# SPECTROPHOTOMETRIC DETERMINATION OF PHENOL IN FRUITS AND BEVERAGES

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## ABSTRACT

*This study aims to determine the concentration of phenol in different types of apples (green, yellow and red), tea and coffee. Samples were taken from different sources and were determined by spectrophotometric method. One sample of each type of apple (green, red, yellow) coffee and tea were considered. The results show high concentration of phenol in all samples of apples, coffee and tea compared with normal value in human body. This increasing of concentration may lead to many harmful effect to human health.*

**Keyword:** *Phenol , NPBHA, Spectrophotometric.*

## 1. INTRODUCTION

Phenols are highly toxic and extensively used in various industries. These are readily absorbed by ingestion, inhalation and through intact skin [1]. The main sources of phenolic compounds in the diet are fruits and vegetables, including apples and processed apple products [2],[3]. Dietary intake of phenolics is estimated to be about one gram per day. This is significantly higher than that of all other dietary antioxidants, including vitamin C, vitamin E and carotenoids [4]. Phenolic compounds widely distributed in plants, attract significant scientific interest due to their bio-functional health-promoting properties [5]-[8]. Fruits are potential sources of natural phenolic antioxidants used as food additives for the prevention of lipid oxidation and thus prolongation of food self-life [9]-[12]. It is not known if phenol causes cancer in humans but cancer developed when phenol was applied to the skin several times per week for the lifetime [13]. Apart from being a suspected carcinogen, phenol and some of its derivatives can also be toxic or lethal to aquatic life. When phenol enters the environment it has a half-life in soil between 1 and 10 days, it has a half-life in water between 10 and 30 days, larger or repeated releases of phenol can remain in the air, water and soil for much longer periods[14,15].

## 2. EXPERIMENTAL

### 2.1 Instruments

"SYSTRONICS SPECTROPHOTOMTER 1700" model was used for electronic spectral measurements with 10 mm matched quartz cells. A Hanna 8521 model pH meter was used for pH measurements.

### 2.2 Preparation of Samples

Samples were taken from different sources.10g of apple (one sample of each type green, red, yellow), 2g of coffee and tea were considered. Samples were cut to small species and digested with (1:3) perchloric acid to nitric acid mixture [16] and heated by using water bath for 30 min. at a temperature of 50-80 Cº. Samples were filtered and measured.

### 2.3 Reagents

All the chemicals used were of AR grade. Double distilled water was used throughout the experiments.

## 3. MATERIAL AND METHOD

### 3.1 Stock phenol solution

1 mg mL $^{-1}$ stock solution of phenol was prepared in distilled water. Working standared were prepared by the appropriate dilution of stock.

### 3.2 N – Phenyl benzo hydroxamic acid

N-PBHA was prepared according to the method given by Priyadarshini and Tandon [17] and solution was prepared in chloroform.

### 3.3 Ammonium meta vanadate solution

Saturated solution was prepared by dissolving in distilled water. Hydrochloric acid solution – 4M HCl solution was used to provide acidic medium.

## 4. PROCEDURE

To aliquates of working standards containing 1µg of phenol, 1ml of N-PBHA solution in chloroform was added. This was followed by addition of 1 ml V(V) solution and 1 ml 4M HCl solution . The purple colour appeared in chloroform layer which was separated and diluted to 25ml. This coloured dye has maximum absorbance at 522 nm.

## 5. RESULT AND DISCUSSION

Beer's law was obeyed in the range of 0.006 to 0.03 µg ml$^{-1}$. The absorption spectra of the coloured product formed in proposed method show maximum absorbance at 522 nm. The calibration curve is shown in fig. 1. Buffer (Ammonium chloride ammonium hydroxide) was used to maintain pH at 10.

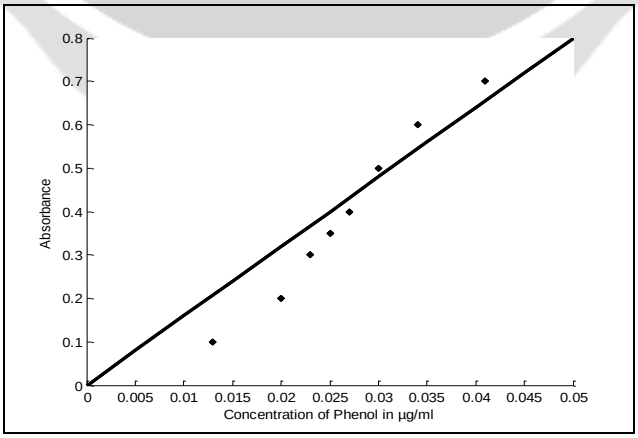


**Chart -1**: Calibration curve for the determination of phenol

**Table -1:** The average concentration of the phenol (µg/ml) in different samples of apples, coffee and tea.

| **Samples** | **Concentration (µg/ml)** |
|---|---|
| Red Apple | 4.642 |
| Green Apple | 4.589 |
| Yellow Apple | 4.124 |
| Coffee | 2.863 |
| Tea | 1.644 |

From table – 1, it is clear that the concentration of phenol in apple, coffee and tea is very high as compared to the acceptable value in human body ≈ 0.28ppm [18].

## 6. CONCLUSIONS

Apple, tea and coffee are plants which need many complementary factors to grow up and give a good product. These factors are soil, water, air, ground water and fertilizer. These factors may be contaminated by phenolic compounds from different sources like factories, industries pesticides, dust,bad time storage due to accumulation of contamination on the products. In industry, phenols are important chemicals for the manufacture of products such as dyes, insecticides, disinfectants, wood preservatives. On the other hand it is used as chemical product in building, agriculture and hospital.

Fertilizer contained chemical components contained many phenolic compounds. These compounds can contaminate the product by phenol. Moreover the occurrence of phenols in the environment stems from the production and use of numerous pesticides, in particular phenoxyherbicides like 2.4 dichlorophenoxyacetic acid or 4-chloro-2-methylphenoxyacetic acid (MC PA) and also phenolic biocides like pentachlorophenol (PCP), dinoseb or diarylether. The presence of phenols in the ecosystem is also related with production and degradation of numerous pesticides and the generation of industrial and municipal sewages. Some phenols are also formed during natural processes.

High value of phenol in apples, tea and coffee lead to many hazard to human body because phenol is well absorbed from the gastrointestinal tract and through the skin of both animals and humans. It is metabolized principlly by conjugation (by sulfation and glucuronidation) with a minor oxidation pathway leading to quinone-related reactive intermediates which bind covalently to protein and are detoxified by conjugation with glutathione. Most of the absorbed phenol and its metabolites are excreted in the urine, with trace amount excreted in expired air and the feces.

In addition, very small amount of phenol is produced endogenously as a breakdown product of protein metabolism by the action of bacteria on normal constituents of the diet in the gut and excreted independent of external exposure to the compound. Some of this internally-produced phenol may be eliminated in the feces and some may pass to the blood. Phenol and their derivatives commonly exist in the environment. Phenol irritates skin and causes necrosis. It damages kidneys, liver, muscle and eyes. Damage to skin is caused by its coagulation related to reaction of phenol with amino acids contained in keratin of epidermis and collagen in inner skin.

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