

NEC Develops High Performance Bioplastic with a High Plant Ratio by Using Non-edible Plant Resources

-- Advanced bioplastic from plant stems and cashew nut shells --

Tokyo, August 25, 2010 - NEC Corporation (NEC; TSE: 6701) announced today the development of a first-of-its-kind durable new biomass-based plastic (bioplastic) that is produced from non-edible plant resources. The bioplastic is created by bonding cellulose (*1), a main component of plant stems, with cardanol (*2), a primary component of cashew nut shells, which achieves a level of durability that is suitable for electronic equipment and boasts a high plant composition ratio of more than 70%.

The new bioplastic characteristics are as follows.

Composed of non-edible plant resources

As an alternative to petroleum-based components, cellulose is the plastic's major ingredient. The cellulose, which is produced in large amounts by plants, including grass stems, etc., is modified by cardanol, an oil-like material that is extracted from cashew nut shells. Most of these stems and nut shells are abundant resources, which are often discarded byproducts of the agricultural process.

High plant component ratio

The use of cellulose and cardanol, both plant resources, as the plastic's primary components produces a plastic that features a high plant component ratio of more than 70%. Current cellulose based plastics include large amounts of petroleum-based additives, which results in a low plant component ratio.

High durability well suited for electronics

After enhancing its reactivity, cardanol is chemically bonded with cellulose, which produces a durable thermo-plastic that is strong, heat resistant, water resistant and non-crystalline (short molding time), due to the bonded cardanol's unique molecular structure consisting of flexible and rigid parts.

- Comparison to existing bioplastics: polylactic acid resin (PLA) (*3) and cellulose acetate (CA) based resin
- Durability (strength & malleability): Twice the strength of existing PLA. Comparable to conventional CA resin
- Heat resistance (glass transition temperature): More than twice the resistance of PLA, approximately 1.3 times more than CA resin
- Water resistance: Comparable to PLA, approximately 3 times more than CA resin
- Molding time: Less than 50% of PLA. Comparable to conventional cellulose-based and petroleum-based plastics.

In recent years, bioplastics composed from plant resources gathered greater attention as an effective measure to reduce the depletion of petroleum resources and alleviate global warming. However, while current leading bioplastics, such as PLA, primarily use feed grains as a plant resource, the possibility of future food shortages has emphasized the importance of using non-edible plant resources to produce bioplastics.

Therefore, non-edible plant-based bioplastics have been developed using such resources as cellulose and castor oil (*4). These cellulose-based bioplastics have conventionally been utilized in stationery, toys and household goods. However, these modified celluloses require large amounts of petroleum-based additives such as plasticizers, which results in bioplastics with a low plant component ratio and poor durability, including heat resistance and water resistance.

A polyamide resin derived from castor oil, a non-edible plant resource is also being used in electronic parts, however, there is an inadequate supply of this plant resource to expand its use and its characteristics are unsuitable for use in a variety of electronics.

However, NEC's newly developed bioplastic resolves each of these issues. Looking forward, the company will continue with research and development towards mass production of this bioplastic and improving its suitability for a wide range of electronic equipment within the 2013 fiscal year.

This newly developed bioplastic will be formally announced at The Chemical Society of Japan / Kanto Branch meeting at the University of Tsukuba on August 31, 2010.

(*1) Cellulose

A main component of plant stems and wood: Cellulose is the world's most abundant non-edible plant resource, featuring a long molecular structure joined with regularly arranged glucose units. Cellulose is unsuitable for human consumption as food as its molecules are strongly attached to one another, which results in a strong resistance to heat and water solubility.

(*2) Cardanol

This is a natural organic compound that is a main component of shells taken from cashew nuts, which are widely cultivated in India and Vietnam. Cardanol is used as an additive for resin composites for such products as automotive brakes, coatings and insulation materials. The NEC group is ensured of a stable supply of Cardanol as an additive for resin composites to produce finished products.

(*3) Polylactic acid (PLA)

One of the most advanced mass-produced bio-plastics, PLA is produced from starch as a raw material. It has begun to be used in electronics and automobiles in addition to general products. Previous measures to improve PLA's practical characteristics, such as strength and flame retardancy, were to blend it with durable petroleum plastics, causing a considerable decrease in plant content. NEC developed a new blending technology using mainly PLA and special additives, without mixing petroleum plastics, enabling the production of a PLA composite with practical characteristics and a top level plant component ratio.

(*4) Castor oil

Oil extracted from castor. A polyamide bioplastic using castor oil as the main resource is in production and is used in a limited capacity for electronic parts.

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For media enquiries please contact:

Will Clarke
NEC Australia Pty Ltd
Tel: 0488 34 54 64
Email: will.clarke@nec.com.au

Georgie Nelson
n2n Communications
02 9213 2308
gnelson@n2n.com.au

Visit www.nec.com.au/news for more information and follow NEC on Twitter @[NEC_Australia](https://twitter.com/NEC_Australia)

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