

REVIEW REPORT

DC14085-001

REVEW OF TEST DATA FOR THE FUTURE POST PRODUCTS

CLIENT

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All tests and procedures reported herein, unless indicated, have been performed in accordance with BRANZ ISO9001:2015 Certification

LIMITATION

The results reported here relate only to the item/s tested.

TERMS AND CONDITIONS

This report is issued in accordance with the Terms and Conditions as detailed and agreed in the BRANZ Services Agreement for this work.

SIGNATORIES

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1. INTRODUCTION

BRANZ was commissioned to carry out a review of the available research on Future Post products, including the testing that has been carried out and its value in assessing the environmental integrity of the products. Future Post manufactures fence posts using post-consumer (recycled) polyethylene. The questions to be addressed concerned the environmental integrity of Future Post products in terms of leaching, ageing and production of microplastics, particularly under the effect of temperature and UV radiation.

As the Future Post product is made from recycled plastic, it is subject to environmental degradation through a number of mechanisms. Limited testing has been carried out on the Future Post product to assess its durability and potential environmental impact.

2. ORGANIC CERTIFICATION

Future Post holds a BioGro New Zealand certificate of compliance as a certified input, in the category of Crop Management. This does not mean that the product is organic, but it is suitable for use in certified organic production. The certification process requires the manufacturer to provide data on the ingredients and production methods of the product, and an on-site inspection. It is unclear what, if any, testing is required for certification.

3. LEACHING

Leaching is the process by which constituents of a solid material are released into a water phase that is in contact with it. The contact water may be dynamic or static. There are a number of factors that may affect the leaching, including:

- internal chemical and physical reactions,
- physical degradation of the solid matrix due to erosion or cracking, and
- loss of matrix constituents due to the leaching process itself.

Leaching tests were carried out by Callaghan Innovation [ref 1] and reported that the post material leached very low levels of metal ions, well below the limits specified in the NZ Drinking Water standard [ref 2]. No organic compounds were detected in the leaching tests.

However, this testing was severely limited for a number of reasons. It was not carried out in accordance with any standard. While this approach can be useful for comparative testing of different materials, it does not necessarily provide a suitable measure of the potential environmental impact of the material in use.

The testing reported by Callaghan Innovation was carried out over a relatively short exposure time, in static water of neutral pH and at a slightly elevated temperature. It did not take into account other factors such as the effects of UV exposure (although this is unlikely in the buried portion of the post), the pH of the surrounding soil or the impact of the microbial content of the surrounding soil.

Most leachate standards refer to testing for leachate as a by-product from landfills and are not completely relevant to this product but may provide some indication of their environmental performance [ref 3, ref 4]. The Toxicity Characteristic Leaching Procedure (TCLP) is used for evaluating whether a waste material is hazardous or non-hazardous under municipal landfill

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conditions. The Synthetic Precipitation Leaching Procedure (SPLP) method is designed to mimic the effect of acidic rainfall on wastes and soils.

There are, however, a number of standards that are concerned with leaching of chemicals from monolithic material. For example, Standards New Zealand refers to BS EN 15863:2015, a method applicable for determining the leaching behaviour of monolithic wastes under dynamic conditions [ref 5]. There are a range of ISO standards on soil quality that give guidance on leaching methods for subsequent chemical and ecological testing [ref 6, ref 7].

4. UV DEGRADATION

Most plastic materials are subject to degradation by UV radiation. This is particularly important in the New Zealand environment due to the high levels of UV exposure experienced across the country.

UV testing was reported by Clariant [ref 8]. Their report states that QUV exposure was carried out in accordance with ISO 4892-3. The exposure was completed using conditions that Clariant state resulted in 1000 hours exposure equating to 217 days outdoors in New Zealand. A total exposure time of 10000 hours was used, comparable to nearly 6 years outdoor exposure using the equivalence stated by Clariant.

The effect of the UV exposure was assessed by measurement of the impact strength of the exposed material, under ASTM D-180 standard conditions [ref 9]. Results showed a rapid and significant loss of impact strength in samples that were not stabilised. Materials that contained stabiliser maintained its impact strength for the full exposure time.

The test report detailed a plan to produce tensile, flexural and Izod impact test bars. However, no results were reported for tensile or flexural testing.

5. MICROPLASTICS

Microplastics are small plastic pieces, less than five millimetres long, which can be harmful to our ocean and aquatic life [ref 10]. Microplastics are divided into two types: primary and secondary. Primary microplastics include microbeads found in personal care products, plastic pellets used in industrial manufacturing, and plastic fibres used in synthetic textiles. Secondary microplastics form from the breakdown of larger plastic items; this typically happens when those larger plastic items undergo weathering, through exposure to, for example, wave action, wind abrasion, and UV radiation.

