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ORIGINAL ARTICLES

Study Of Various Solvents For Caffeine Determination Using Uv Spectrophotometeric

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ABSTRACT

Caffeine acts as a stimulant drug. In humans, caffeine acts as a central nervous system stimulant, temporarily warding off drowsiness and restoring alertness. It is the world's most widely consumed psychoactive drug, but, unlike many other psychoactive substances, it is both legal and unregulated in nearly all parts of the world. Because of the wide spread consumption of caffeine, it is important to collect precise information of their content in types of drinks. Most research activities have been focused on chromatographic such as HPLC methods; however, spectra-photometric determination is preferred because of its rapidity, high accuracy, simplicity and reproducibility. Advantages of UV Specto photometric is cheap and it is found in many laboratories. But caffeine content in tea leaves cannot be determined directly using UV visible spectrometer, due to the matrix effect of UV absorbing substances. Simple and accurate method for the determination of Caffeine content in tea leaves directly using UV-visible spectrometer was developed. Standard linear calibration curve with accepted correlation value was obtained.

Key words:

Introduction:

Caffeine is a white crystalline xanthine alkaloid that acts as a stimulant drug. Caffeine is found in varying quantities in the seeds, leaves, and fruit of some plants, In humans, caffeine acts as a central nervous system stimulant, temporarily warding off drowsiness and restoring alertness. It is the world's most widely consumed psychoactive drug, but, unlike many other psychoactive substances, it is both legal and unregulated in nearly all parts of the world.

Beverages containing caffeine, such as coffee, tea, soft drinks, and energy drinks, enjoy great popularity; in North America, 90% of adults consume caffeine daily.(Amra. P., Mojca. S).

Many consumers prefer to avoid caffeine partially or altogether, due to its stimulant effects and others, still on health concern. This makes decaffeination of tea an important industrial process. In addition, caffeine has a slightly bitter flavor. As a result, decaffeinating coffee beans and tea leaves will leave the flavor slightly changed, even if no other components are lost. It should be noted that, decaffeinated coffee and tea are not caffeine free. Guzin. A. (2002),

Tea is a beverage in the world's second most widely consumed after mineral water. Tea is also very popular as a drink (beverage), in addition to coffee and chocolate, which has had along history and used in almost160countries around the world as a beverage each day. The popularity of tea as a beverage because it is believed to drink tea can improve the health of humans. This is because the tea contains many poly phenols compounds, which known to have high anti oxidant activitybeside caffein (Tuminah S. 2004, Deddy M,2008).
Caffeine is a type of alkaloid that naturally present in coffee beans, tea leaves, cashew leaves, cola nuts, cocoa beans, and some beverages (example: energy drink). Caffeine has a molecular weight of194.19withthe chemical formula$C_8H_{10}N_4O_2$andpH6.9 (1% solution of caffeine in water). Scientifically, the direct effect of caffeine on health did not exist, but that there are indirect effects such as stimulating the respiratory and heart, and give effect be sides sense of anxiety(neuroses), can not sleep(insomnia), and irregular earth beat(tachycardia) (Anonim,2003).In general, caffeine has been used extensively in the field of food and pharmaceutical in dustier, as in the manufacture of can of soft drink beverages, as well as drugs for the treatment repairer stimulant and diuretic. Caffeine is included in the Purina alkaloid called the bromine if it is inchocolate and thiamin if it is in the tea.Low doses of caffeine, 15-60 mg/serve (about as much as in a single cup of instant tea (teabag) or green teaor brewed tea) improved long-term memory. Low to medium doses (about two cup's worth) improved attention, memory and coordination.But of the many benefits of tea, there are bad effect soft one of which is caffeine are dangerous when consumption is too excessive (more than 300 mg/day) (www.kalbe.co.id,2011).So that the necessary monitoring of caffeine levels in tea leaves on the market.

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Evidence of a risk to pregnancy is equivocal, but some authorities have concluded that prudent advice is for pregnant women to limit consumption to the equivalent of two cups of coffee per day or less. Caffeine has diuretic properties when administered to people, who are not used to it, but regular users develop a tolerance to this effect, and studies have generally failed to support the common notion that ordinary consumption contributes significantly to dehydration. With heavy use, strong tolerance develops rapidly and caffeine can produce clinically significant physical and mental dependence (Bolton and null, 1981).

Objectives:

Study of various solvents for caffeine determination using UV Spectrophotometry.

Scope of Work:

1. To validate UV-Visible spectrometer method for the determination of caffeine in several solvent include: wavelengh maximum, sensitivity, range of concentration measurement,limit of detection.
2. Find a suitable solvent used for dissolving the leaves of tea.
3. Find a suitable solvent used for extraction the caffeine from the leaves of tea.
4. Validation of UV spectrophotometric method for determining caffein in tea leaf using several solvent and their result compare each other to obtain the best solvent, extraction of caffein from tea leaf sample , determination caffein in tea leaf sample using UV spectrophotometric with the best solvent to determine the accuracy and precission of the method.

Hypothesis and problem:

Caffeine content in tea leaves cannot be determined directly using UV-visible spectrometer, due to the matrix effect of UV absorbing substances. This effect can be observed in the spectral bands of tea leaves in water that is caffeine spectra interface with other compounds in tea leaves. Therefore, it is necessary to develop a method to overcome this difficulty.

