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A study and abatement of phenolic content in waterfrom various sampling points in the vicinity of River Patalganga

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ABSTRACT

Phenolic compounds find out their way in the water bodies as a result of industrial activities along with being synthesized by other natural commotions. The present investigation deals with the study of leaching effect of such phenolic compounds and its abatement by using a range of carbons acquired from nature and activated in the laboratory using $ZnCl_2$. All the water samples were analyzed for Phenolic content by the 4-Amino Antipyrine method and confirmed by the bromination method. The investigation revealed that the phenolic content in the samples varied from a minimum of 0.01 ppm to 79.65 ppm, which according to WHO was much higher than the permissible levels of 0.2 ppm for 2,4,6-trichlorophenols(2,4,6-TCP) and 0.04 ppm for 2,4-dichlorophenols (2,4-DCP). 2,4,6-TCP and 2,4-DCP being the two most probable phenolic compounds to occur in drinking water.The rise in the values of phenolic content in the samples of Sawla and Jatada were accredited to the leaching effect of the effluent from the agro and insecticide industry, sited in the proximity of these villages.Abatement of phenolic content was carried out by preparing carbons from *Mangifera indica*, *Saraca asoca*, *Psidium guajava* as well as commercial carbon, which were activated in the laboratory using $ZnCl_2$. Each of the natural carbon exhibiting a distinct capacity of lessening phenolic content.

1. Introduction

Phenolics are one of the major contaminants found in water bodies. Many researchers have confirmed the presence of phenolic compound in various forms. Gloria Castellano has listed 33 phenolic compounds in a periodic table (Castellano, 2012). Likewise, M. Letzia Davi has researched a number of chloro and nitro phenols in the EPA Federal Register by GC–MS technique in single ion monitoring. The chloro phenols are one of them having bad odour and taste they are formed as a result of chlorination of water containing some amount of phenols (Letizia Davi, 1999). This presence of phenols in surface water may be due to industrial discharge such as steel industries, agrochemical industries, dye industries and other industries which use phenols as intermediates it may also be due to the degradation of trees (Tuah and Bin, 2006). These phenols are prone to be toxic to human beings. GuangGuo has studied the surface water of Pearl River in south China which shows some chemicals like nonylphenol bisphenol-A and natural estrogen in the river water at certain concentrations can cause disruption to endocrine and can also affect hormonal control of aquatic organism (GuangGuo, 2009). Hence the WHO has taken in account, phenols to be noxious substances for human health, hence to keep a check WHO has declared some phenolic compounds with a Maximum Admissible Concentration (MAC) in drinking water of 0.200 ppm for 2,4,6-trichlorophenols, 9 μg/lfor pentachlorophenol (WHO, 2008). Subsequently, several methods have been developed and adopted for the removal of phenolics from water. The use of water Hyacinth by NASA for removal of phenolics from polluted water (Wolverton, 1975) or adsorption by activated carbon using Ozonization method for phenolic removal from olive oil mill effluent (Olivier, 2009) or reverse osmosis stripping–oxidation and distillation etc. are variedly used as per requirement. Each method comes out with its own drawbacks (Mahapatra, 2012).

The present investigation deals with study and removal of the of phenolic content from various sampling points in the vicinity of river Patalganga, as the river is surrounded by a dense industrial belt. This belt consists of a number of steel industries, agrochemical industries, dye industries etc. hence it was decided to study the water table of the villages in the surrounding.

Several methods related to removal of phenolic content by adsorption on activated carbons are available provided carbons are activate at temperatures is more than 750°–1000 °C. As the adsorption capacity of carbon is completely dependent on the porosity, pore volume and the surface area of the carbon temperature is one

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Fig. 1. Location of Agro and insecticide industry.

of the most important factors in activation process. Quality temperature increases the burn off level of carbon whereas increased burn off level leads to the deepening of the pores consequently increasing the activity of the carbon (Chang et al., 2000). Attaining such a high temperature is not workable in the laboratory and hence carbon used for the present investigation was activated in the laboratory using inexpensive chemical activation method.

Numerous researchers have worked on various activated carbons obtained from bagasse fly ash (Salkinaja Salonen et al., 1995), tobacco residue (Kilic et al., 2011). I Polaert et al. have treated aqueous phenols by two step adsorption – oxidation process (Polaert and Wilhelm, 2002). All the activated carbons used by these researchers were obtained from natural sources hence in the current study, carbons from *Mangifera indica*, *Saraca asoca*, *Psidium guajava* which were easily available in the area of investigation were selected. In addition commercial carbon which had lost its activity was also chosen.

2. Materials and methods

2.1. Location

The Rasayani area is located 18.893°N and 73.157°E. Patalganga (Bhagvati) is one of the three tributaries of the Ganges (Anon, 2017). There are four industrial belts surrounding the river Patalganga. These industrial belts contribute to the river pollution.

2.2. Location of sampling points

The first sampling point was of Mohopada village well water which lies near to the Patalganga industrial zone so as to study the impact of effluent discharged by industries in the zone. The second sampling point was from Rasayani industrial zone which was the combined effluent from the gutter near the agro and insecticide factory. Both of these factories were close to Sawala and Jatada villages. The third sampling point included the groundwater of Sawala village which was merely at a distance of 500 m from the agro industry. The fourth sampling point was of bore well from Jatada village which is located at a distance of 2 km from the agro and insecticide industries. The main aim for the selection of the third and fourth sampling point was to study the leaching effect, if any due to the combined effluent from both factories situated near the villages. Location of Sawala village and Jatada village are seen in Fig. 1. The fifth sampling point was chosen to confirm the potability of the Patalganga river water after it had been given treatment by Maharashtra industrial development corporation (MIDC). This sample was collected from Hindustan Organic Chemicals Ltd. (H.O.C.L) laboratory tap water. The sixth sampling point was selected to study the phenolic content of MIDC water after treating it by domestic water purifier. It was collected from H.O.C.L laboratory. The Fig. 2 displays the location of the Patalganga River and the complete study area under investigation.

2.3. Sampling

The sampling was done in clean PTFE bottles. Approx. 1 g of $FeSO_4$ was added to the samples immediately at the time of sampling for interference removal. Care was taken that the samples were collected before sunrise every day at a preset time. The sampling method suggested by Yolanda Madrid was strictly followed (Madrid and Zayas, 2007). The 4-Amino AntiPyrine method [4-AAP] of estimation was adopted for analysis of phenolic content as it is reproducible and reliable. It is the fastest, most precise and most accurate even in ppb range. The other methods like bromi-