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Research Article

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Chemoprofiling and determination of caffeine content on Arabica Coffee (*Coffea arabica* L.)

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ABSTRACT

This research aimed to find the chemical profile and compared the caffeine content of Arabica coffee (Coffea arabica L.) and coffe in the market. To obtained the chemical profile and the determination of the extract caffeine content of Arabica coffee bean (Coffea arabica L.) by HPTLC method. The results showed that etanol extract of Arabica coffee (Coffea arabica L.) contain caffeine with total content of 120.12 µg/ml and the samples of coffee in the market, namely Coffee A 137.95 µg/ml; Coffee B 262.74 µg/ml; Coffee C 304.65 µg/ml; Coffee D 202,53 µg/ml and Coffee E 24.08 µg/ml. Then the highest total caffeine content was obtained in coffee C as much as 304.65 µg/ml.

Keywords: *Coffea arabica* L., Caffeine, *Chemoprofiling*, HPTLC, Etanol Extract

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INTRODUCTION

Coffee is among the most widespread and healthiest beverages in the world. It is known to be a highly rich source of biologically active natural metabolites which possess therapeutic effects (i.e. caffeine) and functional properties (i.e. chlorogenic acids). Therefore, coffee can be considered a drink which has different positive effects on human health such as cardioprotective, neuroprotective, hepatoprotective, nephroprotective, etc. However, heavy coffee consumption may be related to some unpleasant symptoms, mainly anxiety, headache, increased blood pressure, nausea, and restlessness. During the past two decades, several studies have indicated that there is a close correlation between consumption of coffee and incidence of depression. In addition, phytochemical studies showed that caffeine is the main responsible constituent for antidepressant effects of coffee through multiple molecular mechanisms [1].

Chemoprofiling of herbal drugs represent a comprehensive qualitative approach for the purpose of species authentification, evaluation of quality and ensuring the consistency and stability of drugs and their related products. TLC were performed for preliminary identification of constituent in solvent system [2]. Currently HPTLC is often used as an alternative to HPLC for the quantification of plant products because of its simplicity, accuracy, cost-effectiveness and rapidity[3]. HPTLC fingerprint has better resolution and estimation of active constituents is done with reasonable accuracy in a shorter time[4].

EXPERIMENTAL SECTION

Research conducted at the Laboratory of Phytochemistry-Pharmacognosy, Faculty of Pharmacy, Universitas Muslim of Indonesia and Center of Biopharmaca Research Hasanuddin University, Makassar-Indonesia March-July 2015.

Plant Material

Samples Arabica coffee beans (*Coffea arabica* L.) obtained from Bungin villages, districts Bungin, Enrekang district, South Sulawesi-Indonesia and coffee powder in the local market. Samples Arabica coffee beans (*Coffea arabica* L.) plucked from the tree, chosen seed has matured, then sample arabica coffee beans sorted and sorted dry wet. After the samples were dried then roasted and powdered.

Sample Extraction

Used 20 gram sample of coffee powder. Then extracted by Soxhletation using 500 mL ethanol 70%. Fluid filled in the flask, then powder simplicia Arabica coffee beans are loaded on a perforated tube of glass. The liquid is heated to boiling, so that the liquid vapor will rise up through the pipe side, then condensed back by turning cooler. Fluid down through the powder simplicia coffee beans while dissolving the active substance simplicia powder coffee beans. Because of the chiffon, then after the liquid reaches the surface chiffon, all liquids will be returned to the flask. This process lasts for 6 hours. Results from this soxhletasi form of liquid extract. Collected extract was concentrated by rotary evaporator to obtain a thick extract.

Chemoprofiling by HPTLC Scanning

HPTLC process base on Gunalan, G., *et al* [5] method with any modification; the extract resulting from both of samples were applied to a commercial 10 cm x 10 cm precoated HPTLC silica gel 60-plate (Merck) on various concentration of caffeine used as a standard. Fifteen milliliters of mobile phase consisting of n-hexane and methanol in the ratio of 3:7 v/v was added into a single-trough chamber, to saturate it for 15 min. The plate in the chamber was developed upward over a path of upper mark. The fluorescent image was examined under UV 254 nm by using a UV viewer cabinet (CAMAG). They were captured with a Win CATS Planar Chromatography Manager documentation system (CAMAG) [6].

Determination of Caffein by HPTLC

Extract each sample, then in the identification of the content of caffeine qualitatively using TLC. Extract the sample and comparative standard caffeine each spotted on TLC plates and Rf values obtained. Results Rf values obtained for caffeine standart on various concentration 20, 40, 60, 80 and 100 ppm. Determination of caffeine able to use the tool HPTLC based on Area Under Curves (AUC) of each concebtrartion using linear equation [7].

RESULT AND DISCUSSION

Results and determination caffeine content on samples as shonw on table 1.

Table 1 Determination Results of caffeine on Arabica coffee (*Coffea arabica* L.) and market coffee

Sample	Area	Caffeine Content(µg/ml)
Arabica Coffee	4312,15	120,12
Coffee A	5070,78	137,95
Coffee B	10380,07	262,74
CoffeeC	12163,44	304,65
CoffeeD	7818,28	202,53
CoffeeE	226,02	24,08

Caffeine concentration value of a sample obtained from the calculation using the linear equation of the standard curve of pure caffeine, to substitute the value of the sample area into the formula of linear equations. Of the value area of 4312.15; 5070.78; 10380.07; 12163.44; 7818.28 and 226.02; the obtained value of the caffeine content of coffee samples was 120.12; 137.95; 262.74; 304.65; 202.53 and 24.08 ug / ml.

