

MODIFIED SPECTROPHOTOMETRIC PHENOL ESTIMATION

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ABSTRACT

A modified spectrophotometric method for estimation of phenol in aqueous media is described. It is based on complex formation viz., diazotized sulphanilic acid reacts with phenol to give yellow colored complex. Intensity of color produced is propotional to the amount of phenol present. The complexation reaction can be applied in the range 0.001 to 0.4 $\mu\text{g/ml}$ of phenol. This method is extremely time dependant, needs very careful handling and uniformity throughout the experiment.

INTRODUCTION

Phenol and its derivatives are found in effluents in a number of chemical process industries such as petroleum refinery, dyes, synthetic rubber, steel, plastic and air craft paint stripping (Mahesh et. al., 1998). Dihydroxy aromatic compounds viz., catechol, hydroquinone are widely used in manufacturing pharmaceutical products, insecticides, alizarin and as antioxidants for rubber (Borton and Pllis, 1979). Phenol and its substituted compounds impart typical odour and taste to water and are highly toxic to aquatic life and vegetation even at low concentration.

In general surface water contains a natural phenol and its derivatives, which lies in the range of few $\mu\text{g/l}$. these compounds can arise in the coarse of biological transformation (humification) of vegetable materials (foliage, algae) in the ground and in the water (Fresenius, 1987). Phenols are generally non biodegradable and can not be stabilized by common microbiological species, which are normally responsible for the stabilization of organic matter in municipal sewage (Desh Deepak et. al., 1988).

Some workers (Scott, 1963, Lata Cherian *et al.*, 1988, Raju *et al.*, 1988, Ramchandran, 1996, Andrade, 1997, Malik, *et al.*, 1997, Jamaluddin *et al.*, Fytianos, *et al.*, 1907) have already been developed the methods for the detection of different organic substances by spectrophotometric methods. Phenols and other phenolic compounds are first separated from waste water by distillation and can be detected by using 4-aminoantipyrine and also by p-nitroaniline (APHA, 1989). Also some workers (Heunecke, 1971, Shankaranarayana, *et al.*, 1978, Khanna *et al.*, 1977, Zogarski, *et al.*, 1977) have reported the removal of phenol from different media.

MATERIAL AND METHODS

Phenol estimation is important in water pollution because of objectionable taste from chlorinated phenols in chlorinated drinking water containing as little as 1 ppb. Aqueous phenol solutions of different concentrations (0.005 to 0.4 $\mu\text{g/ml}$) were prepared.

TABLE - 1
Estimation of phenol using p - nitroaniline and sulphanilic acid

Conc. of phenol (in ppm)	Absorbance	
	p-nitroaniline	sulphanilic acid
0.04	0.020	0.012
0.08	0.032	0.030
0.12	0.043	0.030
0.16	0.066	0.038
0.20	0.087	0.050
0.24	0.100	0.064
0.28	0.121	0.082
0.32	0.148	0.084

TABLE - 2
Comparison of phenol concentration by standard method and modified method

Standard method	Modified method
Conc. of phenol of $\mu\text{g/ml}$	Conc. of phenol of $\mu\text{g/ml}$
0.176	0.178
0.232	0.228
0.310	0.314

100 ml of known aqueous solution of phenol or an appropriate small volume which was then made up to 100 ml with distilled water was taken to which 1M sodium carbonate solution was added to bring the pH upto 11.5. if not, add small quantity of 30% sodium hydroxide. 0.216 gm of sulphanilic acid

was dissolved in small quantity of water, 39 ml of 0.2 N HCL added. Then diluted to 250 ml. To this solution small quantity of saturated NaNO_2 solution was added. 10 ml of diazotized sulphanilic acid observations were taken at 460 nm exactly after the twenty minutes of the time of incubation.

RESULTS AND DISCUSSION

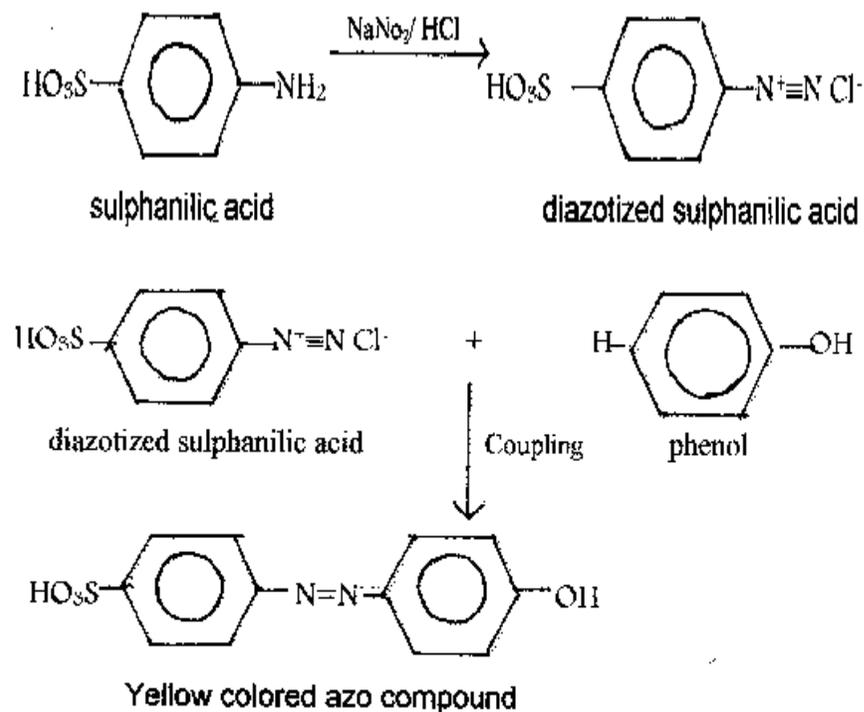
The results obtained during the course of present investigation are summarised in Table 1-2 describes the observations using standard method (water analysis, Fresenius, W. 1987) and modified method. The observations do not follow Beer-Lambert Law below 0.0001 and above 0.4 $\mu\text{g/ml}$ of phenol. Hence by this modified method, phenol can be detected in the same range only.

Few unknown aqueous solutions of phenols were prepared and the phenol content is checked by newly modified method as well as by standard method (P-nitroaniline method).

Detection of phenol is done by using diazotized sulphanilic acid. Hydrochloric acid and sodium nitrite reacts with sulphanilic acid to produce diazonium salt. Reaction is given below;

The alkaline phenol solution further coupled with above diazonium salt to produce yellow coloured azo compound.

The modified method is very sensitive for pH (alkaline 11.5) and time. Uniform handling is necessary throughout the experiment.



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