Cardia Biohybrids™ BL-F Resin Blends:

The following table shows the reduction of greenhouse gas emissions for a range of blends of Cardia Biohybrids™ BL-F Resin with polyethylene:

Biohybrid™ BLF Blend	Biohybrid™ BL-F Addition Rate	Renewable Content	GHG Emission in KG CO_2 eq. / KG Product	GHG Reduction vs LDPE
LDPE	0%	0%	2.8	0%
BL-F (10%)	10%	7%	2.6	6%
BL-F (20%)	20%	13%	2.5	11%
BL-F (30%)	30%	20%	2.3	17%
BL-F (40%)	40%	26%	2.2	23%
BL-F (50%)	50%	33%	2.0	28%
Biohybrid™ H-F	75%	50%	1.6	42%
BL-F (100%)	100%	66%	1.2	57%

Life Cycle Management - Life Cycle Analysis

Cardia Bioplastics™ is committed to Life Cycle Management (LCM) of its products. Cardia has commissioned three independent leading agencies to verify our environmental claims.

- A cradle to grave Life Cycle Assessment (LCA), was performed by the Centre for Design at RMIT University, Melbourne, Australia.
- An Environmental - Ecosystem analysis was performed by ExcelPlas, Edithvale, Victoria, Australia Life Cycle.
- A recycling analysis on plastic containing Cardia Biohybrid™ resin was completed by Smith RAPRA Technology (Rubber & Plastics Research Association) in the United Kingdom.

Analysis (LCA) qualifies the environmental impact of products and processes within pre-defined boundaries; for example cradle to gate, a cradle to gate (recycling), or a cradle to grave concept depending on end of life scenarios. The methodology is defined as a set of standards set by ISO 14040 series. Studies comparing energy consumption and related (GHG) emissions of bio-based plastics (BBP) with petrochemical polymers conclude that thermoplastic starch can provide energy savings of 51% MJ/kg BBP (Patel et al 2003).

Benefits of Cardia Biohybrid™ Resins Summary:

- Made from renewable content (high content).
- High performing packaging resins with a wide processing and application window.
- No Additional capital required for conversion to Cardia Bioplastics™ by manufacturers.
- Environmentally, makes plastic with lower GHG emissions compared with conventional plastic.
- Ability to tailor plastic products to customers performance and sustainability requirements.
- A cost effective way of contributing to more sustainable packaging.
- Be recoginzed as an innovator with new packaging solutions.

For additional information, please contact Cardia Bioplastics™

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Environmental Benefits of Cardia Biohybrid™ Resins

A Position Statement

The Company

Cardia Bioplastics™ is an Australian company developing, manufacturing and distributing environmentally friendly polymer resins and products for the global plastics market. We manufacture a broad range of renewable Biohybrid resins, internationally certified Compostable resins as well as Sustainable finished plastic products.

Our Mission

Become a leading global supplier of sustainable and renewable products to the plastics packaging industry.

Cardia bioplastics™

Cardia Biohybrids™

Scientists at Cardia Bioplastics™ have achieved a major breakthrough in polymer technology to create Biohybrid resin. This cutting edge technology allows for the homogenous blending of starch with polyolifin polymers, which are incompatible by nature. Using Cardia Biohybrid™ resin can produce sustainable plastic products with excellent physical properties.

Cardia Biohybrids™ Products

Cardia Biohybrid™ resins are a blend of polyethylene and thermoplastic starch (TPS) made from renewable, sustainable raw materials such as corn and tapioca. Cardia Biohybrid™ finished plastic products have a lower carbon footprint compared with conventional plastics.

Environmental Benefits of Plastics containing Cardia Biohybrid™ Resin

• Sustainable • Lower Carbon Footprint • Recyclable • Life Cycle Management

Sustainable:

A key environmental benefit of Cardia Biohybrid™ products is the renewable raw material that is used to make our thermoplastic starch polymer. Cardia uses only GMO free grown products to produce it's hybrid resin. Cardia Bioplastics starch supplier(s) have certified that the starch products Cardia uses as raw material meet various environmental criteria regarding the source of the starch.

The rapid depletion of the world oil reserves and the proven adverse impact of increased consumption of fossil fuels on the environment will inevitably lead to radical technical, environmental and social challenges. In recent years leading scientists internationally agree that the effects of global climate change needs to be slowed down, stopped and reversed to avoid catastrophic consequences for the world we live in. The longer we extend the usage of the world's finite resources (oil and natural gas), the better the chances to develop and implement environmentally sound alternative solutions for the vast number of applications that currently rely on petrochemical and natural gas raw materials.

