

Novel Biodegradable Polyamide 4

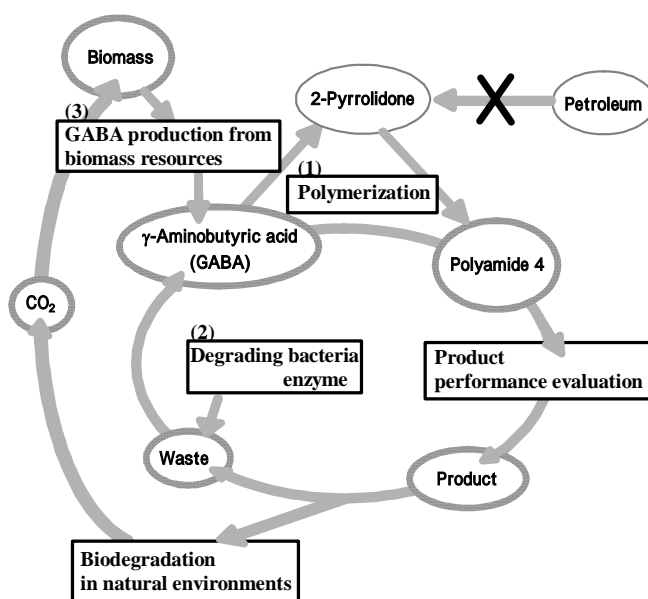
Naoko Yamano, Norioki Kawasaki, Atsuyoshi Nakayama, Noboru Yamamoto, Seiichi Aiba
National Institute of Advanced Industrial Science and Technology (AIST)
JAPAN

Polyamide (nylon) has excellent thermal and mechanical properties but it is known to be nondegradable in the natural environment. One of polyamides, polyamide 4 is a linear polymer of γ -aminobutyric acid (GABA). It has also excellent properties based on its high melting point (260°C). Unlike other polyamides, it can be biodegraded in an activated sludge as we reported. From these properties, polyamide 4 becomes a new attractive biodegradable material. Furthermore polyamide 4 has the possibility as a novel bio-based polymer because it is synthesized from 2-pyrrolidone, a lactam of GABA, and GABA can be made from glutamate. Glutamate fermentation system using biomass as a raw material is already developed. Our objective is establishment of new recycling system of novel bio-based and biodegradable polymer, polyamide 4.

In this study, we report (1) The synthesis of the branched polyamide 4 and their properties¹⁾. In order to apply in wide practical use, we attempted to improve the properties of polyamide 4. We clarified that introducing branched structure into the polyamide 4 chains it makes possible to improve the tensile strength. (2) Polyamide 4 degrading bacteria isolated from activated sludge.

Isolated bacteria were identified as *Pseudomonas* sp. strain ND-10 and 11. From the detection of GABA as an intermediate product it was suggested that it degraded polyamide 4 by hydrolysis of amide bonds. (3) Glutamate decarboxylase (GAD) derived from archaea. It catalyzes the reaction from glutamate to GABA. We cloned the GAD gene from archaea, *Pyrococcus horikoshii* and prepared recombinant GAD. Prepared GAD was thermostable and could react at high temperature (>95°C).

1) Kawasaki *et al.* Polymer 46, 9987-9993 (2005)



Polyamide 4 recycling system

