Modeling of environmental impact assessment of Kolaghat thermal power plant area, West Bengal, using remote sensing and GIS techniques

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Abstract The Kolaghat Thermal Power Plant is a major Thermal Power Plant in West Bengal, India. It is located at Mecheda (approx.) and 55 km from Kolkata. It is situated on the right site of the Rup Narayan River bank which is under the district of Purba Medinipur, west Bengal. The Power Plant is operated by West Bengal Power Development Corporation. The Kolaghat Thermal Power Plant (KTPP) was established during India's sixth plan period (1980–1985). When the plant first become operational KTPP had only one 210 MW unit. The plant's first expansion. Took place in 1985 when an additional five 210 MW units were added in two stages. Currently the plant has a total of six units with a capacity of 1260 MW. The KTPP covers about 900 acres of land out of which 871.89 acres lie in the Panskura-II block and the rest in the Sahid Matangini block, Talmuk. Although the plant has a number of befits, the lack of treatment of the fly ash generated from this plant has been detrimental to the productivity and quality of crop of the surrounding area is also

responsible for some changes in land use pattern. Studies were made to assess the impact of a Thermal Power Plant located at Kolaghat on vegetation and soil in surrounding areas. Pollutant concentration in the area gradually decreases along a belt in the prevailing wind direction and a gradient of structure and functional change in plant and soil was observed. The evaluation of the maximum concentration of air pollutes such as SO₂, NO_x, and suspended particular matter is usually considered of primary important for environmental impact assessment. The effect of the power plant emission on water, soil, and eco-physiological characteristics such as pH, DO, water conductivity, organic matter concentration in soil; Leaf injury symptoms, number and distribution of plant species; chlorophyll content in leaves, percentage of photosynthesis activities leaf area; accumulation in algae etc. seemed to be a functional of the pollutant gradient existing in the area. There was a relationship between plant response and change in the chemical factor of water, soil and plants due to pollution of thermal power plant. This study indicates possible elimination some medicinal plant species, first the trees then the shrubs and lastly the herbs and grasses from the environs of thermal power plant. The increase in soil acidity in the area may cause cat ion-anion exchange imbalance and reduction microbe population to affect soil fertility.

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Introduction

Thermal power plant is most heat generated power conservation system. In the world first power generated system was established pearl street station in New York and

holbornviaduct power station in London, by James watt (1882). In the Power generated system reciprocating steam engines were used. It generated 6000 kW electricity by the use of 500 tons coal. India was first NTPC started power plant on 1975 at Shaktinagar in up; generated $2 \times 250 = 500$ mw electricity [Wikipedia a, [https://en.wikipedia.org/wiki/Thermal_power_station\(a\)](https://en.wikipedia.org/wiki/Thermal_power_station(a))].

Kolaghat Thermal Power plant is a major thermal power station in west Bengal. It is Located at approx. Mecheda 55 km from Kolkata, in Purba Medinipur district. The power plant is operated by west Bengal power Development Corporation limited (WBPDCL) is installed capacity 210 MW (Table 1). The power plant has six unit of each total capacity 1260 MW. This power projects are started during two stages, the period of 1984–1995. Due to the increase of population the demand of electricity has also increased. At the Kolaghat thermal power plant the power conserved capacity has increase year to year; it generate in the year of 1986 (240 MW) electricity and present time it produced 1260 MW electricity. Below the installed capacity of the plant (Wikipedia b, [https://en.wikipedia.org/wiki/Kolaghat_Thermal_Power_Station\(b\)](https://en.wikipedia.org/wiki/Kolaghat_Thermal_Power_Station(b))).

