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Impact of Air-Pollution on pH of soil of Saran, Bihar, India

Srivastava K.P.* and Singh Vikash Kumar
Ganga Singh College, Jai Prakash University, Chapra-841 301, Bihar, INDIA

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Abstract

The pH of the upper and lower layers of soil of selected places of Saran district of Bihar was determined to access the soil-pollution due to interaction of brick chimneys smoke with soil. It was observed that the soils located near the brick chimney plants are highly polluted.

Keywords: Air-pollution, soil-pollution, pH, smoke interaction, brick chimney plants.

Introduction

The earth is surrounded by the air constituting the environment up to about 1600 kilometers from its surface[1].The atmosphere is a reservoir of several elements essential to life and it serves many purposes and functions. It contains life saving gases like oxygen for human beings and animals, and carbon dioxide for plants to perform the process of photosynthesis. As per a rough estimate it has 5×10^{18} cubic meters of air and contains oxygen (21%), nitrogen (78%), carbon dioxide (0.3%), and hydrogen (0.7%) in a fixed proportion. However, anthropogenetic activities on the surface of the earth are causing an increase in the proportion of gases except O_2 in our atmosphere, thereby polluting the air which is so precious for life. There are many types of causative agents called pollutants creating air pollution. The pollutants exert different types of visible and invisible biological effects. Hence, it is necessary to have an equal understanding of both environment and organisms[2].

For our better living standards we need pure clean air, pure water, nutritious foods, clothes and space etc. which are the basic needs for life. But the quality of air and water is likely to deteriorate because of population explosion, rapid industrialization and urbanization.

Environmental pollution and human efforts for the betterment of living standards are the two sides of the same coin. In the wake of rapid industrialization, consequent urbanization and ever increasing population, the basic amenities of life, viz. air, water and land, are being populated continuously. Industrial complexes have become the focus of environmental pollution.

Air may be regarded as polluted when it is changed in its quality and composition as a result of human activities. The release of low amount of pollutants into the air does not lead to any serious effects because the atmosphere has a considerable absorptive capacity.

Various industrial installations such as asphalt plants, brick chimney plants, boiling and heating installations, cement manufacturing, fertilizer manufacturing, mineral acid manufacturing, paper and pulp manufacturing, thermal and nuclear power plants, sewage treatment plants, engineering workshops etc. form the stationary sources of the urban air pollution. The automobiles such as cars, scooters, motors, trucks and buses moving on the urban roads form the mobile sources of air pollution.

Saran district in North Bihar (INDIA) has various temporary as well as permanent brick chimney plants surrounding the district head quarter Chapra town. All the brick chimneys emit smoke rich in CO_2, SO_2 etc, which directly or indirectly interact with the constituents of the soil[3,4]. The interaction of the dusty smoke with soil might bring about changes in physical as well as chemical nature of top layer of soil supporting plants. In continuation of our research on air-pollution and its effect on quality of soil the present research article deals the effect of air pollution on soil pH[5-9] of Saran district of Bihar, INDIA.

Material and Methods

The soil samples were taken from different locations situated at different places from dense brick chimney plants. These brick chimney plants are sources of industrial pollution around Chapra town of North Bihar. The soil of various villages was also taken for studies of pollution effect. All these places, upper as well as lower layer (from depth of 15cm) of the soil were also taken.

The pH titration was performed at room temperature and 2N-HCl solution was used. 2N HCl acid was prepared from concentrated boiling 6N HCl by weight.

10 grams of the soil sample of different locations were taken, 100ml distilled water was added and kept for 24 hours after through shaking. Then it was decanted and made up to 250 ml solution using distilled water. 10 ml soil solution is taken in bottles and 2N HCl id added in order of increasing multiple. Then pH measurement was done. The data obtained were plotted on graph papers for analysis and interpretation (figure-1-3).

Results and Discussion

The titration curve of pH value with 2N HCl of the sample of upper soil layer solution of Mehiyan village near east of Chapra town has show sharpness from 2.4 to 0.8 ionization of 8ml solution (figure-1). On the other hand the lower layer soil solution has initial pH 1.4 which becomes 1 on addition of only 4 ml 2N HCl. Hence, the pollution of upper layer soil is higher than the lower layer soil (figure-2). The sudden drop of pH shows that more basic titrable groups are present in upper layer soil.

When comparative pH titration curve (figure-3) of upper and lower layers of soil of Vishnupura near south-east of Chapra town was plotted, we observed that pH value of upper and lower soil layers in the vicinity of chimney plants are parallel to each other. The drop in pH value was from 2.3 to 1.5 on addition of 8ml of 2N HCl. On the other hand upper and lower layer has starting pH of 1.8 come to 0.9 when the similar amount of 2N HCl was added. Thus the conclusion may be drawn that effluent gases are absorbed more when it comes in contact with soil at the nearest distance from the chimney plants. The gaseous air is less acidic in nature than the soil which is situated in Vishnupura near south-east of Chapra. The pH titration curve of upper and lower soil shows that it is not dropping suddenly but slowly. It shows that interaction of H^+ ion is not sufficient.