The samples exposed to UV in the Clariant testing [ref 8] were examined optically for surface degradation. The sample without stabiliser was observed to have significant surface micro-cracking at the end of the testing. Surface microcracking, as visible in the images of the sample without stabiliser, has potential to lead to the production of secondary microplastics in the environment. Images in the report suggested that the materials that contained stabiliser exhibited limited surface degradation at the end of the 10000 hour exposure period. However, as discussed above, the accelerated exposure was stated to be equivalent to approximately 6 years outdoor and it is not possible to predict the ultimate breakdown mechanism for the stabilised samples from the test. As such, it is unclear whether stabilised products will ultimately degrade via a mechanism with potential to product microplastics.

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6. DISCUSSION

No evidence of other testing was found on the Future Post website [ref 11] or elsewhere. The testing that has been carried out is limited in scope and provides limited insights in answering questions about the environmental integrity of Future Post products.

In order to assess the potential environmental impact of Future Post products further testing is recommended. Suggested testing is as follows:

- Leaching tests, in accordance with a suitable standard such as given in the references [ref 3-7], that reflect the environmental conditions that the posts will experience. There are a number of accredited New Zealand analytical laboratories (e.g. Hills Laboratories, Eurofins, etc) that routinely conduct TCLP and SPLP testing.
- UV exposure testing representative of a longer exposure period. Future Post claim a 50-year life expectancy for their posts, so the exposure testing needs to reflect this. The reported testing was equivalent to around 6 years. There are reports in the literature of research around the durability of polyethylene in the New Zealand environment [ref 12-13]. These could provide some guidance regarding the durability of the posts, although the timeframes for these other works are significantly less than 50 years. Also there may be differences between virgin and recycled material, including a contribution from the source of the recycled material.
- For an environmental impact assessment, the effects of the exposure on the surface degradation are highly relevant. An examination of these effects would give an indication of the likelihood that the posts will generate secondary microplastics over the life of the product.
- Fence posts are embedded in the ground, and sometimes in concrete. The soil conditions (e.g. pH, microbes etc) may have a significant effect on the durability of the material. Additional research or testing would be useful to assess this. If the fence posts are concreted in place, then they are exposed to another different environment (highly alkaline) which may give rise to different durability behaviour.

7. CONCLUSIONS

Limited research has been presented or found relating to the durability and environmental impact of Future Post's recycled plastic fence posts. The test results that have been found are incomplete or of limited relevance to the intended use of the posts.

Some information may be available from other research, but more testing is required to provide confidence that ageing and degradation of the posts over a 50 year life will not have an adverse impact on the environment.

8. REFERENCES

[ref 1] Robert Breukers, "Investigation of potential leaching into water from Future Post Samples". Callaghan Innovation Report dated 25 November 2019.

[ref 2] Ministry of Health. 2018. Drinking-water Standards for New Zealand 2005 (revised 2018). Wellington: Ministry of Health.

[ref 3] Toxicity Characteristic Leaching Procedure (TCLP, US-EPA 1311)

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[ref 4] Synthetic Precipitation Leaching Procedure (SPLP, US-EPA Method 1312)

[ref 5] BS EN 15863:2015 Characterization of waste. Leaching behaviour test for basic characterization. Dynamic monolithic leaching test with periodic leachant renewal, under fixed conditions. Standards New Zealand

[ref 6] ISO 18772:2008 Soil quality – guidance on leaching procedures for subsequent chemical and ecotoxicological testing of soils and soil materials

[ref 7] ISO 21268 series Soil quality –leaching procedures for subsequent chemical and ecotoxicological testing of soil and soil-like material

[ref 8] Vitalii Furt, Clariant New Zealand Laboratory Report E000040845 dated 16/02/2021

[ref 9] ASTM D180-64 Methods of Testing Tolerances for Cotton Yarns (Withdrawn 1967)

[ref 10] https://oceanservice.noaa.gov/facts/microplastics.html

[ref 11] https://www.futurepost.co.nz/

[ref 12] Marston, NJ and Jones, MS, 2007. Weathering of Polymeric Materials in New Zealand. BRANZ Study Report SR182. BRANZ Ltd, Judgeford, New Zealand.

[ref 13] Shaw, P and Marston, NJ, Reliable durability prediction of polymeric materials, (In) Proc. Corrosion & Prevention, Nov 15-18, 2015, Adelaide, Australia.

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