

Thesis Title	Investigation of Conditions for Assam Green Tea Extraction and Separation	
Author	Miss Renita Wati	
Degree	Master of Science (Food Technology)	
Supervisory Committee	Dr. Sailom Sampanvejsobha	Supervisor
	Dr. Niramol Punbusayakul	Co-Supervisor

ABSTRACT

Green tea is becoming an attractive material for research due to increased human preference and health concerns. Many efforts have been made to find an effective way to produce green tea extracts with high contents of catechins (main active ingredient in tea). Therefore, this study investigates the optimum conditions for assam green tea extraction, the kinetics of its compounds during extraction (both in laboratory and pilot plant scale) and also the fractionation of green tea extract compounds. With varying tea-water ratio (1:5, 1:10, 1:20 and 1:30) and pH (4, 5, 6 and 7), extraction in tea-water ratio 1:20 at pH 5 was found to be the optimum condition by providing the maximum amount of total polyphenols. In order to increase the extraction efficiency, a two step extraction procedure was necessary to be conducted.

Extractions for the kinetics study in the laboratory scale were performed (using the optimum condition from the previous study) at five different temperatures (50⁰C, 60⁰C, 70⁰C, 80⁰C and 90⁰C) for 1, 3, 5, 10, 20, 40 and 80 minutes. The content of total polyphenols, tannin, total amino acids, caffeine and individual catechins were increased rapidly in 10 minute intervals, and then approached the equilibrium value. The relationships between those concentrations and times were found to fit the first order kinetic equations. Extraction at 90⁰C was found to be the

optimum condition to obtain green tea extract with the highest equilibrium value for the extraction of total polyphenols, caffeine, individual catechins and total catechins. The maximum rate constant for extraction of total polyphenols, total amino acids, EGCG and ECG were all reached at 90⁰C. Moreover, the optimum rate constant for tannin extraction was reached at a temperature of 50⁰C, while for extraction of caffeine, EGC, EC, GC, C, G and total catechins were reached at a temperature of 70⁰C.

Scaling up the kinetic study to pilot plant scale is important to set up an efficient process for green tea extraction at an industrial scale. The extractor model unit designed by Wongsuwan (2008) was used in this experiment. Extractions were performed with tea water ratio 1:28, pH 5 at a flow rate of 1 kg/s. Similar to the kinetic study in the laboratory scale, the content of total polyphenols, tannin, theanine, caffeine, individual catechins and total catechins were increased very fast in the first 10 minutes. The relationships between those concentrations and times were found to fit the first order of kinetic equations. By providing the maximum of equilibrium value, the optimum temperature for extraction of all the analyzed parameters was 90⁰C. Furthermore, the highest rate constant for extraction of total polyphenols, tannin, caffeine, EGCG, EC, GCG and total catechins were reached in extraction at 90⁰C, while for extraction of the remaining compounds were achieved at 70⁰C.

In fractionation of green tea extract, various resins, including polyamide 6, amberlite XAD7HP, poly (dimmer acid-co-alkyl polyamine) and nylon 6 were used as a stationary phase. It was found that polyamide 6 exhibited the better ability to separate caffeine from polyphenols compounds when water, 50% of ethanol and 75% of ethanol were used as eluting agents. By using the regeneration treatment, polyamide 6 still has ability for caffeine separation after four uses. However it was observed that this ability was decreasing.

Keywords : Assam green tea / Green tea extraction / Kinetic of green tea compounds during extraction / Fractionation of green tea extract