ABSTRACT

In recent years the environmental issues concerning hazardous waste, global climate change, stratospheric ozone depletion, groundwater contamination, disaster mitigation and removal of pollutant have become the focus of scientific research. Though, all the segments of environment are being polluted in one way or other, the study of water pollution continues to be on the top as it is not only an extraordinary liquid but also is the elixir of life. Although, water is the most common liquid used very commonly, its anomalous behaviour has made it unique among other oxides of VI group in the periodic table. India in general and Odisha in particular has severe water pollution problem in both cities as well as even in rural areas due to various factors. Keeping this in mind, a few areas such as Jagdalpur, Bacheli and Kirandul and Damonjodi of Chhattisgarh and Odisha were selected considering the backwardness associated with these places. Water quality of these areas is reported not to be good from the point of view of drinking. A large number of tribal people inhabit in the study area and it is one of the reasons to select these as study areas. They do not have any access to good water for drinking purpose. In view of the above facts, it is essential that the water quality in this area is determined to benefit those tribal people. Jagdalpur is a small town having many iron factories. Bacheli and Kirandula area are covered with iron ore mines. Asia’s biggest iron ore factory (National Mineral Development Corporation) is situated at Bachel and Kirandula area. Asia’s biggest aluminium factory named, National Aluminium Company Limited, is situated near Damonjodi area. It has a capacity of extracting about 240000 tonnes of the bauxite from the alumina ore annually.

The groundwater samples were collected from the above three study areas at twenty different locations during pre-monsoon, post-monsoon and winter period for assessment of physico-chemical parameters as well as for its heavy metal content.

The analytical data of various physico-chemical parameters indicated that the parameters like pH, Electrical conductivity, DO, chloride, total alkalinity, total hardness, total dissolved solid, nitrate, bicarbonate, fluoride, aluminium, iron, and lead were found to be more than the prescribed limit in a few groundwater samples of the study areas. The Water Quality Index value indicated that water samples of a few areas were unfit for drinking purpose because of high concentration of iron and fluoride. A few locations in study area, water was not even suitable for irrigation purposes. Due to high content of iron, fluoride, lead and
aluminium, the water was found to be unsuitable for drinking. Water type is explained with the help of Piper and Chadha diagram.

Defence Research and Development Organisation (DRDO) is situated close to Jagadalpur, where water was found to be polluted with perchlorate ion due to production of missiles in that area. A huge quantity of ammonium perchlorate is used as oxidizer along with other ingredients in production of missiles. The ammonium perchlorate is highly soluble in water. Moreover, perchlorate ion is stable, inert and it remains in surface water, groundwater and soil for long time. Therefore, it is essential to remove perchlorate ion from groundwater. As per USEPA recommendation, perchlorate ion concentration in drinking water should be below 15 ppb. Aim of the present work is to develop a potential adsorption medium for removal of perchlorate ion from water. SIR-110-HP, a strong base anion exchange resin was used for adsorption of perchlorate ion. The adsorption media were characterized by XRD, FTIR, and SEM etc. For the removal of perchlorate ion, batch experiments were carried out using fixed weight of resin with 50 ppb, 100 ppb, 250 ppb, 500 ppb, 1 ppm, 5 ppm, 10 ppm, 25 ppm, 50 ppm of initial concentration of perchlorate ion and its effect on pH, time and co-ions were also studied. Desorption and regeneration studies were carried out to assess its reusability. Kinetics study revealed that removal of perchlorate ion followed second order kinetics. Intra-particle diffusion rate constants were calculated which were found to increase with increase in initial adsorbate concentration, indicating the probability of concentration diffusion. Thermodynamic parameters were calculated which indicated the feasibility and spontaneity of the ongoing process. The kinetic model was found to be sensitive to the Freundlich adsorption intensity parameter n. Column study and breakthrough analysis were also carried out to find out the breakthrough time of adsorbent.

**Keywords:** Perchlorate ion, Water Quality Index, Langmuir isotherm, Freundlich isotherm, Temkin isotherm, Kinetic study, Intraparticle diffusion, Thermodynamic parameters, Column study, Backwash,