Due to the fly ash Environmental impact has been originated pollution in the KTPS. Which is the main problem of the coal based thermal power system; the coal which is used in KTPP is mostly in type of bituminous, of Gondwana age, (Table 2) it is a poor quality coal with high ash content (about 5–50 %) (Mondal and Sengupta 2005), and low calorific value, resulting in large volume of ash production per unit of energy generation. In Earlier studies

various researchers had worked on ash pond of KTPS and reported on Indian radio activity of fly ashes from thermal power plants indicate that the Indian fly ashes contain 1.8–6.0 ppm of U and 6.0–15.0 ppm Th. However, recent studies have shown that ash generated from coal contains as much as 50 ppm of ^{232}Th (Mandal and Sengupta 2011); 1 ppm Th = 4.046 Bq/kg and 1 ppm U = 12.36 Bq/kg; see McDonald et al. 1997). the cropping pattern has incre- abedly change due to fly ash. The water quality has day to day decrease by various harmful components such as silica, zinks, cooper, calcium- oxides, aluminum, which is jumble of fly ash. That component are polluted the ground water intensity and also surface water. Coal at the thermal power plant produced CO_2 , SO, NO, and CFCS and other in organic air particles' which is the main sufficient of water, plant, and surface consummation system. These particles' are mainly responsible for greenhouse effect Avirneni and Bandlamudi (2013).

Aim Environmental impact assessment of the Kolaghat thermal power plant.

Objectives Following are the effect of the environment on surrounding 5 km of the Kolaghat thermal power plant.

- Find out impact of the fly ash on production of major commercial crop and cropping pattern.
- To identify the change in land use and land cover degradation due to fly ash.
- Effect on ground water and water body due to the thermal plant.
- Effect of air quality due to plant chimney.

Table 1 Installed capacity of the plant. Data source: KTPS office

Stage	Unit number	Installed capacity (MW)	Date of commissioning
I	1	210	September 1990
I	2	210	March 1986
I	3	210	October 1984
II	4	210	April 1995
II	5	210	May 1991
II	6	210	January 1994

Table 2 Chemical composition of fly ash produced from different coal

Sl no.	Chemical component (% by wt.)	Coal types, from which fly Ash is produced		
		Bituminous	Sub-Bituminous	Lignite
1	Silica (as SiO_2)	20–60	40–60	15–45
2	Alumina (as Al_2O_3)	5–35	20–30	10–25
3	Iron Oxide (as Fe_2O_3)	10–40	4–10	4–15
4	Calcium (as CaO)	1–12	5–30	15–40
5	Magnesium (as MgO)	0–5	1–6	3–10
6	Sulphuric Anhydride (as SO_3)	0–4	0–2	0–10
7	Sodium (as Na_2O)	0–4	0–2	0–6
8	Potassium (as K_2O)	0–3	0–4	0–4

- Management of fly ash from the plant.

Study area Kolaghat thermal power station (KTPS) is located at Mecheda (22°24'56"N, 87°52'12"E) approx. it is situated on right bank of Rupnarayan river in the district of Purba Medinipur. And north east direction are situated Howrah district. KTPS is located 80 km south–west of Kolkata and 50 km north–west of Haldia. Our study area is surrounding 5 km of the Kolaghat thermal power plant. It has three block—Panskura-II, Sahid Matangini block (Purba Medinipur dist.) and Bagnan block (Howrah dist.) (Fig. 1).

Production of ash As per the report in present 401,603 metric ton coal is use in KTPS and 1,74,577 metric ton (Jan, 2016) source KTPS, fly ash was generated of the plant. Coal combustion.

Fly ash collection Fly ash is captured and removed from the flue gas by electrostatic precipitators or fabric bag filters (or sometimes both). It located at the outlet of the furnace and before the induced draft fan. The precipitators or bag filters are remove fly ash gradually and sometime it is periodically removed. Generally, the storage silos fly ash is subsequent transport by trucks or railroad cars (Wikipedia a, [https://en.wikipedia.org/wiki/Thermal_power_station\(a\)](https://en.wikipedia.org/wiki/Thermal_power_station(a))).

Bottom ash collection Bottom ash generally collected from the bottom of the boiler. Bottom ash is generated mixed with water, and it is disposed of ash pond. There are six ash pond is located surrounding 4–5 km south of the Kolaghat thermal power plant (Fig. 2).

