Applied Mechanics and Materials Vols. 44-47 (2011) pp 605-609 *Online: 2010-12-06*

doi:10.4028/www.scientific.net/AMM.44-47.605

Production of bacterial cellulose by Gluconacetobacter xylinus using Taguchi methods

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Keywords: orthogonal arrays. initial pH, glucose concentration, modified YPD medium

Abstract. The production of bacterial cellulose (BC) from *Gluconacetobacter xylinus* could be improved by the Taguchi method. Both the initial pH and glucose concentration are the important factors to affect the production of the BC. The optimum combination of these factors and levels is the *G. xylinus* ATCC 23768, YPD as the basic growth medium, initial pH=4.5, glucose concentration = 5% (w/v), acetic acid concentration= 1.5% (v/v) and liquid height=7.2 cm. After the modified of factors and the levels, the maximum BC concentration and wet film thickness could be increased 37.5% to 0.557 g-dry cellulose/L and 39.0% to 3.92 mm, respectively.

Introduction

The bacterial cellulose (BC) is a kind of biopolymer produced by the bacteria such as the genera of *Acetobacter*, *Agrobacterium*, *Gluconacetobacter*, *Pseudomonas*, *Rhizobium* and *Sarcina*. In these genera, the application of the BC composed from *Gluconacetobacter xylinus*, also known *Acetobacter xylium*, have been discussed but the inoculated environments are different between strains [1]. From the *G. xylinus*, the BC is composed by pure polysaccharide which containing no lignin and hemicellulose than planting cellulose [2]. The characteristics of BC are high cellulose purity, great mechanical strength, high water keeping property and consisted of nano structure [3]. For example, the nata de coco is a food product produced from the fermentation of coconut milk by *G. xylinus*. The applications of this biomaterial are popularly, such as food industry, papermaking, filtrated membrane, organic electroluminescence display, artificial blood vessels and cosmetic industry [4-6]. However, the production of the BC has been affected by several factors. In this study, the design of experiments will be used to discuss the major influential factors in the production of the BC pellicle.

Materials and Methods

Bacterial strains. Three different *G. xylinus* strains (ATCC 23769, 11142 and 23768) were obtained from the Bioresource Collection and Research Center, Taiwan. The *G. xylinus* cultures were reserved on YPM agar (5 g/L yeast extract, 3 g/L peptone, 25 g/L mannitol and 15 g/L agar) slant at 4°C and resuscitated in YPM broth at 30°C for 2 days.

Factors, levels and the orthogonal array. In this study, six major factors were considered for get the maximum production rate including *G. xylinus* strains, basic medium type, initial pH, glucose concentration, acetic acid concentration and liquid height which. Each factor had three levels which are listed in Table 1. With the Taguchi methods, the L_{18} orthogonal array was been adopted and duplicate of L_{18} were proceeded. The parameter design of the L_{18} (3^6) orthogonal arrays for the