when a product is going to be released into the environment, the tests should be started in winter	Outdoor weathering tests on complete end products shall be undertaken in accordance with ASTM D1435 or ISO 882-2. Tests shall be commenced during the winter months NOTE Tests commenced in the summer months may not give a true reflection of a products performance in the environment	
		4		Te	During the accelerated artificial weathering tests unknown quantities of volatile by-products will be generated. These may gather as gases or in the spray liquid. This will be indicative of the products emitted, released and potentially washed away when a product is degrading in the environment. It is therefore essential such by products are collected and tested for eco-toxicity	Add requirement to the accelerated artificial weathering tests to collect all gaseous emissions and liquid	
		5		Te	It is not known or possible to predict when potentially eco-toxic by products will be generated or released, it is also possible that reactions between 2 substances not classified as eco-toxic under CLP will create molecules which are eco-toxic therefore it is essential to test for eco-toxicity before a product begins to degrade, during abiotic degradation, after abiotic degradation and also after biodegradation	Add: Full eco-toxicity testing shall be undertaken before accelerated artificial weathering, on gases and liquids formed in the abiotic test, on the formed “waxes” and after biodegradation is complete.	
		5.1.1		Te	None of the bullets provide adequate justification for avoiding eco-toxicity testing. A substance which is considered food safe means it has been tested according to specific criteria in relation to human toxicity. This is not the same as eco-toxicity.	Delete all bullets	
		5.2.1		Te	These are certification rules not appropriate in a specification. Delete and require testing	Delete text.	
		5.3		Te	Assessment of microbial activity is necessary	Add nitrification inhibition test (ISO15685)	

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		6.1.1		Te	These are certification rules not appropriate in a specification. Delete, testing is required	Delete text	
		6.1.1		Te	The biodegradation limit provided in 6.1.3 is based on BS EN13432 which has been set the standard also requires biodegradation testing on constituents between 1 and 10%, for home composting of carrier bags under prEN17427 constituent testing is required between 1 and 15% There is no such "back up" in this PAS, it is therefore possible that a wax which plateaus at 90% does so because the remainder is recalcitrant to biodegradation. This might not only be due to the presence of non biodegradable constituents but also because gels were formed during the abiotic exposure	Add new text: All waxes shall be tested for biodegradation according to 6.1.2. If non plastic constituents are present in quantities between 1 and 15 % w/w then the constituent shall be separately tested for biodegradation according to 6.1.2	
		6.1.3		Te	Add constituents	The test sample and where tested individual constituents shall.....	
		6.1.3	Note	Ed	It is BS EN 13432, if a ISO organic packaging reference is preferred use ISO18606	Change to BS EN 13432 or ISO 18606	
		Annex A	Figure	Te	This is a certification rules flow chart not appropriate for this PAS	Redo figure to include PASS/FAIL at each point	
		Annex B	All	Te	This is certification rules not appropriate in a specification	Delete	
		Annex C	All	Te	Mostly void since the necessary text is already present in clause 4	Delete	
		Annex E	All	Te	The correct reference for e and f is BS EN ISO4892-1 The thickness of a tested sample will affect the rate of abiotic and biotic breakdown.	The correct reference for e and f is BS EN ISO4892-1 Report the thickness of the tested sample, as an upper limit for the applicability of the PAS to that sample type.	

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