Environmental impact In earlier studies in KTPS according to Mondal and Sengupta (2005) were collected coal sample from inside of the thermal power plant. These are collected from the boiler. Fly ash and bottom ash sample were collected from ash pond and also from the bottom of the electro static precipitator (ESP). The ash samples were collected from ash pond during pre-monsoon and post monsoon period. An area of 100 × 100 m was chosen and about 1 kg ash sample were collected at 10 m at the corner of the middle of the grid. And analyzed ²³⁸u, ²³²Th, and ⁴⁰K by a naI (Ti) based gamma-ray spectrometer. The result show that ²²⁶Ra and ²³²Th range from 81.9–126 to 132–169/kg in fly ash and 25–50 and 39–55 Bq/kg in coal Mondal and Sengupta (2005), the mixed component of the fly ash is lished on the soil with the help of rain water surrounding areas are flooded and gradually the fertilizing powers of land are decrease.

One of the major problems of kolaghat is fly ash. The plants are overflowed during the season of monsoon and contaminated nearby villages. The villages of dakhin-rakhasha chak, andulia and bonmecheda are most affected during the problem. According to West Bengal Pollution Control Board (WBPCB) the total economic and environmental activity are typically changed, the land ecosystem and conservation power are gradually decrease so, local

farmer are sold their land to other. The characters of land are incredibly changed; the local characters of land are changed from agriculture land to fallow land. The trends of land are changed and economic progressivity is changed to industrial based economic.

It has three block surrounding KTPS. The author collected in different year wise 'crop-coverage report', according to the report the crop coverage pattern has incurably changeable. Report analysis say that production of paddy has decreased also the horticulture are affected. The crop coverage reports are shown below the table. Map is delivered to show the various characteristic of the crop coverage pattern.

Thermal criteria of the study area Kolaghat temperature says today increase. The variation of temperature in Kolaghat is 24–35 °C. Kolaghat mainly temperate zone however temperature variation so low due to Rupnarayan river (Fig. 3). The variation of temperature has an effect of the criteria of other physiological condition.

Impact of water Water is an important phenomena in environmental phenomena aspect. However water has two types—Surface water and Ground water. They are sincerely interrelated. Surface water give impact of ground water and the pollution of ground is incredibly control by surface water. The approaches to pollution of the both category of water discuss below.

Surface water Surface water is directly related by runoff estimation the total volume of rain fall is not properly utilize and not flow ash a surface water by some kind of water is absorbed, some is precipitated, evapotranspiration, and the rest volume of water is flow ash a surface runoff.

Kolaghat thermal power plant is typically polluted by fly ash it is mixed with water and change the chemical compound of water physiology. By the air, storm the fly ash is mixed with surface runoff and change this chemical compounded. The fly ash who are come from plant chimney are spread out by the air in the local compound basically agriculture land, pond, river, canal, aquaculture land etc. (Fig. 4). There are various harmful ingradients are mixed with fly ash such as As, cd, cu, cr, hg, pb, zn etc. and some organic matter also mixed with fly ash they are- benzol and phenol. This chemical compound are decrease the nutrient capacity of surface water as a result the temperature of surface water is day by day increased some scientist and researcher have shown due to the increase of chemical compound the biophysical water is destroyed. A big amount of fish species is lost. Various algae and redacted zooplankton are decreased the oxygen capacity of water and as a result water changed as a polluted water how heavier they are has big hand of fly ash component. The ph of water is decreased day by day the author was also surveyed of surrounding area KTPS and collect sample of

Fig. 1 Location map

Fig. 2 Ash pond detection map

water of pond, canal and Rupnarayan river, the physiochemical of water is discuss below.

Water quality analysis of surrounding study area (KTPS) Water quality testing is an important part of environmental monitoring. When water quality is poor, it affects not only aquatic life but the surrounding ecosystem as well.

These sections detail all of the parameters that affect the quality of water in the environment. These properties can be physical, chemical or biological factors. Physical properties of water quality include temperature and turbidity. Chemical characteristics involve parameters such as pH and dissolved oxygen. Biological indicators of water quality include algae and phytoplankton. These parameters are relevant not only to surface water studies of the ocean, lakes and rivers, but to groundwater and industrial processes as well. Analysis of the water quality of surrounding KTPS how far effected are discuss below.

