Beta Analytic Inc
4985 SW 74 Court
Miami, Florida 33155
Tel: 305-667-5167
Fax: 305-663-0964
info@betalabservices.com

ISO/IEC 17025:2005-Accredited Testing Laboratory

August 12, 2019

Mariangela Spina
LEGOPLAST SRL
VIA MONTEROSA 13
ROMENTINO
28068
Italy

Dear Ms. Spina

Please find enclosed your radiocarbon (C14) report for the material recently submitted. The result is reported as “% Biobased Carbon”. This indicates the percentage carbon from “natural” (plant or animal by-product) sources versus “synthetic” (petrochemical) sources . For reference, 100 % Biobased Carbon indicates that a material is entirely sourced from plants or animal by-products and 0 % Biobased Carbon indicates that a material did not contain any carbon from plants or animal by-products. A value in between represents a mixture of natural and fossil sources.

The analytical measurement is cited as “percent modern carbon (pMC)”. This is the percentage of C14 measured in the sample relative to a modern reference standard (NIST 4990C). The % Biobased Carbon content is calculated from pMC by applying a small adjustment factor for C14 in carbon dioxide in air today. It is important to note is that all internationally recognized standards using C14 assume that the plant or biomass feedstocks were obtained from natural environments.

Reported results are accredited to ISO/IEC 17025:2005 Testing Accreditation PJLA #59423 standards and all chemistry was performed here in our laboratory and counted in our own accelerators in Miami, Florida.

The international standard method utilized for this analysis is cited on your report. The report also indicates if the result is relative to total carbon (TC) or only total organic carbon (TOC). When interpreting the results, please consider any communications you may have had with us regarding the analysis. If you have any questions please contact us. We welcome your inquiries.

Sincerely,

Chris Patrick
Digital signature on file

Chris Patrick Director

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**Summary of Results -** % Biobased Carbon Content
ASTM D6866-18 Method B (AMS)

**Certificate Number:** 420114532681102924

**Validation:** Chris Patrick
Digital signature on file

| | |
|---|---|
| **Submitter** | Mariangela Spina |
| **Company** | LEGOPLAST SRL |
| **Date Received** | August 01, 2019 |
| **Date Reported** | August 12, 2019 |
| **Submitter Label** | 18XXX |

**RESULT:** 91 % Biobased Carbon Content (as a fraction of total organic carbon)

| | |
|---|---|
| **Laboratory Number** | Beta-532681 |
| **Percent modern carbon (pMC)** | 90.62 +/- 0.25 pMC |
| **Atmospheric adjustment factor (REF)** | 100.0; = pMC/1.000 |

Package received - labeling COC

View of content

14744.2mg analyzed (1cm scale)

Disclosures: All work was done at Beta Analytic in its own chemistry lab and AMSs. No subcontractors were used. Beta's chemistry laboratory and AMS do not react or measure artificial C 14 used in biomedical and environmental AMS studies. Beta is a C14 tracer-free facility. Validating quality assurance is verified with a Quality Assurance report posted separately to the web library containing the PDF downloadable copy of this report.

Precision on the RESULT is cited as +/- 3% (absolute). The cited precision on the analytical measure (pMC) is 1 sigma (1 relative standard deviation). The reported result only applies to the analyzed material. The accuracy of the RESULT relies on the measured carbon in the analyzed material having been in recent equilibrium with CO2 in the air and/or from fossil carbon (from living more than 40,000 years ago such as petroleum or coal. The RESULT only applies to relative carbon content, not to relative mass content. The RESULT is calculated by adjusting pMC by the applicable "Atmospheric adjustment factor (REF)" cited in this report.

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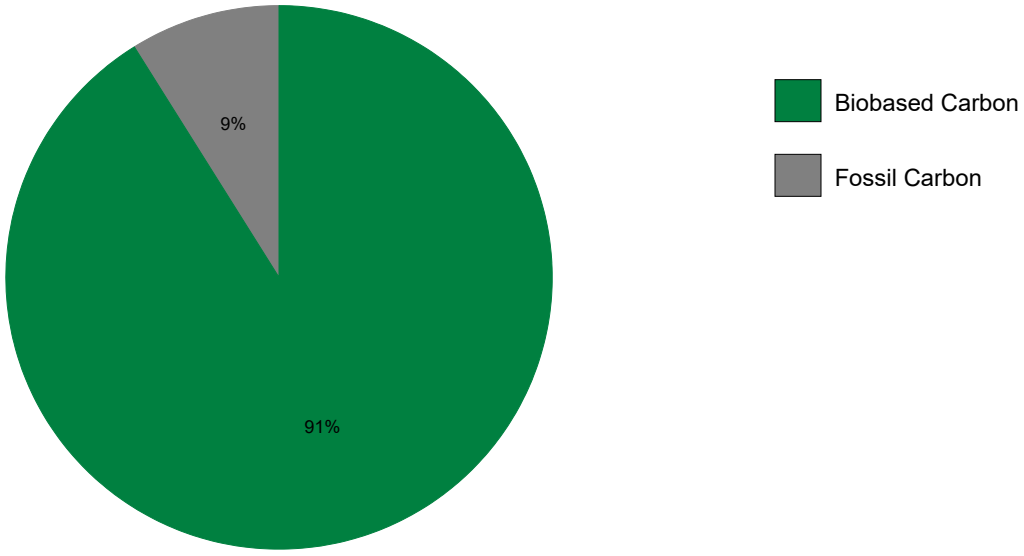


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# % Biobased Carbon Content ASTM D6866-18 Method B (AMS)

## Explanation of Results

The result was obtained using the radiocarbon isotope (also known as Carbon-14, C14 or 14C), a naturally occurring isotope of carbon that is radioactive and decays in such a way that there is none left after about 45,000 years following the death of a plant or animal. Its most common use is radiocarbon dating by archaeologists. An industrial application was also developed to determine if consumer products and CO2 emissions were sourced from plants/biomass or from materials such as petroleum or coal (fossil-based). By 2003 there was growing demand for a standardized methodology for applying Carbon-14 testing within the regulatory environment. The first of these standards was ASTM D6866-04, which was written with the assistance of Beta Analytic. Since ASTM was largely viewed as a US standard, European stakeholders soon began demanding an equivalent CEN standard while global stakeholders called for ISO standardization.

The analytical procedures for measuring radiocarbon content using the different standards are identical. The only difference is the reporting format. Results are usually reported using the standardized terminology “% biobased carbon”. Only ASTM D6866 uses the term “% biogenic carbon” when the result represents all carbon present (Total Carbon) rather than just the organic carbon (Total Organic Carbon). The terms “% biobased carbon” and “% biogenic carbon” are now the standard units in regulatory and industrial applications, replacing obscure units of measure historically reported by radiocarbon dating laboratories e.g. disintegrations per minute per gram (dpm/g) or radiocarbon age.

The result was obtained by measuring the ratio of radiocarbon in the material relative to a National Institute of Standards and Technology (NIST) modern reference standard (SRM 4990C). This ratio was calculated as a percentage and is reported as percent modern carbon (pMC). The value obtained relative to the NIST standard is normalized to the year 1950 AD so an adjustment was required to calculate a carbon source value relative to today. This factor is listed on the report sheet as the terminology “REF”.

Interpretation and application of the results is straightforward. A value of 100% biobased or biogenic carbon would indicate that 100% of the carbon came from plants or animal by-products (biomass) living in the natural environment and a value of 0% would mean that all of the carbon was derived from petrochemicals, coal and other fossil sources. A value between 0-100% would indicate a mixture. The higher the value, the greater the proportion of naturally sourced components in the material.