

CHAPTER 5

CONCLUSION

An aromatic plant pressed peels of lime namely Namhom (*Citrus aurantifolia* Swingle), the various ten-ton wastes from lime drinking industry in Chiang Mai, were fermented with Bio-fermented products in ratio 1:1 in the absent air and hydrodistilled in clevenger type apparatus at 100°C for an hour to obtain the colorless distilled lime oil for evaluation of physicochemical properties and major changed chemical components analysing by TLC, GC and GC/MS comparing with the essential oils from unfermented peels. TLC analysis used toluene: ethyl acetate (96: 4, v/v) as developing solvent and vanillin–sulphuric acid spraying reagent as developing agent.; by GC with DB-1 and GC/MS with Alltech 15897 AT-1MS were used temperature of capillary column at the same conditions. The column was held isothermally for 10 min at 70°C and then program up to 80°C at 2°C /min and to 220°C at 7°C /min and finally held 220°C for 5 min. Sample concentration was 1 % (v/v) in methanol. Volume of sample was 1µL. It was present that after fermentation distilled lime oil had new aroma odor and increased in amount. Before fermentation distilled lime oil was colorless, fresh citrus, sweet and yields 0.15 % v/w. All distilled lime oils were colorless, fresh citrus and yields up to 0.21% v/w after 90 day fermentation. The physicochemical properties of distilled lime oil showed the specific gravity from 0.837 to 0.849 (25°C) and refractive index from 1.470 to 1.471 (25°C) that were nearly values. But optical rotation (25°C) of 10 % distilled lime oil in 95% ethanol was decreased from +6.63° to +6.05° after fermentation. The major components identified were (+)-limonene, β-myrcene, (1S)-(-)-α-pinene and α-terpineol from TLC and GC analysis. By GC/MS analysis there were 27 chemical components that could observe clearly in unfermented pressed peel of lime oil and 16

chemical components in 45 day fermented pressed peel of lime oil. After fermentation the kind of observed chemical components was less than before fermentation and two new chemical components, isocineole and fenchol, were observed. While the major components of distilled lime oil before fermentation identified were limonene (68.78%), *p*-cymene (8.51%), γ -terpinene (7.82%) and α -terpineol (3.44%). It contained limonene (74.17%), *p*-cymene (3.77%), γ -terpinene (11.65%) and α -terpineol (2.68%) as the major components of distilled lime oil after fermentation. In addition the relative amounts of the major components of distilled lime oil after fermentation that increased were limonene and γ -terpinene and the decreased were *p*-cymene, terpinen-4-ol, β -bisabolene and α -terpineol. Besides α -terpineol contents was decreased from 28.57 ± 0.12 to 24.03 ± 0.06 mg/g. The property of distilled lime oils after fermentation was different from the essential oils before fermentation. These may due to actions of microorganisms, fermentation under acidic solution of bio-fermented products and distillation process. The major components were still maintained in various amounts, these lead to occur new aroma odor.

However, this process is not via high heat and chemical synthetic or extraction, easy to do by one, cheap cost and helps economics in community for good environment and quality of life. These results are useful for the new rout production of essential oils that improve the odor of bio-fermented products by using biotechnology. Besides the research information is benefit for community related to scientific data and it may be one of the results for further study investigation of quality improvement of essential oils from other interested plants.