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Determination of Phenolic Compounds in Vegetables by Spectrophotometric Method

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ABSTRACT

Determine the concentration of 1-naphthol and 2-naphthol in green vegetables (Spinach, Cabbage and mustard greens). Collection of samples from agricultural land which is effected by industrial pollution and were determined by spectrophotometric method. One sample of each type of Spinach, Cabbage and mustard greens were considered. The results show high concentration of 1-naphthol and 2-naphthol in all samples of Spinach, Cabbage and mustard greens compared with normal value in human body. This increasing of concentration may lead to much harmful effect to human health.

Keywords: Phenolic, Spectrophotometric, N-phenyl

I. INTRODUCTION

Phenols and their derivatives are released into the environment through municipal/industrial sewage, and landfill leachate [1]. The presence of phenolic compounds have been documented in different mediums such as sewage sludge, influent and effluent of wastewater, river water and soil [2-4]. The other results indicated concentration of phenol over 40mg/l in river water, which was receiver of wastewater from petrol industry [5]. Phenols are also included in The List of Priority Pollutants by the US Environmental Protection Agency (EPA) [6]. They are also highly toxic which is very important due to ecological aspects [7]. Chronic toxicity of phenols in humans results in: headache, vomiting, difficulty in swallowing, liver injury, fainting and etc. [8]. Therefore, due to the environmental and ecological safety it is advisable to clean municipal and industrial wastewater of toxic organic micro pollutants, to the level excluding their negative impact on the natural environment and surroundings. Among the methods used to phenols removal, adsorption is one of the simplest and widely applied method. Examination of wastewater treatment containing phenolic compounds, have shown that adsorption on activated carbon is considered as a most potential treatment technique [9].
The toxicity of 1-naphthol and 2-naphthol to the aquatic organisms does not seem to have been adequately tested and in the few studies on the toxicity to aquatic organisms of 1-naphthol or 2-naphthol and its degradation product the latter has been reported to be more toxic [10,11]. Earlier, we reported that 1-naphthol or 2-naphthol was more toxic than the parent compound to two size groups of the carp. Labeo rohita (Ham.) [12]

Due to its toxicity to marine life [13] and human beings [14], industrial wastewater containing 1-naphthol must be treated before it is discharged into or reused in the environment [15]. Fungi play an important role in the metabolism of many chemicals, including aromatic hydrocarbons, in both aquatic and terrestrial environments [16, 17].

II. EXPERIMENTAL

Instruments: Systronics Spectrophotometric 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.

Preparation of Samples: Samples were taken from different types of vegetables.10g mixture of green vegetables. Samples were cut to small species and digested with (1:3) per chloric acid to nitric acid mixture [18] and heated by using water bath for 20 min. at a temperature of 60-90ºC. Samples were filtered and measured.

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

III. METHODS AND MATERIAL

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

N – Phenyl benzo hydroxamic acid: N-PBHA was prepared according to the method given by Priyadarshini and Tandon [19] and solution was prepared in chloroform.

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.

Procedure: A simple, sensitive and rapid method is proposed for the determination of 1-naphthol and 2-naphthol in green vegetables (Spinach, Cabbage and mustard greens) sample by using N-PBHA as complexing agent. The calibration curve was obtained by following method – An aliquot containing 0.00010-0.00110 µg/ml of 1-naphthol and 0.000122-0.00122µg/ml of 2-naphthol was taken in 125ml separating funnel. This was followed by addition of 10ml of buffer solution, 1ml of N-PBHA acid in chloroform, 1 ml Vanadium(V) solution and 1 ml 4M HCl solution. The content were shaken violet to reddish violet colour was obtained. The organic layer was separated in 25ml calibration flask and the solution was made up to the mark and the colour was developed immediately. The absorbance was measured at 513nm for 1-naphthol and 510nm for 2-naphthol against reagent blank.

IV. RESULTS AND DISCUSSION

The optimum condition were established by alternating one variable at a time of 1-naphthol and 2-naphthol at absorption maxima which gave linear and reproducible graph in the concentration range of 0.00010-0.00110µg/ml and 0.000122-0.00122µg/ml respectively. The calibration curve is shown in Figure 1 and 2.

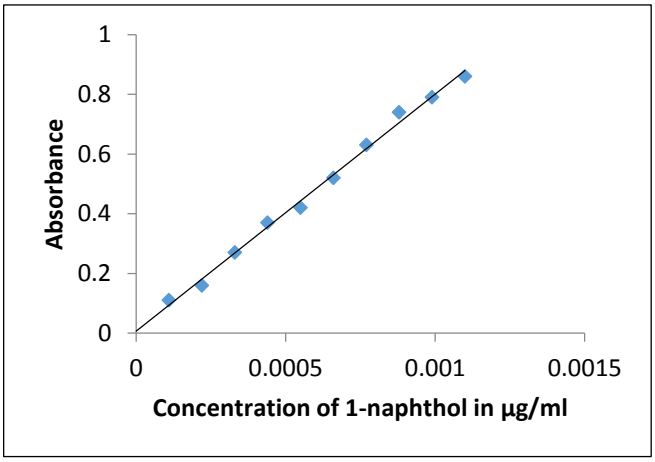

Figure 1: Calibration curve for 1-naphthol – NPBHA complex

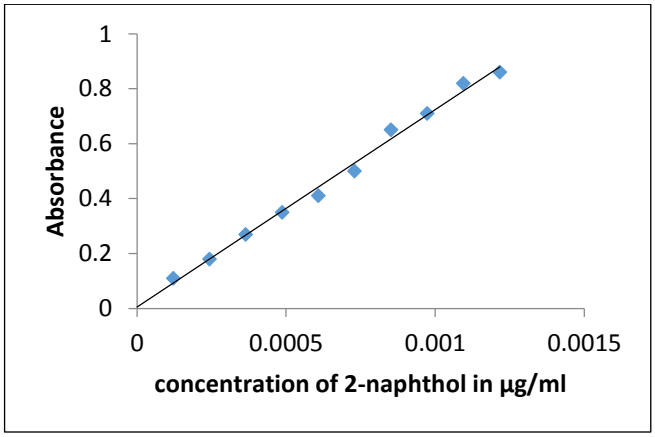

Figure 2: Calibration curve for 2-naphthol – NPBHA complex

Applications of Beer's law: Adherence to Beer's law by the coloured product was determined by measuring absorbance at appropriate wavelength for a set of solutions containing varying amount of analyte.

TABLE I

THE AVERAGE CONCENTRATION OF 1-NAPHTHOL AND 2-NAPHTHOL IN DIFFERENT SAMPLES OF VEGETABLES.

Samples	Concentration (µg/ml)	
	1-naphthol	2-naphthol
Spinach	3.864	3.021
Cabbage	2.469	2.135
Mustard greens	1.893	1.968

From Table – I, it is clear that the concentration of phenol in Spinach, Cabbage and mustard greens is very high as compared to the acceptable value in human body ≈ 0.28ppm [20].

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V. CONCLUSION

Spinach, Cabbage and mustard greens are plants which need water and other energy sources to growth. Some factors are air, water, soil, ground water and fertilizer. These factors may be effected by phenolic compounds from different sources like factories, industries pesticides and dust etc. 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 many phenolic compounds. High value of 1-naphthol and 2-naphthol in Spinach, Cabbage and mustard greens lead to many hazard to human body because 1-naphthol or 2-naphthol entered the internal body from the gastrointestinal tract. Small amount of phenols may be harmful for human health and animals also. Some of this internally-produced from food material like vegetables and enter to the blood. High concentration of phenol and their derivatives damages liver, kidneys, eyes and other internal organs.

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