Analysis And Investigation Of Water Treatment In The Kanpur Area

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Abstract:-

In electrolysis, water-soluble inorganic and organic materials usually decompose or settle on the suitable electrode during the electro-chemical redox reaction. By using this method, the organic pollutant is broken down into less toxic or non-toxic products like carbon dioxide and water, and the metals are deposited on the surface of the corresponding electrode. This process is used to get rid of the turbidity and color from the tainted water. Given that this technique can eliminate all dissolved solids (less than 200 mg/l), pre-treatment steps were required for waste water. The process is carried out in a tank or multiple tanks that are connected in series with the necessary metal electrodes.

Introduction:-

Adsorption is commonly employed in the process of eliminating heavy metal ions. In the context of chemical engineering, adsorption—the concentration of materials on the surface of solid bodies—is a surface phenomenon that can be explained in terms of a unit operation. The use of surface forces is the primary focus of this operation. The reason it's regarded as the best waste water treatment method is its low cost, wide range of applications, and simplicity of use.It illustrates how it can be used for biological, inorganic, and organic pollutants that are soluble or insoluble. Its removal efficiency, which falls between 90 and 99%, makes it important for use in both home and industrial settings. The amount of surface area and micropore size that make up an adsorbent determine how well it can bind molecules. There are two types of absorbents: crystalline and amorphous. Because of their micropores, molecular sieves are an adsorbent material (Motsi et al., 2011). Selectivity, long-term stability, mass transfer rate, and adsorption capacity are the essential properties of an adsorbent. Micro-porous solids are adsorbents because they contain micropores that are nanoscale in size. Activated carbon is the primary non-polar adsorbent.

STUDY-AREA

In the central-western region of the state of Uttar Pradesh, at 26.449923°N 80.331874, is Kanpur. The city is roughly 90 km from Lucknow, the state capital, and 475 km from New Delhi, the capital of the nation. It belongs to the historical Awadh region. Kanpur is 318 meters above sea level on average and is located in the flat Indo-Gangetic Plains.[16] Numerous ghats, including the Sati Chaura and Sarsaiya ghats, are situated on the banks of the Ganges, which flows past the city. Another ghat of religious significance is the Brahmavart Ghat, which is situated at Bithoor (25 km to the north).

METHODS OF SAMPLING

A selection criterion was created in order to find appropriate ground water location sites for quality evaluation. Water samples were taken from hand pumps that are regularly used for drinking and household purposes and that are in good working order. Furthermore, the sampling network was established with the goal of selecting hand pumps that would accurately represent the entire study area. A total of 250 groundwater samples (deep-shallow bore Hand pump, India Mark-II) were collected from the research area. One hundred and twenty-five (125) ground-water samples were taken in May 2021 and the same number in November 2021 in order to represent the pre- and post-monsoon seasons.

Characterization of developed zeolite

The surface area, composition, and size of the formed zeolites were characterized. The characterization methods listed below were applied to verify the zeolite synthesis formation.

CHARACTERIZATION BY XRD-ANALYSIS:

Through the use of an X-ray diffraction pattern obtained from the material's analysis by an X-Ray-Diffractometer (Panalytical X-pert pro USA), various crystalline phases that developed in the synthesized zeolite (FAZ) were examined. JCPDS was used for integration.

CHARACTERIZATION BY SURFACE AREAS:

Using the BET equation, the Surface Area Analyzer (1C-Quantachrome USA) measured the surface area of the developed zeolite particles based on the nitrogen-adsorption-desorption isotherm (Braunauer et al., 1938).

CHARACTERIZATION BY SEM:

Using a SEM-micrograph (SEM model LEO 430, Cambridge, England), surface topography was investigated.

CHEMICAL CHARACTERIZATION (XRF):
Utilizing an X-ray fluorescence spectrometer, the chemical composition was determined.

ADSORPTION-KINETICS:
0.120g of synthetic zeolite (FAZ) was added to 100ml of mixed metal solution with a 50,100ppm concentration to undergo adsorption at 3, 4, and pH levels. The study period had a set length of 10–240 minutes. For metal concentration investigations, 0.5 ml of solution was removed at regular intervals. Whatman 0.45 μm filter paper was used for the filtration process. A 2% solution of HNO3 was added to the samples for AAS analysis in order to precisely determine the concentration of metals.