PH The pH of surface water is the measure of how acidic or basic the water is on a scale of 0–14. It is a measure of hydrogen ion concentration. US natural water falls between 6.5 and 8.5 on this scale with 7.0 being neutral. The contrition of physiochemical phenomena in water has been fall impact on the water ph variability. However KTPS region the mean ph value is moving around 7.80. The water salinity is strong then water acidity on Kolaghat region.

Since ph is a logarithmic scale the difference all ph value is varied between 1 POH what aver OH^- value are derived from ph measurement. The concentration of hydroxide ion (OH^-) in water is related to concentration of hydroxide ion. The KTPS surrounding area had a measured pH ranging from 6.8 to 8.9 in three time tests of a range of locations in 2015–2016 (Fig. 5).

Different sample are collected different place and during rain water is naturally acidic at about 5.6. Stream water

Fig. 3 LST map of 2015

usually ranges from a pH of 7.5 to a pH of 8.9; this range is considered to be an optimal range for most aquatic life. The natural pH range of surface water is largely determined by the fly ash of the KTPS, for example Koloni side areas will result in pH 8.9 and streams having naturally higher pH levels and Rakhsachak areas will have naturally low pH levels. Carbon dioxide from the atmosphere can also affect the pH of a river; when it mixes with the water it increases its soil fertility. Decrease the pH level (below optimum level) impact killed fish and damage physical property.

Dissolved oxygen (DO) Dissolved oxygen (DO) refers the non-compound oxygen present in water or any other liquid. It is the main source of water in habitat, the organism living the water is arsenical for the living. However the quantity of DO is determines the level of water. Dissolved oxygen analysis measure the amount of gaseous oxygen (O_2) dissolved in an aqueous solution. The main source is DO is air and other waste product of photo synthesis. The amount of dissolved oxygen can determine how healthy the water is. It is also determine the amount of phytoplankton present in water, the mineral condition in water and aquatic condition in water (Wikipedia c, [http://www.fondriest.com/environmentalmeasurements/parameters/waterquality/dissolvedon/oxygen\(c\)](http://www.fondriest.com/environmentalmeasurements/parameters/waterquality/dissolvedon/oxygen(c))).

The KTPS surrounding region measurement DO in three different time and analysis they do that Khanjatapui 3.2 mg/l and Koloni 3.5 mg/l are the low level and

Ramchandrapur area 12.5 mg/l (Fig. 6) are high level of DO. From the DO profile other places it can be seen that the DO level is maximum near the water surface due to the proper mixing of surface water with the open atmosphere. As we go deep down the DO level decreases accordingly but it is still sufficient for the aquatic life to survive. Amount of DO on KTPS is 5.38 mg/l.

Chlorophyll Chlorophyll is main component of living organism. It is responsible for photosynthesis; in the criteria sunlight can take a main role in the process obtaining it. Chlorophyll is bound within the living cell of algae and other phytoplankton in surface water. It is the main biochemical indicator for Chlorophyll enables plant and other chlorophyll content in organism to perform photosynthesis process. Chlorophyll is mainly is chilled in which central metal is ion, it is bounded a larger organic molecule called porphyrin. It is mainly compound of carbon, hydrogen, nitrogen, and other. In surface water variability it can take a major role in photosynthesis process and it distribution give an idea about water health, composition and ecological status Virginia Institute of Marine Science (2005). The amount of chlorophyll in water is usually highest in summer and lowest in winter because of course it is not easy for plants to grow in winter. There are many human activities that affect chlorophyll in water, such as sewage inputs and destruction of lake and river shorelines (Horne and Goldman 1994).

Measurement of surrounding study area in chlorophyll is 8.24 g/l (Fig. 7). The highest chlorophyll are located in Srikrishnapur 15.3 g/l and Ramchandrapur 13.5 g/l region and lower range of chlorophyll content are located in Kakdih 4.1 g/l, Koloni 4.5 g/l and other surrounding areas. High content in chlorophyll are damage fish living population and high chlorophyll is provide ideal breeding environments for mosquitoes.

