CHAPTER 5

Conclusion and Suggestions

5.1 Conclusion

Rice residue from food waste collected from the canteen of the Faculty of Agro-Industry, Chiang Mai University, composed of moisture content (7.18±0.34%), crude fat (0.75±0.01%), ash content (0.38±0.03%), crude protein (1.29±0.03%) and carbohydrate content (90.00±0.01%). The screening of oleaginous red yeast which could directly use rice residue or hydrolysate of rice residue as a carbon source for biomass, lipids and carotenoids productions from flowers and leaves samples collected from Doi Inthanon National park, Chiang Mai, Thailand, and the culture collection of Thailand Institute of Scientific and Technological Research (TISTR) and Division of Biotechnology, Faculty of Agro-Industry, Chiang Mai University, Thailand were investigated.

Sixty-seven of red yeast isolates were obtained and four isolates were identified as oleaginous red yeast namely *Rhodotorula glutinis* KM281508, *Rhodosporidium* sp. KX281510, *Sporidiobolus pararoseus* KX709872 and *Diozegia* sp. TISTR5792. These strains produced the maximal lipids and carotenoids when cultivated in the basal medium supplemented with enzymatic-rice residue hydrolysate from food waste. The maximum lipids were 1.61±0.09, 1.70±0.09, 1.04±0.09 and 0.98±0.04 g/L, with the lipids content of 24.26±0.56, 23.69±0.91, 23.07±0.80 and 22.43±1.09% (w/w), respectively. Moreover, strain KM281508, KX281510, KX709872 and TISTR5792 also produced total carotenoids of 0.82±0.05, 1.57±0.05, 2.68±0.09 and 1.64±0.35 mg/L, with the total carotenoids yield of 150±0.10, 280±0.22, 595±0.90 and 400±0.13 μg/g, respectively. Only two strains of *Sporidiobolus pararoseus* KX709872 and *Diozegia* sp. TISTR5792 were classified as amylolytic oleaginous red yeast based on its ability to directly use rice residue from food waste as a carbon source for their growth, lipids and

carotenoids productions. The strain KX709872 produced the maximum α-amylase activity and AMG activity of 540±0.09 and 23±0.00 mU/mL, respectively.

The Plackett-Burman statistical design was applied for screening the effect of medium composition on seven responses of biomass, lipids, lipids content, total carotenoids, total carotenoids yield, β-carotene and β-carotene yield by strain KX709872. Only one factor of C:N ratio was significant and influenced on all responses at confidence level above 90%. The optimal conditions for the maximum biomass, lipids and carotenoids productions were further investigated using a response surface methodology (RSM) via a central composite design (CCD). At the C:N ratio of 25:1, pH of 5.44, temperature of 25.34°C and agitation rate of 192.73 rpm, the volumetric production of biomass and lipids and lipids content of strain KX709872 were 17.96±0.07 g/L, 8.99±0.33 g/L and 49.22±0.12% (w/w), respectively. Moreover, the volumetric production of total carotenoids and β-carotene, total carotenoids yield and β-carotene yield were 6.81±0.06 mg/L, 2.71±0.08 mg/L, 387±14.11 μg/g and 154±8.53 μg/g, respectively.

The up-scale production of biomass, lipids and carotenoids productions by strain KX709872 under the optimal medium and cultivation conditions was investigated in 5.0−L stirred tank bioreactor with 2.5−L optimized medium (agitation rate, 300 rpm; aeration rate, 3.0 vvm for 7 days). The volumetric production of biomass and lipids, lipids content and lipids productivity reached 16.33 g/L, 8.75 g/L and 56.61% (w/w) and 2.188 g/L/d, respectively at days−4 of cultivation period. While, the maximum of total carotenoids, β-carotene, total carotenoids yield and β-carotene yield were 7.10±0.09 mg/L, 2.99±0.06 mg/L, 600±0.06 μg/g and 252±0.01 μg/g, respectively at days−6 of cultivation period. Moreover, the lipids produced from *Sporidiobolus pararoseus* KX709872 were rich in oleic acid (62.13±0.04%), indicating to be a high potential feedstock for third-generation of biodiesel.

5.2 Suggestions

These suggestions have been made based on the overall results from this study which would be useful and improve the understanding for the future study.

5.2.1 Type and concentration of various contaminants found in rice residue from food waste (e.g. NaCl, herbs and spices, fats and oils) are varied and might influenced on cell growth, lipids and carotenoids productions of *Sporidiobolus pararoseus* KX709872. Hence, the effect of type and concentration of those contaminants should be further investigated.

5.2.2 According to the ability of directly use starchy material as a carbon source for lipids and carotenoids productions of *Sporidiobolus pararoseus* KX709872, the effect of others starchy wastes (noodle waste, cassava starch processing wastes and rice processing waste) on lipids and carotenoids productions by strain KX709872 should be further investigated.