Research and Preparation of a Degradable Material

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Introduction

Foamed plastics are common materials for heat preservation, thermal insulation and cushioning material, and are widely applied in building, packaging, filling and energy absorption fields, etc. However, foamed plastics have two major drawbacks: one is that the raw material is obtained from petroleum; for example, 65 L petroleum is required to produce 1 m3 polystyrene foamed plastics; but petroleum resources are limited; another is that foamed plastics are difficult to decompose in natural environment. Plastic items may cause suffocation and entanglement and disrupt digestion in birds, fish and mammals. Plastic debris not only ruins the beauty of the environment, but also pollutes water resources and soil, endangers livestocks and wild animals, and lays a heavy burden on the ecological environment on the earth.

The research on bio-based degradable plastics has been in the ascendant to solve above problems. However, up to now, all bio-based plastic materials, such as polylactic acid (PLA), poly butylenes succinate (PBS), polypropylene carbonate (PPC), etc., are produced from sugar, which belongs to a food foodstuff of human and animals. Even if lignocellulose is used as the fermentation raw material, lignocellulose has to be hydrolyzed into sugar firstly, then transformed into a monomer for synthesizing plastics through liquid-submerged fermentation or bio-transformation, and finally polymerized into bio-based plastics through a chemical process (PHA is a macromolecular material directly synthesized from sugar through bio-synthesis and accumulated in cells; therefore, raw PHA can be obtained only after a cell wall breaking process). Such processes consume a large amount of raw material and energy, possess complicated process route, complex production technology, high equipment investment, higher costs than that of existing general-purpose plastics, and cause heavy pollution in the production process. Hence, at present, it is difficult to apply such products widely.

Terrestrial plants have got cell walls with dense and complex structures mainly formed by cellulose, hemicellulose and lignin in the long-term evolution process. The lignin and hemicellulose constituents are cross-linked with each other and wrap the polysaccharide moiety of fibrin. A mixture of such three-dimensional structures is generally referred to as lignocellulose. Lignocellulose is a renewable biomass in the highest yield. It is considered that lignocellulosic biomass comprises about 50% of world biomass and its annual production was estimated in 10-50 billion ton Lignocellulose is an ideal resource for human in the future. At present, up to 6-7 MT renewable lignocellulose resources (e.g., straw wastes) are not exploited and utilized economically and effectively every year in China, and even become a burden on farmers in the countryside. Straw burning still continues despite repeated prohibition, produces a large amount of PM2.5 pollutants and has become a new pollution source in China. How to transform the huge amount of straws into valuable resources has become strategic challenge in the social and economic development in many countries.

If the straw resources can be utilized as a raw material to produce bio-based materials that are widely accepted in the market, attain high economic benefits and are environment friendly with novel fermentation techniques at a low cost without pollution, it will be of great significance for industrial structure adjustment and even for economic

and social development.

Though there are some research reports on utilizing microorganisms to prepare bio-based materials presently, the cultivating processes involved in those reports have to be carried out under sterile conditions and have demanding requirements for the cultivating conditions, thus the preparation cost is relatively high. Therefore, in this research, non-sterilized substrates mainly composed of soybean straw were used to cultivate *Ceriporia lacerata* for preparing mycelium-soybean straw composite materials (MSCM), which would greatly reduce energy consumption for sterilization and lower production cost of Mushroom Materials. And no antibacterial/bacteriostatic agents were added in the non-sterilized substrates. The effect of the particle sizes of soybean straw on preparing MSCM was evaluated. In addition, compression properties, thermal conductivity and sound absorption properties of MSCM were tested.