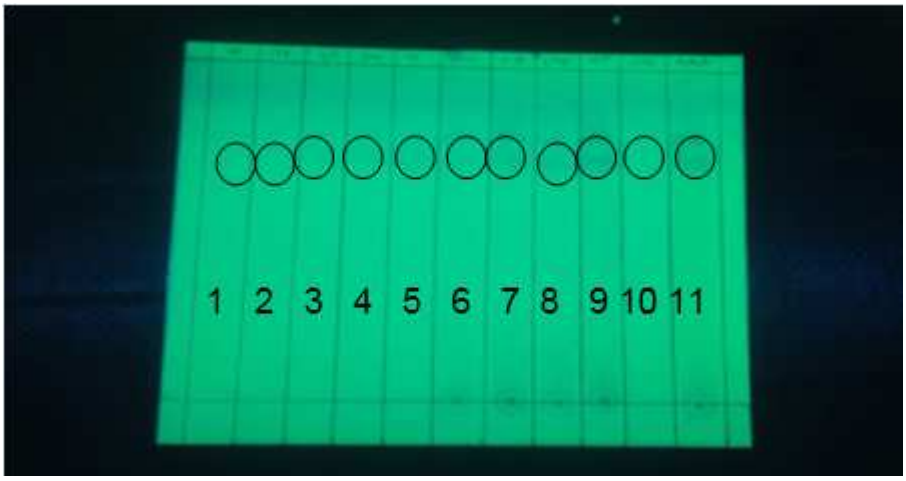

Figure 1. **TLC profile at 254 nm UV light. 1-5 Caffeine standard, 6 Arabica Coffee, 7-11 Market Coffee**

In Figure 1 shows caffeine was used as the standard. The concentration of caffeine taken in a graduated concentration 20, 40, 60, 80 and 100 ppm with Area Under Curves (AUC) respectively are 406.87; 818.90; 1279.44; 2388.93 and 3876.59. While the Rf value from the analysis of pure caffeine is 0.70; 0.71; 0.72. The Rf values which indicate the results of the qualitative analysis of pure caffeine. This means, the caffeine contained in coffee beans arabica absolutely pure caffeine.

Chemprofiling measurement results on HPTLC found on track 11 coffee samples that often appear in all tracks that have the same Rf value is 0.70 - 0.72 with a wavelength range is 250-300 nm. This compound has a value area on tracks 1-11 are respectively 406.9; 818.9; 1279.4; 2388.9; 3876.6; 4312.2; 5070.8; 7818.3; 12163.4; 226.0 and 10380.1 compound qualified as chemprofiling compound for each location are penotolan, where one of the conditions on Standardization is the repetitiveness of a compound chemprofiling as swon on figure 2 below:

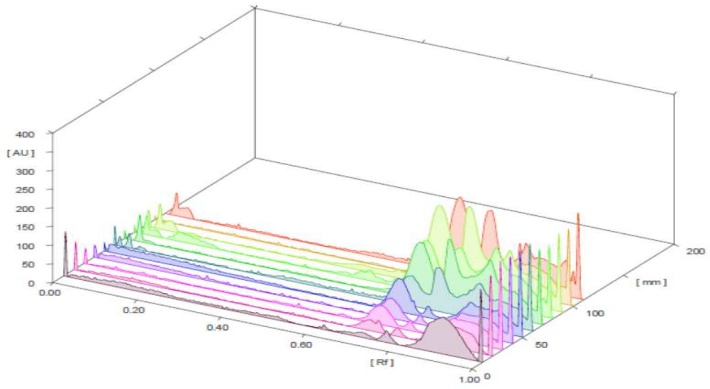

Figure 2. **Chemoprofiling Compound**, **5 Tract in front Caffeine standard, T r a c t 6th Arabica Coffee, Tract 7-11 Market Coffee**

This research was conducted by High Performance Thin-Layer Chromatography (HPTLC) for analyzing the caffeine content of Arabica coffee (*Coffea arabica* L.) and coffee in the market. These results indicate that the compound caffeine in Arabica coffee (*Coffea arabica* L) origin Enrekang district, South Sulawesi values obtained caffeine levels 120.12 ug / ml and coffee A, B, C, D and E is 137.95; 262.74; 304.65; 202.53; and 24.08 ug / ml.

The content of the highest levels of caffeine contained in the caffeine content of coffee C with 304.65 ug /ml and content of the lowest levels of caffeine found in coffee E with levels of caffeine 24.08 ug / ml. This is because coffee E is coffee Arabica that have undergone a process of decaffeination or reduced levels of caffeine.

The particle size distribution of ground coffee samples was examined as a function of grinding time, in order to determine the extent to which particle size can be controlled and whether there is a threshold grinding time beyond which further grinding makes little difference. For each grinding time the content of extractable compounds (that are present in caffeinated beans but absent in decaffeinated ones) in the resulting brewed coffee was determined [8].

CONCLUSION

Based on the test results of this study showed the determination of the caffeine content of 70% ethanol extract of Arabica coffee beans (*Coffea arabica* L.) contain high levels of caffeine 120.12 ug / ml and the samples of coffee in the market, namely coffee A 137.95 ug / ml, coffee B 262.74 pg / ml, coffee C 304.65 ug / ml, coffee D 202.53 ug / ml and coffee E 24.08 ug / ml. So we can conclude the highest levels of caffeine found in coffee C as much as 304.65 ug / ml and the content of the lowest levels of caffeine found in coffee E with levels of caffeine 24.08 ug / ml.

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