Methods and Material

UV-visible spectrometer UV wavelength range from (180-400) nm (Shimadzu model 1650, Tokyo, Japan) was used, all the glassware were soaked overnight with chromic acid solution and washed thoroughly with water and detergent, then rinsed with distilled water before use. UV-1601-UV-Visble spectrophotometric. Volumetric flask (10mL-100mL) glass bottle, pipette(10mL-100mL), Beaker, water bath, Magnetic stirrer, Filter paper, Test tube, Funnel, Standard flask (10mL-100mL), small Spoon, thermometer, reparatory funnel. UV- visble spectra-photometer. The solvents use in this study including (Methanol, Chloroform, water and Ethyl Acetate) with were of high quality at least analytical grade. Coffee and tea samples were obtained from markets The coffee and tea samples were kept at room temperature.

Sample preparation procedur:

Immerse (10 mg) of pure caffeine into (50 ml) of different solvents and stirred by magnetic stirrer for 30 min. The absorbance versus wavelength of the solution was measured using spectrophotometricaly at the max. Tea sample preparation, Distilled water for dissolving three types of tea bags was at 40°C, Three types of tea bags.:

1. Heat (50 ml) of distilled water to (40°C).
2. Add (100 mg) of tea bags to the hot water and stirred for (30 min) with a magnetic stirrer.
3. Filter through a glass filter and cool to room temperature
4. Proud (50 ml) of selected solvent into the tea infusion and stirrer for (10 min) with a magnetic stirrer.
5. Separate the water phase from the organic phase with a reparatory funnel.
6. Proud the solution into (1 cm) quartz UV cell and place into the sample holder of the spectrometer and measure the sample.
7. The sample is measured by precision and Accuracy .

Results and Discussion

Many solvents were studied to find the best one for dissolving leaves of tea, water, ethyl acetate, chloroform and methanol were studied. Standard calibration curve were obtained for each solvent as shown in previous figures, It is clear from figures that chloroform is the best solvent because of its calibration curve has

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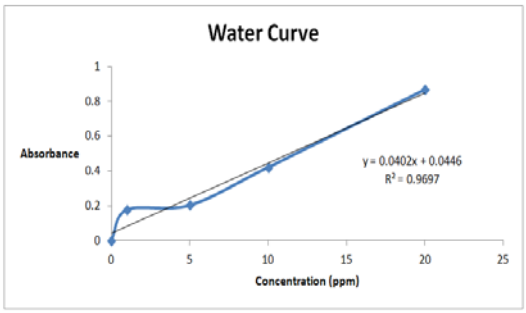
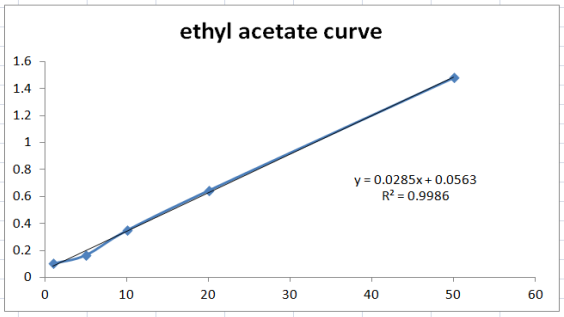
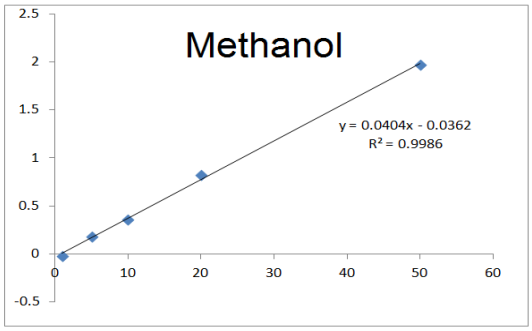
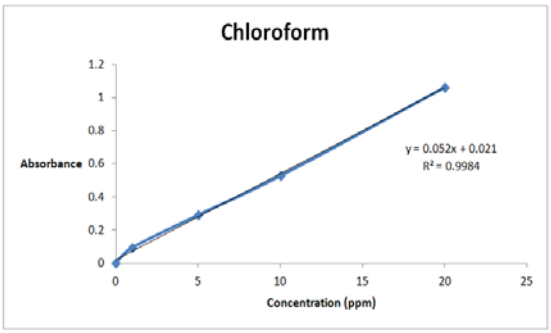
the highest value of the slope in addition to good solubility of tea eaves in it so we considered chloroform the best one.

Linearity: The calibration graph was generated Six different concentrations of caffeine from 10 ppm to 100 ppm were analyzed according to experimental conditions. Then the calibration curve was established according to the obtained response (peak area) and the concentrations of caffeine in standard solutions. The results show a good linear relationship.









Conclusion:

Simple and accurate method for the determination of Caffeine content in tea leaves directly using UV-visible spectrometer was developed, the best solvent was chloroform. Standard linear calibration curve was run to obtain the linear range of sample analysis, correlation factor was with accepted value = (0.9984) and the standard calibration curve was linear over the range (0-20) ppm caffeine with equation (y=0.052X + 0.021).

Chloroform was the best selective solvent between the four solvents due to it polarity properties and good ability to dissolve leaves of tea.

References

Amra, P., S. Mojca, K. Zeljko, W. Bernd, O. Frank, G. Sabine, 2006. Extraction of active ingredients from green tea (camellia sinensis): Extraction efficiency of major catechins and caffeine, Food Chem., 96: 597-605.

Bolton, S., G. Null, 1981. Caffeine ,psychological effects, use and. Abuse, *Orthomol Psychiatr*., 10(3): 202-211.

Guzin, A., 2002. Derivative spectrophotometer determination of caffeine in some Beverages. Turk. J. Chem., 26: 295-302.

http://www.kalbe.co.id/files/144_16AntikoksidanTea.pdf/144_16AntioksidanTea.htmL. (diaksestanggal 28 April 2011)

Tuminah, S., 2004. Teh (CameliaSinesis O.K. VarAssamica (Mast)