CHAPTER 1

INTRODUCTION

Dyes are used in large quantities in many industries including textile, leather, cosmetics, paper, printing, plastic, pharmaceuticals, food, etc to color their products (Garg *et al*., 2004). In 2004, textile and clothing industries covered 6.5 % of total exports with the value of 254,705 million Baht (3,922,411 million Baht). The numbers of textile industries in Thailand were 4,480 factories of textile excluding several unregistered small textile factories distribute in all part of Thailand (Textile Industry division, 2005). Textile industries consume substantial volumes of dyes, chemicals and water for wet processing. Those are used for desizing, scouring, bleaching, dyeing, printing and finishing (Banat *et al*., 1996). Recently, more than 9,000 dyes are incorporated in color index belonging to various chemical application classes. Colored wastewater is a consequence of batch processed both in the dye manufacturing industries and in the dye-consuming industries. Two percent of dyes that are produced and discharged directly in aqueous effluent, and 10% are subsequently lost during the textile coloration process (Pearce *et al*., 2003).

Color is the first contaminant to be recognized in wastewater and has to be removed before discharging into water resource or on land. The presence of very small amounts of dyes in water (less than 1 ppm for some dyes) is highly visible and affects the aesthetic merit, water transparency and gas solubility in lakes, rivers and other water resource (Banat *et al*., 1996). Currently, the major methods of textile wastewater treatment involve physical and chemical processed. Such methods are often costly and, although the dyes are removed, accumulation of concentrated sludge created a disposal problem. There is also the possibility that a secondary pollution problem will arise because of excessive chemical use. Other emerging techniques,

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such as ozonation, treatment using Fenton's reagent, electrochemical destruction and photocatalysis may have potential for decolorization. However, such technologies usually involve complicated procedures or are economically unfeasible. The biological treatment systems that can effectively remove dyes from large volumes of wastewater at a low cost are considered to offer a preferable alternative (Pearce *et al*., 2003). In biological treatment or technical operations, immobilized microbial cell systems could also provide additional advantages over freely suspended cells. These include ease of generation and reuse of the biomass, easier solid-liquid separation and minimal clogging in continuous-flow system (Arica *et al*., 2001). White-rot fungi are the most intensively studied as dye-decolorization microorganisms. They were used for the decolorization of distinct synthetic (textile) dyes and synthetic effluents, i.e. dye mixtures (Wesenberg *et al*., 2003). The major mechanism is biodegradation because they can produce the lignin modifying enzymes including laccase, manganese peroxidase (MnP) and lignin peroxidase (LiP) to mineralize synthetic lignin or dyes (Fu and Viraraghavan, 2001). However, the relative contribution of LiP, MnP and laccase to the decolorization of dyes may be different for each fungus.

In northern Thailand, The problems rising from industrial wastewater are increasing including Lamphun, The center of industries in the north (http://www.reo10.in.th/frame%20detail_tread_pollution.html). Furthermore, one of famous souvenirs of this province is Batik and the dye-contaminated wastewater from these factories is causing the environment problems.

As *Coriolus versicolor* RC3 is thermotolerant white-rot fungus exhibited the capability in strongly degrading of various dyes. An immobilized cell of this strain also demonstrated the potential to degrade Orange II dye continuously in packed bed bioreactor system (Kitwechkun, 2004). The decolorization of textile dyes by immobilized *C. versicolor* RC3 may be used to solve the problems of effluents from the textile industries in our country especially in northern of Thailand as Lamphun, the well-know Batik production area.

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Objectives of this study

1. To find out the suitable support for immobilized *C. versicolor* RC3
2. To investigate the efficiency of *C. versicolor* RC3 in degrading of synthetic textile dye and textile dyes wastewater from batik dyeing process
3. To determine optimal conditions in lab scale decolorization
4. To up-scale from lab scale to pilot scale decolorization
5. To monitor toxic by-product from decolorization effluent

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