Toyota Boshoku Corporation
Toyota Central R&D Labs., Inc.
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Novel bio-based plastic with top-level impact strength

"Salami in co-continuous phase structure" 10 times stronger than conventional bio-based plastic

(AICHI, Japan) November 15, 2013 – Toyota Boshoku Corporation (TOKYO: 3116), a premier manufacturer of automotive interior systems, and Toyota Central R&D Labs., Inc., contributing to present and future businesses of Toyota Group companies through technological innovations, are pleased to announce that they have developed an original technique to realize a bio-based plastic alloy with top-class impact strength. The bio-based plastic alloy (bio-alloy) is made from polyamide 11 (PA11), a 100% bio-based resin originating from plants and synthesized by castor oil*[1] extracted from *Ricinus Communis* (castor bean plant) as a raw material, and polypropylene (PP) derived from petroleum-based resin. The performance of this high impact bio-alloy surpasses polycarbonate alloys.

The impact strength of the bio-alloy was achieved by controlling the phase structure of PP and PA11 at the nano level through a "salami structure*[2]" mixture (dispersion) resulting in the world's first "salami in co-continuous phase structure*[2]". To improve the chemical characteristics (affinity) of raw materials, a special reactive compatibilizer was added to the raw materials and a molten blended technology was carried out to lead to a chemical reaction. By utilizing this technology, we have achieved an impact strength bio-alloy that is 10 times greater than that of PP conventionally used in car interior decoration parts and 13 times greater than that of bio-based plastic (PP/PLA).

When this bio-alloy is put to practical use, the adaptation of bio-based plastic for automotive parts can be significantly expanded. In particular, interior decoration parts such as automotive door trims, installment panels or as a collision energy absorber to increase part safety impact strength and rigidity that are necessary for passenger protection at the time of crash. Furthermore, this bio-alloy can be applied to exterior automotive parts made from resin such as fenders or bumpers.

Toyota Group's Toyota Boshoku and Toyota Central R&D Labs., Inc. plan to further improve the development of this technology including material technology aimed at early practical use of this bio-alloy, to contribute to the making of cars that harmonize with the global environment.

*1 Seeds of the castor plant (a non-edible plant) of the Euphorbiaceae are cultivated in tropical and temperate zones. PA11 is obtained by the polymerization of 11-amino undecanoic acid derived from the extraction of castor oil.

*2 The phase structure of compound resin is formed from numerous raw materials. The name "salami structure" came from the resemblance of a cut section of salami with the "salami structure" consisting of three parts: 1) the "lake" phase in the "island" (dispersion) phase, 2) the "island" phase in the "sea" (continuous) phase and the 3) "sea" phase. The "salami in co-continuous phase structure" has a salami structure in each continuous phase. In addition, at this time there are no reports of salami in co-continuous phase structure, this is the first such report (as of October 2013 per company research).