Turbidity Turbidity is a measure of water's lack of clarity. When water is high turbidity is cloudy and while water is low turbidity then clears. The cloudiness is produced by light reflecting off of particles in the Water; therefore, the more particles in the water, the higher the turbidity. Many factors can contribute to the turbidity of water that soil erosion, urban runoff, industrial waste etc. the particle of the absorb heat in the sunlight, thus raising water temperature, which in turn lowers dissolved oxygen levels. Thereby decreasing the Photosynthetic rate. Reduced clarity also makes the water less aesthetically pleasing. Turbidity is measured in Nephelometric Turbidity Units, NTU. When heavy rain and water level high then turbidity is increase in water. Turbidity can be lower than expected in still water because of the settling of suspended particles that might occur. The standard for drinking water is 0.5 NTU to 1.0 NTU American Public Health Association (1999). The survey report was seen that Rupnarayan

Fig. 4 Water quality sample location area

Fig. 5 Variations of pH in surface water

Fig. 6 Variations of DO in surface water **Fig. 7** Variations of chlorophyll concentration in surface water **Fig. 8** Variations of turbidity in surface water

river day to day increase turbidity due rain water (Fig. 8). Runoff over the area increase turbidity and death of fish. And the depth of the Rupnarayan River at the surrounding of K.T.P.P. has been reduced rapidly during last decade.

Temperature Water temperature is physical property expressing how hot or cold water is. Temperature can be

measurement of average thermal energy substance. Thermal energy is the kinetic energy of atoms and molecules, so temperature in turn measures the average kinetic energy of the atoms and molecules this energy can be transferred between substances as the flow of heat. Heat transfer, whether from air, sunlight, another water source or thermal

pollution can be change water temperature (Wikipedia d, [http://www.fondriest.com/environmentalmeasurements/parameters/waterquality/watertemperature/watertemp3\(d\)](http://www.fondriest.com/environmentalmeasurements/parameters/waterquality/watertemperature/watertemp3(d))). Temperature impact of growth aquatic organisms also effected of the plant species. Rate of plants' photosynthesis, solubility of oxygen in river water, and organisms' sensitivity to disease, parasites, and toxic materials. At a higher temperature, plants grow and die faster, leaving behind matter that requires oxygen for decomposition.

Increasing of Water temperature depend upon various factors that are shown below.

- Decrease dissolved oxygen (DO)—increase temperature.
- Increase turbidity—increase temperature.
- Increase conductivity—increase temperature.

Thermal power plant has a lot of contribution to increase water temperature. It can negatively affected water quality. There are several significant consequences of thermal pollution; including Diminished dissolved oxygen levels, fish kills and influences of invasive species. The KTPS surrounding area sampling three different times and showing the result are Mahisgoat and Sundarchak is high temperature (35 °C) and other areas are (30–32 °C). The standard value of temperature of river water is 20–30 °C (ECR 1997) (Fig. 9).

Conductivity of water level Conductivity is a measurement of the ability of an aqueous solution to carry an electrical current. An ion is an atom of an element that has gained or lost an electron which will create a negative or positive state. For example, sodium chloride (table salt) consists of sodium ions (Na⁺) and chloride ions (Cl⁻) held together in a crystal.

In water it breaks apart into an aqueous solution of sodium and chloride ions. This solution will conduct an electrical current.

Conductivity depend on different factor discuss the below.

1. The concentration or number of ions.
2. Mobility of the ion.
3. Oxidation state (valence) and;
4. temperature of the water.

Determining mineralization: this is commonly called total dissolved solids. Total dissolved solids information is used to determine the overall ionic effect in a water source. Certain physiological effects on plants and animals are often affected by the number of available ions in the water (Wikipedia e, [http://www.uvm.edu/~empact/water/conductivity.php\(e\)](http://www.uvm.edu/~empact/water/conductivity.php(e))).

