THE PRESENT STUDY
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Population explosion, industrial revolution and uncontrolled exploitation of natural resources have taken their toll on the environment. Unscrupulous discharge of industrial effluents has led to the contamination of aquifers with metals deep inside the earth. Geological nature of certain regions of the world has also been one of the causes for the contamination of groundwater with metals due to leaching during weathering of rocks. One such instance is the problem of arseniferous groundwater in the Bengal delta plains, which has emerged as a global issue. The problem is spread over a wide geographical area both in West Bengal and in Bangladesh. Unfortunately, the consumption of groundwater has resulted in acute environmental health disorders in the entire region. Hence, the provision of safe drinking water to a vast cross section of population in West Bengal and Bangladesh has become an issue of great concern. There is no possibility to refrain people from drinking well water or stop the practice of wetland cultivation. Simultaneously, there is no possibility to arrange alternate drinking water supply through community water treatment systems for the rural and semi-urban population. The choice of any remedial technique must therefore be low-cost and affordable by the rural population that should comply with the existing framework of groundwater use as well as the land use pattern in the region. The technique used to treat wastewater or drinking water depends upon the contaminant present in the water. Sometimes a combination of different techniques has to be used in the case of recalcitrant pollutants, especially metals. History has shown that metals pose a serious problem to human health and needs to be removed from water before use. Technologies that are used at present to remove metals are expensive hence non-affordable and ineffective in removing trace levels. The complex and non-biodegradable nature of metals has led scientists to delve into various techniques mainly due to economic reasons. Hence, there is a constant search for a cost-effective treatment technology for metal-bearing waters.
In the present study, an attempt was made to treat iron and arsenic bearing groundwater with microbial system. Water and soil samples were collected from iron and arsenic contaminated areas of Ramnagar Old Hotkola area of Kolkata city, West Bengal. Fungi and bacteria were isolated from these samples. The microbes were screened for their resistance against iron and arsenic. The most resistant strain was selected and used for further biosorption studies. Biosorption studies were initially conducted using aqueous solutions in batch and column modes. To improve biosorption efficiency, the selected fungal biomass was subjected to various pretreatments viz. autoclaving, acid pretreatment, alkali pretreatment, formaldehyde pretreatment, autoclaving followed by FeCl₃ pretreatment and autoclaving and FeSO₄ pretreatment. In batch mode studies, optimum treatment conditions, viz., contact time, adsorbent dosage and pH were determined. Desorption studies were also conducted to determine the feasibility of recovering the metals and recycling the biosorbent. In column mode (fixed bed), flow rate and bed volume were optimized. Comparison of $Q_0$ value from batch mode and $N_0$ value from column mode revealed that batch mode was more effective than fixed bed. Hence, the ground water sample collected from Ramnagar area was subjected to batch mode treatment at optimum conditions for the removal of Fe(II), As(III) and As(V). Preliminary IR studies were also carried out to identify the functional groups present on the surface of the fungal biomass. This study shows that adsorption using microbial biomass might prove to be a promising technique in the treatment of groundwater. Biosorption is economical as the adsorbent can be reused for several cycles. It is moreover a safe technique as dead biomass is used.