The pH value of samples of upper and lower layer soil solutions of Chanchawra and Bhainshmara villages near north of Chapra town with 2N HCl is plotted as shown in figures-1-3, the curve is running parallel to each other. This shows that the upper layer soil is not polluted so much because of the lesser number of chimney plants. When titration curves of pH value of sample of upper and lower layer soil solution of Bhainshmara village near Chapra town with 2N HCl is drawn, the drop in pH values of upper and lower layer soil is same which shows that the soil is not so much polluted.

Conclusion

The following conclusions may be drawn on the basis of observation with pH data of different places due to atmospheric pollution being caused by brick chimney plants near district towns of Saran division in north Bihar: i. The pollution of upper layer soil is higher than the lower layer of soil. The sudden drop in pH shows that more basic titrable groups are present. ii. When pH value of upper and lower layer of soil was taken, the difference in pH is about 0.1 which again goes upward on addition of more than 8 ml of 2N HCl. Thus, the titrable groups are not smoothly distributed between upper and lower layers of soil. iii. When comparative titration curve of upper and lower layer of soil was taken from the, Vishnupura and Chanchawra villages, the upper and lower layers are parallel to each-other. The drop in p^H value is from 2.3 to 1.5 on addition of 8 ml of 2N HCl. On the other hand, upper and lower layer has starting pH of 1.8 comes to 0.9 when the similar amount of 8ml 2N HCl is added.

Thus, it may be concluded that effluent gases are absorbed more when these come in the contact with the soil at the nearest distance from plants site. The gaseous air is less acidic in nature than the soil which is situated distant from the plants site.

Overall conclusions drawn on the basis of research work done are that maximum absorption of gases by the soil takes place surroundings the brick chimney plants unit. With the help of pH value it appears that the pollution of soil takes place gradually and not immediately.

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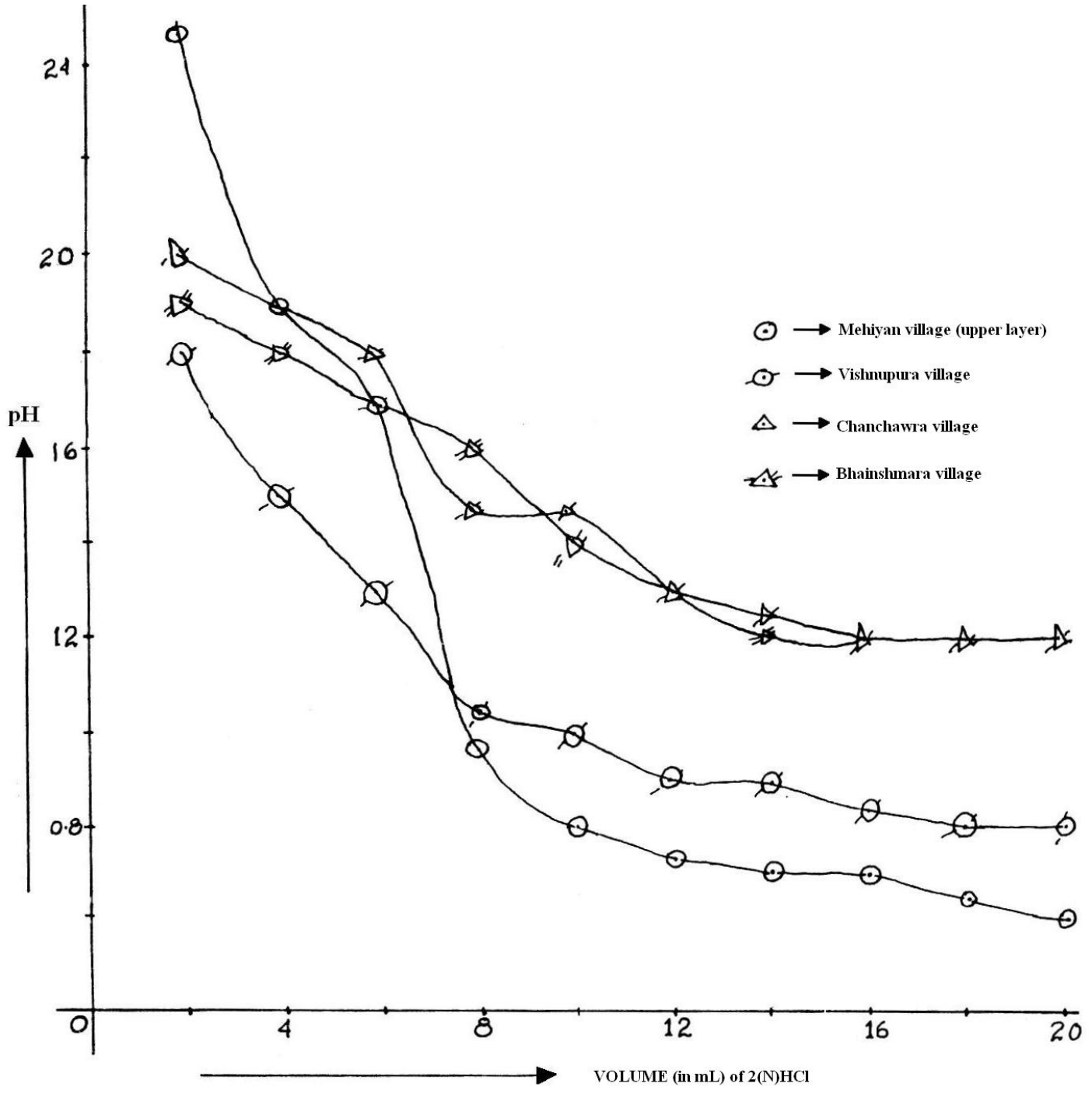

