CHAPTER 1 INTRODUCTION

1.1 Background and research importance

Green tea is oneof the most popular beverages in theworldbecause of its stimulating effects and help to reduce heart disease and dental cavities. Green tea is made with the leaves of Camellia sinensis that have undergone minimal oxidation because they are not fermented during processing. Because of this, green tea provides the most antioxidants and therefore health benefits, compared with oolong tea and black tea.

Green tea containcatechins and caffeine. The main catechin compounds found in green tea are epigallocatechingallate (EGCG), epigallocatechin (EGC), epicatechin (EC) and epicatechingallate (ECG). Catechins are the dominant phenolic compounds. Phenolic compounds are effective anti-oxidants and free radical-scavenging activity. Green tea contains three to four percent by weight of caffeine. However, there were reports concerning the harmful side effects from drinking green tea, i.e. anxiety,headaches, irritability and insomnia due to caffeine. Caffeine can also increase heart rate and blood pressure. Many consumers demand decaffeinated teas.

Current methods of green tea decaffeination are extraction by, for example, ethyl acetate, methylene chloride, supercritical carbon dioxide, or hot water. However, organic solvents extraction is not widely accepted by consumers due to its chemical residues, which pose a serious health risk. The main drawback to the extraction by supercritical carbon dioxide is its high cost. The use of hot water for extraction is solely applicable for fresh tea leaf. Health benefits associated with anti-oxidants in green tea are also lost. [1]

Adsorption by biomass-derived adsorbent leaves no residual chemicals in green tea and potentially is a cost-effective method. There were reports about interactions between caffeine and lignocellulose prepared from wood [2, 3]. Caffeine adsorption by rice husk-based adsorbents suggested that NaOH treated rice husk was able to partially remove caffeine from green tea [4]. The modified rice husk was incorporated with various ions such as Na^{+} and Ca^{2+} but exhibited relatively the same removal percentage.

As the contents of cellulose and hemicellulose in corn cob are very high (38.4 % wt. cellulose and 40.7 % wt. hemicellulose) [5], it is used in this work. When treated with NaOH, some hydroxyl groups in corn cob are converted to oxy groups, increasing the hydrophilicity of the corn cob. This work presents experimental study on the adsorption of caffeine in green tea by adsorbents prepared from corn cob, which is a natural by-product. Adsorptions of polyphenols and tannin were also investigated.

The NaOH treated corn cob in this work was ion-exchanged into Na^{+} and Ca^{2+}-forms because both ions were consumable. Ability of the unmodified and chemically modified corn cobs to adsorb caffeine, polyphenols, and tannin was investigated. The adsorption by packing the adsorbents in tea bag was also studied.

1.2 Objective

To evaluate the potential of corn cob and NaOH-treated corn cob as caffeine adsorbents for green tea

1.3 Scopes

1. Corn used in this study was sweet corn or Zea mays saccharata. The adsorbent was made from corn cob, which was composed of chaff (or beeswing), woody ring, and pitch. After grinding, particles ranged from 16-18 mesh (1.0-1.4 mm) were used.
2. Corn cob was treated with 0.1 M NaOH to obtain modified corn cob containing oxy groups and used as Na^{+}-form modified corn cob. The chemically modified corn cob was also ion-exchanged into Ca^{+}-form.
3. Green tea wascamellia sinensisthai tea.
4. The adsorptions were carried out using two methods. The first one was brewing by putting tea leaves and adsorbents in 110 ml 80 $^{\circ}C$ water. Another method was to brew tea leaves and adsorbents packed in a 5×8 cm^2 tea bag in 80 $^{\circ}C$ water.
5. The concentrations of caffeine, polyphenols, and tannin were analyzed by a UV-Vis spectrophotometer.

1.4 Expected benefits

Adsorption of caffeine in green tea by natural and modified corn cob provides an alternative method for reducing the health hazard compound and leaving no harmful chemical residues in the green tea. This method also has a good potential to be commercialized because of its simplicity.