



Characterization and Quantification of Polyphenolic Compounds in Refused Tea

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by

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Abstract

Polyphenols are the main bioactive molecules in tea. Polyphenols are a group of chemical substances found in plants, characterized by the presence of more than one phenol unit. Research indicates that polyphenols show antioxidant characteristics with potential health benefits. Oxidation reactions in human tissues can produce free radicals, which start chain reactions that damage the cells. Free radicals are known to contribute to numerous disorders in humans including cancer, heart diseases, arthritis, gastritis, dementia, renal disorders etc. Antioxidants act as 'free radical scavengers', hence prevent and repair the damage done by the free radicals. Antioxidants are widely used as pharmaceuticals, food preservatives, food supplements etc. Currently available synthetic antioxidants have been suspected to cause or prompt negative health effects, hence natural antioxidants are acquiring a huge demand in the present.

Main objective of this study was the 'Characterization and quantification of polyphenolic compounds in refused tea', for it to be used as a source of natural antioxidants. In addition we intended to determine the content of caffeine in refused tea, which is one of the major components of black tea; mainly for the comparison of the amounts of polyphenols with the amount of caffeine in refused tea. We have selected a sample of refused tea (manufacturing waste of black tea) from a tea factory at Thalawakele, Sri Lanka. The extraction of polyphenolic compounds and caffeine was done by two different methods (method 1 and 2), in order to select the best method which extracts maximum polyphenol content. Both methods employed liquid extraction, using 70% methanol (v/v) as the solvent, but rest of the conditions provided were vastly different between the two methods.

High Performance Liquid Chromatography (HPLC) was used to analyse and quantify the extracted polyphenolic compounds and caffeine. Standard preparation, sample preparation, and chromatographic analysis were carried out according to the methods described in ISO14502-2:2005(E). Identification of individual polyphenols was done by comparing the retention times of samples and standards, and quantification was done by the external standardization method.

In our study we have determined the presence and the quantity of some selected polyphenols; such as gallic acid, catechins (namely; (+)-catechin hydrate, (-)-epicatechin, (-)-epigallocatechin gallate and (-)-gallocatechin gallate) and caffeine in refused tea. The quantities of polyphenols and caffeine in (mg/g) that were extracted from refused tea sample are as follows. From method - 1; gallic acid (2.40), (+)-catechin hydrate (0.0334), (-)-epicatechin (0.232), (-)-epigallocatechin gallate (0.0806) and (-)-gallocatechin gallate (0.407). From method-2; gallic acid (2.45), (+)-catechin hydrate(0.157), (-)-epicatechin(0.254), (-)-epigallocatechin gallate (0.0710) and (-)-gallocatechin gallate (0.0953) and caffeine (14.7). Further we found that the refused tea sample contains the above polyphenols as well as caffeine in a lower quantity than the Sri Lankan black tea, which is quite acceptable.

Hence it is evident that the refused tea could be used as a source of natural antioxidants, for the preparation of pharmaceuticals, food supplements, food preservatives, animal food etc. Further it could be suggested that refused tea could be used to make tea tablets, which is somewhat similar to instant tea. This effort could increase the economical value of refused tea which is otherwise discarded most of the time. When it comes to the optimization of the extraction protocol, according to the results obtained it was not possible to identify the best method of extraction for refused tea, out of the two selected methods. Because some of the catechins showed a higher extraction in method-1, some catechins in method-2. As a further step of this research it can be suggested, to vary the extraction conditions such as extraction temperature, extraction solvent, duration of extraction etc., one at a time within a selected method to optimize the extraction protocol of refused tea. Selection of a method should depend on the intended use of polyphenols.