

BioPin™ Tech Sheet



BioPin™ - 100% biodegradable turf and matting pin is not just another pin. BioPin™ is the result of years of research and development that have produced the most unique turf and matting pin available today.

Composition of BioPin™

BioPin™ is a natural plastic that originates from materials that are abundantly grown in the United States making it an environmentally friendly alternative to common plastics made from fossil fuels. BioPin™ is a Polyhydroxyalkanoate (PHA) plastic that is made from plant sugars and vegetable oils. Bacterium ralstonia eutropha converts sugars directly into plastic in the case of PHA.

Processes of Biodegradation

BioPin™ : Biodegrade from microbial attack, which is a surface erosion mechanism. BioPin™ degrade in cold (6°C) to hot (80°C) conditions and do not require a pre-hydrolytic reduction in molecular weight for degradation to begin. Bacteria in the soil breakdown BioPin™, thus BioPin™ breakdown faster in more fertile soils. BioPin™ will degrade completely from the soil in 8-24 months.

Starch Based Blends, Polyvinyl Alcohol, and Polylactic Acid (PLA): These products require a pre hydrolytic reduction in molecular weight followed by microbial attack of lower molecular weight species. This generally requires a hot (60 °C - 65 °C) and moist composting step, which is not a common condition for soils where turf staples are used. These materials dissolve or swell in water to cause mechanical degradation of the sample followed by slow bacterial or fungal breakdown.

Oxobiodegradable Products: Products that require the polymer to be exposed to heat and/or light so the polymer can be reduced by a radical mechanism with the introduction of high levels of oxygen groups. Oxobiodegradable products are responsive to microbial attack only after pre-exposure conditions are met. The pre-exposure requirements are temperatures of 70 °C to 80 °C lasting weeks to months. These conditions rarely occur in soils where pins are used.

Unique Properties of BioPin™

- Biodegrade in cold (6°C) to hot (80°C) conditions
- 100% biodegradation from bacteria (in accordance to ASTM5338 and ASTM5271)
- Do not require a pre hydrolytic reduction in molecular weight for degradation to begin
- Water resistant and do not soften from moisture during storage



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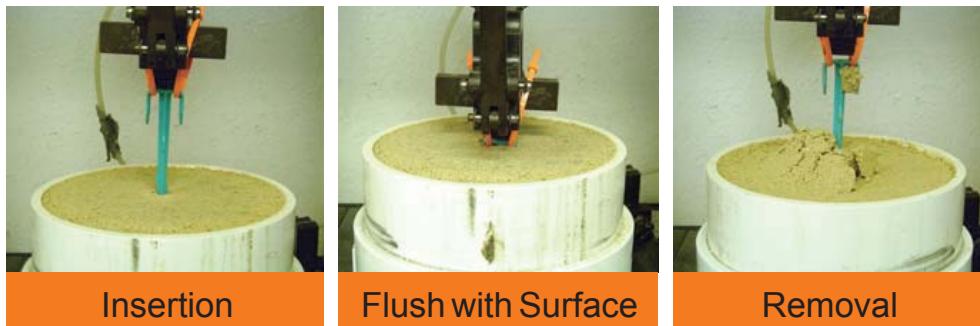
All Stake Supply

ENVIRONMENTAL
TERRAIN
SOLUTIONS

Established 1976

Independent Testing Proves BioPin™ Superior Anchoring Strength

4" and 6" BioPin™ were tested along with other common products that are used to anchor rolled erosion control products and turf.



Insertion

Flush with Surface

Removal

All Pins were installed into soil pots that were compacted to $90 \pm 3\%$ of standard Proctor at a soil moisture within 3 % of optimum content as per ASTM D698.

Pins were mechanically installed at a rate of 580.8mm per minute. After one minute, the pins were extracted vertically upward to a rate of 50.8mm per minute, while measuring the force required.

Results:

6" BioPin™ contains 1,212%, 647%, 422%, 277%, and 187% more anchoring strength than 6" Round Top Steel Staples(E), Competitor Biodegradable 4" (D), 6" Steel Staples (C), Competitor Biodegradable 6" staple (B), and 4" Competitor Biodegradable (A), respectively.

4" BioPin™ contains 763%, 407%, 265%, 174%, and 117% more anchoring strength than 6" Round Top Steel Staples(E), Competitor Biodegradable 4" (D), 6" Steel Staples (C), Competitor Biodegradable 6" staple (B), and 4" Competitor Biodegradable (A), respectively.

Anchoring Strength of BioPins and Other Turf Staples