Figure – 1
Comparative Titration Curve of pH value against sample solution of upper layer solid solutions with 2(N) HCl

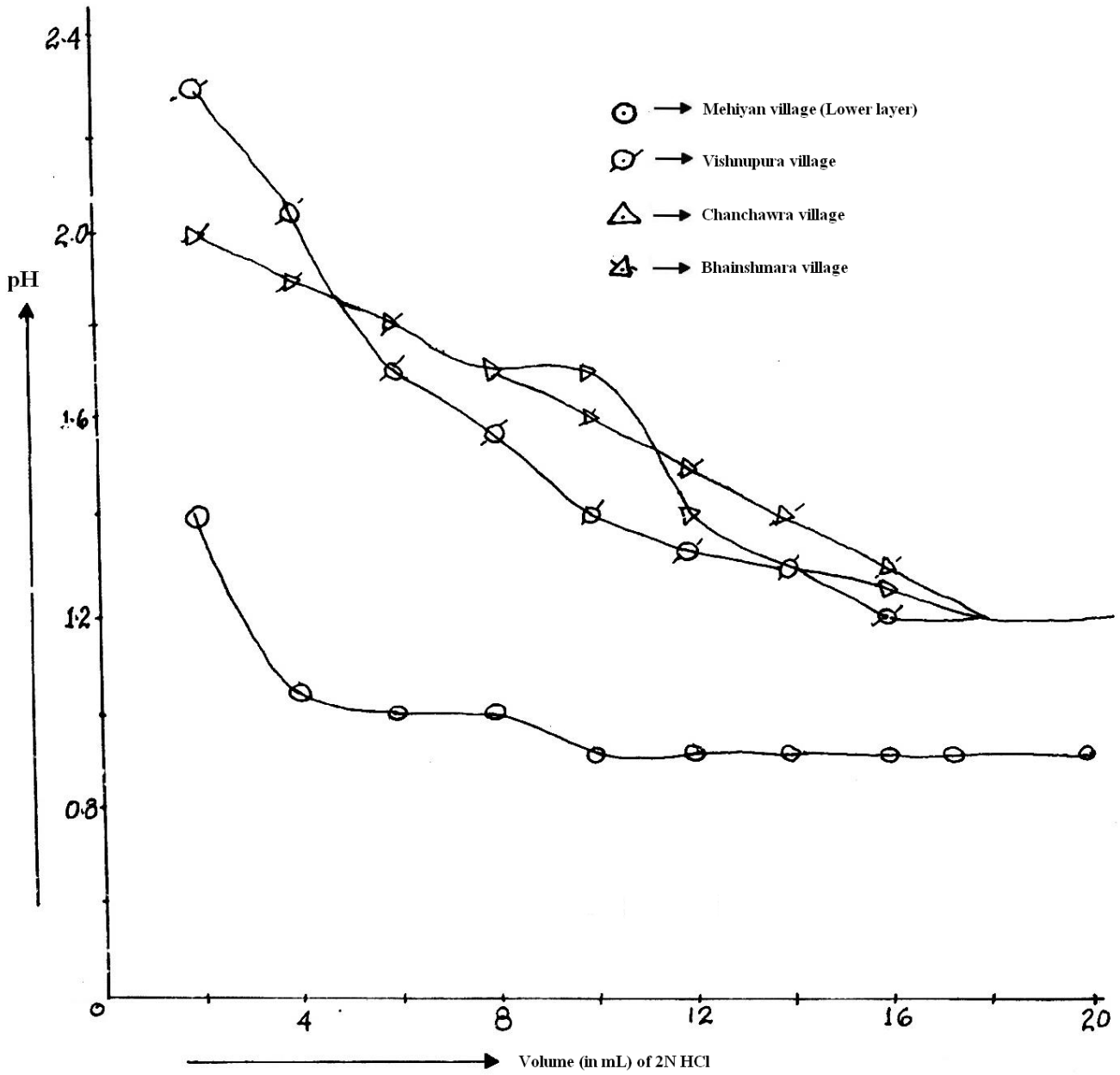

Figure – 2
Comparative Titration Curve of pH value against sample solution of lower layer solid solutions with 2(N) HCl

