# Chemically and Microbiologically Synthesized Poly-γ-Glutamic Acid Derivatives and Their Applications


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**ABSTRACT**

poly-γ-glutamic acid (PGA) is a naturally occurring bio-material produced by microbial fermentation. It is water soluble, biodegradable, edible and nontoxic toward humans and the environment. PGA has potential applications in the field of food, cosmetics, medicine and environmental. Development of this material is both environmentally and economically valuable. In this study, we investigated the effects of pH, aeration and agitation on γ-polyglutamic acid (γ-PGA) production of Bacillus subtilis C1 in a 10-L fermenter. When the bacteria were cultivated in medium T1 composed of Glycerin (17 %), Citric acid (2.2%), NH4Cl (0.7 %), K2HPO4 (0.05 %), MgSO4・7H2O (0.05 %), CaCl2・2H2O (0.015%), FeCl3・6H2O (0.004 %), MnSO4・4~6H2O (0.0104 %), the optical PGA production was pH6.00, aeration rate 5L/min, agitation speed 150rpm, temperature 37℃；the highest yield was 8.25g/L after 84 hr cultivation. The yield increased 89%from 4.36g/L in shake flask culture to 8.25g/L in a 10-L fermemter. The chemical shifts in ppm, 1.8-2.1(m, β,2H), 2.3-2.4(b, γ,2H)and 4.1-4.2(b, α,1H), correspond to the peak positions of the authentic γ-PGA previously synthesized ；in addition, the chemical shifts in ppm, 3.50-3.54(dd,2H), 3.60-3.62(dd,2H), 3.72-3.77(m,1H) corresponds to the peak positions of glycerol. The number-average molecular weight (Mw) determined by gel permeation chromatography was 2,929,844. This product is a γ-PGA-glycerol conjugate. We also investigated the water-absorption properties of γ-PGA derivatives. A crosslinked product produced by coupling of 2.5 wt % γ-PGA of Bacillus licheniformis CCRC 12826 and 150 μl Diglycidyl ether of bisphenol A (DGEBA) at pH5.33, for 4 days, displayed strong water-absorption activity；the specific water content (wt of water / wt of polymer) was approximately 50-60. It was also found that the specific water content (wt of water / wt of polymer) was approximately 26 in 30min water-absorption period for the γ-PGA-glycerol conjugate produced by Bacillus subtilis C1；however, this material totally dissolved after 30min in water.



Keywords : poly-γ-glutamic acid、crosslinking、hydrogel


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