Adsorption Efficiency/capacity:
The adsorbed metal measurement, or t, is determined using the following equation per gram of adsorbent (FAZ):

$$\text{Removal Efficiency } qe(\%) = \frac{C0-Ce}{m} \times V \text{ ....}\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$$

m

Where;

The initial concentration of metal is denoted by C0, the equilibrium concentration by Ce, the volume of solution by V, and the amount of zeolite in grams by m. In our investigation, 240 minutes were spent mixing 0.120g of zeolite with 100ml of metal solution (50 to 300 ppm) at pH 3.0.
SOFTWARE USED
In this study, several software programs (such as Surfer and Design Expert 6.0) were utilized primarily to simplify environmental problems with greater accuracy.

CHARACTERIZATION OF SYNTHESIZED ADSORBENT (ZEOLITE)
Understanding the properties of the raw materials is crucial for the production of zeolites as well as for using sorbents in the treatment of water. Because of the intricacy of their chemical structures, a detailed characterization of them may be extremely challenging. Nonetheless, a complete understanding of their structure can be attained by integrating the outcomes of various approaches. The physical, chemical, and mineralogical qualities of the starting materials determine the technological properties of zeolitic products and regulate the entire processing of treating polluted effluents. This study employed a variety of analytical methods, some of which are covered below:

XRF ANALYSIS:
The material's weight percentage of constituents (FA-flyash and ZFA-zeolitized flyash) that were examined using the XRF technique are displayed in Table 4.14. The increase in di-sodium oxide content further supports the reduction in silica content of FA, which is an indication of zeolitization processes.

Constituents (wt %)	FA	ZFA
SiO_2	57.80	46.90
Al_2O_3	25.20	22.10
Fe_2O_3	10.10	8.23
TiO_2	1.9	1.60
CaO	0.98	0.70
MgO	0.34	0.23
Na_2O	2.0	21.10
K_2O	1.0	0.83

Chemical components of ZFA and FA

XRD ANALYSIS:
The XRD technique was used to identify the various phases that were present in the FA and ZFA. shows that the presence of crystalline phase sodium aluminum silicate hydrates would be indicated by additional peaks in the powder diffraction pattern of ZFA.The various zeolitic forms of aluminum silicate hydrate are called faujasite (Fu) and cowlesite (Co).

SEM-ANALYSIS:
SEM-micrographs were captured for FA and ZFA.Confirming the zeolite synthesis, the result displays the spherical smooth surface of the fly-ash particles that has been converted to a rough surface. According to zeolite synthesis, the SEM micrographs clearly demonstrate that the size of the ZFA particle is approximately 1 micron, while the FA spherical

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The ZFA synthesis, which exhibits an enhancement of 13 to 16 times over the original (FA) one, is further supported by surface area measurement. The aforementioned is the outcome of the crystallization process that occurred on the smooth surface of FA. The specific surface area of the FA and ZFA particles was found to be 2.77 and 55 m2/g, respectively, using the BET equation (Braunauer et al., 1938). The purpose of our study was to evaluate the effectiveness of synthesized zeolite (ZFA) in heavy metal adsorption in an aqueous solution. At first glance, ZFA was found to be effective in removing copper, chromium, cobalt, nickel, and zinc without requiring any additional modifications, which supports its low cost effectiveness. Moreover, it might work with other metals that have been identified, but it would need to be modified, which would raise the price. Thus, using the modified form, more research can be done.

CONCLUSION: -

The district of Kanpur in Uttar Pradesh has evaluated the quality of its groundwater for industrial, domestic, and drinking purposes. There was study on major ion chemistry. pH, conductivity, salinity, TDS, resistivity, K, Na, Cl-, and T. Hardness are some of the parameters that have been examined in the research area. Magnesium hardness, calcium hardness, calcium, magnesium, T. alkalinity, CO32-, HCO3-, silica, ammonical N2, NO2-, SO42-, PO 3-, br-, F-, Cr6+, NO3-, and Cu, B, Al, Be, Mn, Fe, Sn, Mo, V, Pb, Ni, Zn. Following conclusions were drawn from the data:

In both seasons in the research area, the samples' pH values ranged from slightly acidic to slightly alkaline. The maximum number of samples that, during both seasons, violated the BIS desirable limit of 500 mg/l for total dissolved solids. In most of the samples, the alkalinity also surpassed the desired 200 ppm limit. A pre-monsoon sampler's hardness of 60% and a post-monsoon sampler's hardness of roughly 57% exceeded the desired limit of 300 ppm. A total of 31%, or roughly 21% of the two seasons, had fluoride levels above the recommended threshold of 1.0 ppm. In the maximum number of samples, nitrate was measured within the desired range in both seasons. The study's elevated levels of these ions could be attributed to anthropogenic activities.

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