

**Prediction of external lifetimes  
of natural polymers and  
composites under a wide range  
of weathering conditions**

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## Summary

The use of natural polymers and composites for long-term applications was investigated. Three natural based polymers (Arboblend, Mater-Bi N and Starpol 2000) were mixed with various additives (Tinuvin<sup>®</sup> 327, Cyasorb<sup>®</sup> 1164, and Cyasorb<sup>®</sup> 2908) at varying levels (0.1% and 0.3%) and were exposed to up to three months of accelerated heat, UV and water degradation. Samples with Titanium Dioxide (a pro-degradant) at levels of 2% and 5% were tested too. Polypropylene mixed with green pigment and Tinuvin<sup>®</sup> 770 was also tested to provide a comparison with a non-natural polymer. After accelerated weathering, the sample materials were tested with a tensile tester to obtain each material's properties. These tests were done on samples after 0 months, 1 month, 2 months and 3 months weathering. The results from the tensile testing were analysed and reasons for the patterns and trends shown are given. From these, lifetime predictions for all the different materials/additive combinations are given for three sites in the UK – Bognor Regis, Greenwich and Stornoway. This is done by using formula that correlates accelerated UV weathering with natural outdoor UV weathering. It does not factor in heat and water degradation processes. All the data obtained showed that the only one of the three natural based polymers that could be considered for use in long-term applications is Arboblend. It shows similar properties and lifetimes to that of Polypropylene with green pigment and Tinuvin<sup>®</sup> 770. Mater-Bi N is too ductile and is affected too much by UV and Starpol 2000 is too brittle in its natural state. Titanium Dioxide does not work as a pro-degradant in these materials. Much more work is needed on natural polymers and composites before they can replace non-natural polymers in long-term outdoor applications.