The author collected the surface water of surrounding KTPS in different three time and analysis the conductivity of water quality the amount of the conductivity 2.80 $\mu\text{S}/\text{cm}$ and the highest conductivity value of Kakdihi 8.5 $\mu\text{S}/\text{cm}$ and lowest Ramchandrapur 0.1 $\mu\text{S}/\text{cm}$ (Fig. 10).

Salinity Salinity is the saltiness or dissolved salt content of a body of water (see also soil salinity). Salinity is an important factor in determining many aspects of the chemistry of natural waters of biological process with in it. Along with temperature and pressure, governs physical characteristics like the density and heat capacity of the Water. Salinity is incurably river, water, pond, lake and ocean. While salinity can be measured by a complete chemical analysis, this method is difficult and time consuming (Water Environment Federation and the American Society of Civil Engineers 1999). Seawater cannot simply be evaporated to a dry salt mass measurement as chlorides are lost during the process (Stewart 2004).

Fresh water brackish water Saline water Brine.

<0.05 % 0.05–3 % 3–5 % >5 %.

Salinity measure of Kolaghat surrounding areas in different three time and show that salinity is increase of the

Fig. 9 Variations of water temperature in surface water

Fig. 10 Variations of electric conductivity in surface water **Fig. 11** Variations of salinity in surface water

surface water. The amount of the salinity is 0.85 ppm. Rupnarayan sides are very high salinity (2.0–2.2) ppm and other areas are similarly low (0.5–1.0) ppm (Fig. 11).

Impact of air pollution Environment is the most important phenomena of the human life. It is a composed of more of the natural phenomena however degradation of environment fall impact on physical structure of the ecosystem. One of the important phenomena of environment is air. The pollution of air is the most serious problem. Other biophysical condition and human structure of phenomena are also depend on air. One of the major criteria of air pollution industry and urbanization from industries the air pollution are caused dust particles, heavy metal (<300 micron) are oriented the struck of the chimney of industries. The air pollution is the cost by emission of particles that is held by toxic organic disposition. UNESCO has said the air pollution is consider when level of air is less than 130 micron. However the quality of air also depend on sunlight variability, speed of Air, transport of wind, topography, recirculation of air, horizontal dispersion of pollution by wind etc. atmospheric boundary is the

composed of temperature and moisture. The variability of pollution, atmospheric pressure and difference in diurnal heating and cooling has impact on air circulation. Changes in climate also change air circulation of process (Santosh Kumar and Ganesh Kumar 2014).

As discuss above air quality depend on topographic phenomena and structural distribution and man- economic co relation. Kolaghat is industrial region. The temperature variability of Kolaghat also depends on the topographic structure in Kolaghat. They are two phenomena of wind which is air direction and wind velocity.

Wind direction The direction of wind is depend on seasonal characteristic. Wind direction is measure and instrument called weather vane. The country wise it is indicate the direction of wind and also the forecast of weather. In the India climate there are four main season—summer (March to May), rainy season (Jun to September), winter (December to February) and autumn (Oct to Nov). Scientist say that in the season of summer in which direction the wind is blowing, season of winter is blowing opposite direction.

In our study area the wind is take a major role in fly ash distribution.

Wind speed The speed of wind is depend on the pressure condition. The wind is moved from high pressure to low pressure. In whether forecasting the wind speed take a major role. In the Indian climate the speed of wind is varied between 10–15 knot. However in thundered storm the variability of wind is high. Wind speed and wind direction is collected from distance the pollutance gate dispersed. The study area is mainly temperate climatic region. The temperature is varied between 25 and 35 °C however the study area is affected by air pollution due to industrial rehabitation. In the rainy season the wind speed is between 20 and 25 knot (Fig. 12).

Wind dispersion model Wind dispersion model or air flow model in the year of 1947 sir graham suttom was deliver and air polluted plume dispersion equation. In this equation gaussian distribution for the vertical and cross wind dispersion of the plume and also the effect the ground reflection of the plume.