Plastic packaging has been at the forefront in the development of sustainable products from renewable raw materials. Cardia Bioplastics™ can help the plastic industry, its customers and consumers to make an active choice towards a better environment. Using a Cardia Biohybrid™ resin masterbatch blended at low addition rates allows customers a low risk entry into sustainable products. The polyolefin base allows processing on standard extrusion equipment at familiar processing conditions and behaviour. Addition rates can be gradually increased as confidence is gained. This makes for a great marketing story of improved environmental benefits.

Recyclable:

All Cardia Bioplastics™ Resins are recyclable. Common production rejects, trim and change over material can be granulated and fed back into the process at common addition rates of up to 15 percent without adversely effecting product properties provided that recommended process temperatures / conditions are adhered to.

Cardia Biohybrid™ resin can also be recycled in a post consumer recycling stream. Cardia Bioplastics™ compatible technology is proprietary; it is used to ensure the material blend with polyolefin is homogenous in a recycling stream. The compatible technology remains readily available and ensures any dilution with polyolefin remains homogeneous.

Carbon Footprint:

A carbon footprint is part of a full Life Cycle Assessment (LCA), see below . It evaluates the total amount of greenhouse gases produced to directly support human activities, usually expressed in equivalent tons of carbon dioxide (CO2). Cardia Bioplastics™ resins offer a significant reduction in their carbon footprint in comparison to petrochemical polymers.

The following paragraphs describes a partial life cycle analysis that focuses on the carbon footprint of Cardia Biohybrid™ H-F in comparison to polyethylene in a "cradle to gate" scenario. The study is based on Australian conditions. It demonstrates the concept and the significant benefits for the environment that Cardia Bioplastics™ resins can offer.

Product Description:

Cardia Biohybrid™ H-F consists of a blend of thermoplastic starch (TPS) with polyethylene. This Cardia Bioplastics™ resin is compatibilised to offer a high level of mechanical strength, outstanding elongation properties and toughness. The starch resin is based on corn starch which is an annually renewable raw material (RRM).

Functional Unit:

The study compares the carbon footprint of 1 kg of polyethylene with 1 kg of Cardia BiohybridTM H-F. The functional unit for GHG emissions is kg Co2eq. / kg of product.

Study Components and Boundaries:

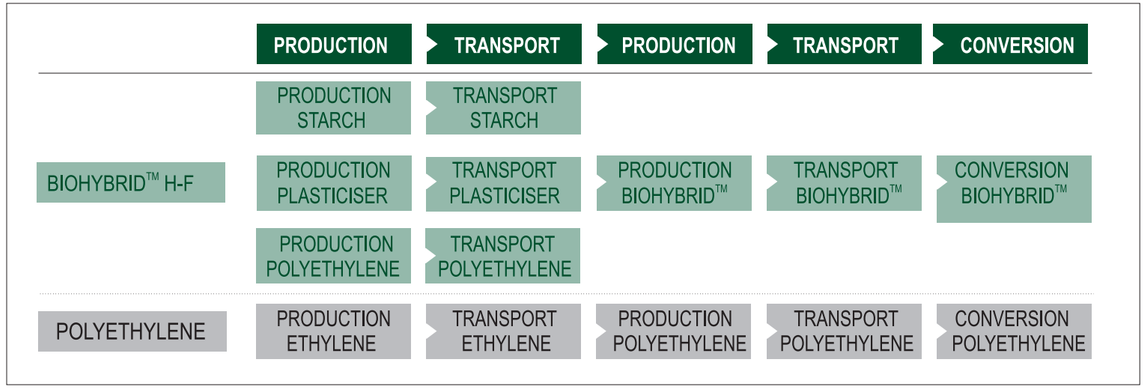

Figure 1 LCA Boundaries - comparison of Cardia Bioplastics™ H-F with polyethylene

Material	GHG Emissions in kg Co2 eq. / kg BBP
LDPE	2.8
Biohybrid™ H-F	1.62

Results:

An analysis of energy consumption and related carbon emissions of each individual step in the process resulted in the following figures for greenhouse gas emissions:

Cardia Biohybrid™ H-F resins show a significant reduction of 42% in greenhouse gas emissions when used in an application where it replaces polyethylene.

A Metric ton of plastic made of 50% LDPE and 50% Cardia Biohybrid™ DF sustainable resin has a 21,5% lower carbon footprint than a Metric ton of plastic made from 100% LDPE.