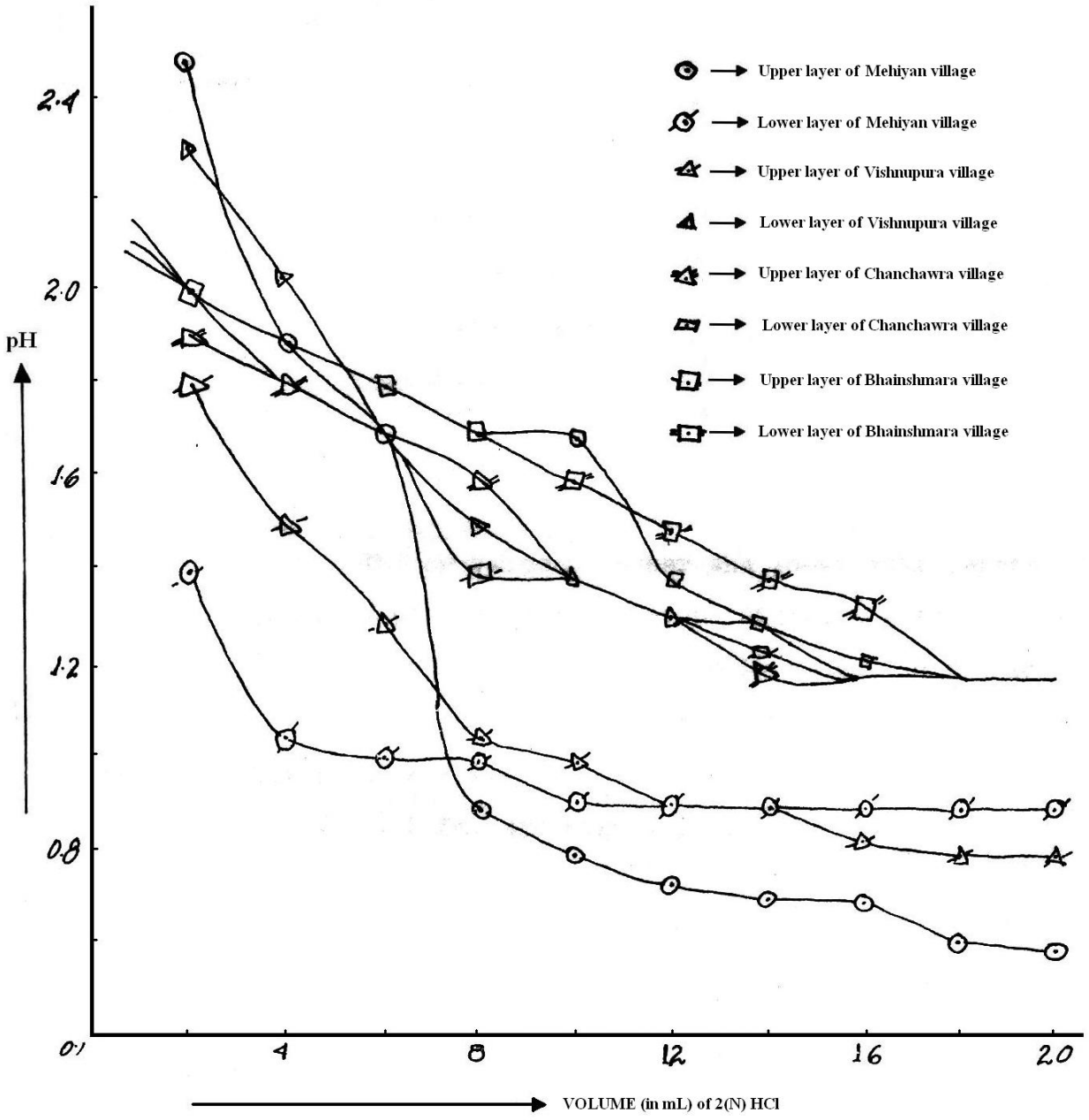

Figure – 3
Comparative Titration Curve of pH value against sample of upper and lower layer solid solutions with 2(N) HCl