Atmospheric dispersion model is the mathematical solution of how air pollutend disperse in the ambient atmosphere.

It is perform by computer programming to solved mathematical equation and alight which was simulated polluted dispersion. However this model is more appropriate to solution the ambient the concentration of air pollution and toxic chemical pollutants from industrial plant. In scenario the future concentration of air pollution and toxic imbalance are due to plume.this model is mostly useful overcome the problem for pollutance dispersed over large distances and react on the atmosphere. In this model epiedeological statistics land use regression model are use.

Dispersion model is most used by the Indian government ton protect and managed the ambient air quality. United state other nation are use this model to reduce a

mission to harmful air polluted. Air pollution control office are US are conduct this study in the year of 1960. It is also used to public safety and emergency management accidental chemical released.

Air flow model

Air flow model terrain co-ordinate system was used. The physiological co-ordinate (x, y and z) was transform to calculation co-ordinate.

The LPDEM proposed by Thomson was applied for the prediction of dispersion over topography.

$$du = a_i(x, u, t) dt + b_{ij}(x, u, t) d\tilde{z}_j$$

where, $u (=u_i)$ and $x (=x_i)$ are the velocity and position of a fluid element of particle, t is the time, $d\tilde{z}_j$ is the increment of a Wiener process.

Thomson proposed the equitation to derive the coefficient of Gaussian turbulence.

$$a^i = - \left(\frac{\delta_{ij} C_0 \varepsilon}{2} \right) (V^{-1})^{jk} (u^k - U^k) + \phi^i / g_a$$

where, G_a is the density function of the distribution of the fluid elements, $U (=U_i)$ is the mean Eulerian wind velocity, $V (=V_{ij})$ is the Reynolds stress tensor, δ_{ij} is Kronecker's delta, ε is the energy dissipation rate, C_0 is Kolmogorov's universal constant for a Lagrangian velocity structure function.

The value of C_0 has been reported to be in the range of 1–10 under various turbulence conditions.

Due to topographical effect evaluated the atmospheric dispersion. In general it is evaluated in 1 h's average concentration of exhaust gasses. It is difficult simulate the equivalent one hours average in wind terminal. The conventional turbulence generator cannot produce wind turnal

Fig. 12 Showing the result of the wind speed (1990–2015) in line graph

Fig. 13 Air model (distance from KTPS)

in wind fluctuations in real atmosphere Ichikawa and Sada (2002).

From the diagram relation between elevation and distance from industrial center are discuss from the diagram we can see there was a positive relation between elevation and industrial center (KTPS). From the wind dispersion model elevation criteria are positively related to distance criteria. Whereas the dispersion is discuss in air flow model (Fig. 13).

KTPS is the industrial region. The amount of pollution is highly correlated with elevation. Due to degradation, rehydration, the nutria capacity of KTPS is decrease day to day however from the model we can air quality.

Conclusion

The present investigation summarizes various water and soil quality parameters of the samples collected from 13 sites of the Kolaghat Thermal Power area. The results of the Parameters significantly fluctuated over different seasons.

It is recognized that the fly ash is the major problem in Kolaghat thermal power station. The utilization of enormous amount of coal has created various problem of environment at KTPS. Carbon die oxide is the main greenhouse gas associated with thermal power plant pollution how aver the study propose some mitigation method to resolved the problem—(a) necessary steps to control the environmental effect by using latest pollution control device, (b) ESP has to be replaced every year, (c) the fly produced by the power plant should be used to construct the road, like the mission of Pradhan mantri Gram Sarok Yojana. (d) wall should be constructed on the surrounding area which cover the KTPS to resolve the fly ash pollution. (e) Plantation on the surrounding area to control pollution.

However fly ash has to be used in many way in the project to mitigate the fly ash problem and manage the effect of pollution in the surrounding environment. As the season changes there is a fluctuation in the physicochemical characters of the water, this will be due to ebb and flow, change in the temperature and salinity as during the pre-monsoon, monsoon-and post-monsoon changes (Mondal et al. (2016).

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