

### Bioremediation of Used Water as tool for management of water resources:

Pakistan is facing threats of water shortage and growing water-borne infectious diseases. The trend of urbanization without adequate infrastructure to provide safe drinking water, treatment of sewage water and ever increasing water demand for agriculture is at alarming level. Recently, Pakistan has been ranked at 125<sup>th</sup> in a list of 163 countries in 2010 Environmental Performance Index regarding environmental public health and ecosystem vitality. In 1950s per capita water availability in Pakistan 5300 m<sup>3</sup> has drastically reduced by 82 per cent hitting 955 m<sup>3</sup> in 2011, and a careful estimation predicts further stress to 750 m<sup>3</sup> in 2013. In Pakistan water-borne infections such as cholera, typhoid fever, and dysentery have added significant economic losses, costing nearly 250 thousand deaths of children under age five annually and these are directly related to unsafe water, sanitation, and hygiene practices. However, through efficient management of water the related economic losses can be reduced significantly and has been estimated to bring PKR 518 billion per year to the economy by reducing water borne diseases and increasing the availability of high quality water. In order to address these issues urgent measures are needed for the development of sustainable, low cost, energy efficient natural solutions.

Pakistan is an agriculture country and agriculture sector is the basic source of income for the people of rural areas of Pakistan. Cottage industry is the key of development in any economic model and it is necessary to link the agro-cottage industry with development. There is dire need for adoption measures to address the negative effects of climate change. Environment plays an important role in production and economy, currently there is very unsatisfactory condition of state as Pakistan is losing 7 percent of its GDP in form of environmental degradation which shows its development in reverse form. Health impacts of pollution are as high as in any underdeveloped country in the world which is causing losses in the form of finances and life lost.

Fazilia Trust Pakistan (FTP) a not for profit organization Established in 1993, comprises of a team of diversified development practitioners; all strongly adhered to the universal

commitments of helping their nation achieve the set targets of, Millennium Development Goals. The trust management is governed by 11 Board of Trustees, which are selected by a general body, comprising of 200 members from all across Pakistan with a gender sensitive distribution (the Vice chairperson being a female). The team at Fazilia believes in the ability of individuals to help bring positive and sustainable change in the society and to conserve and protect the natural environment. FTP believes in the principles of participatory development paradigms and therefore involve individuals and communities right from the inception of the projects. This participatory approach helps quantify the needs of communities in a better way.

Fazilia Trust Pakistan with a vision to work in the fields of education, health and environment to improve the quality of life of the poor and the downtrodden irrespective of gender, race, religion and color has taken this challenge to introduce a low cost biological solution called "bioremediation technique" which does not require machinery or external energy for its operation but uses certain plants and naturally occurring microorganisms to do the job in constructed wetlands. Fazilia Trust Pakistan (FTP) has an outstanding record of developmental works in various fields particularly the education and water related issues. The present initiative of FTP in setting up the Bioremediation Institute is an urgent need for a country like Pakistan, which is suffering 955 m<sup>3</sup> per capita water stress, being already in the drought hit category. Bioremediation is a unique system to reclaim solid and waste water. In Pakistan there is no facility for acquiring education in this field. Untreated waste water of Pakistan ranging approximately 4.2 billion gallons per day is the major source of waterborne diseases and costs about 518 billion PKR annually.

Fazilia trust Pakistan in collaboration with highly qualified team of experts and with the financial assistance of UN Grass Root Initiative Programme (GRIP) has introduced and demonstrated a model of bio remediation which treats the sanitation, used and waste water of 300 households approximately 2000 people of the village through Nano technology at Garhi Ghghana, a small village in Tehsil Taxilla district Rawalpindi. The water treated through bioremediation in the constructed wetlands has been certified by standard laboratories to be fit for agricultural purposes and discharging into rivers or natural reservoirs with quality parameters well below the National Environmental Quality Standards (NEQs). The successful

functioning of constructed wetlands provides impetus to replicate the models at micro and macro scales in villages and cities to deal with the domestic and industrial effluents. This bio remediation plant in Garhi Afghana caters to about 300 households and irrigates about 200 acres of land. This plant treats about 50,000 gallons of waste water per day and has the capacity to treat 100,000 gallons of waste water per day thereby covering the need of whole village and can irrigate approximately 450 acres of land.

Before the construction of the bio remediation plant at taxilla there were no proper street pavements and surface drains in Garhi Afghana. The stagnant waste water in the streets was a major issue. It was not only the cause of diseases and health issues but also was a cause of polluting the underground drinking water reservoir. The polluted water was causing harm to agriculture land and causing the average amount of produce to reduce.

The main aim to construct this bio remediation plant was to make at least 200 acres of land in village Garhi Afghana as suitable for irrigation and cultivation as possible. Basic source of income of masses in Pakistan is agriculture. The village people are mostly illiterate and are unaware of techniques to purify water and make it suitable for irrigation. Agriculture is the most important source of income for the rural people of Pakistan and it was a felt necessity that the irrigation system in Garhi Afghana be improved in order to improve the living standard of these poor and downtrodden people. Another reason for the construction of the bio remediation plant was to protect the environment, provide sanitation facility, to provide productive recycling of waste water to the villagers and to create awareness amongst the villagers. The bio remediation plant also serves the purpose of beautification of the facility. Landscaping has been done and a small garden has been made in the area of waste land. It would also help to restore the natural ecosystem of the area. The plant is properly fenced to not only protect the facility but also to provide protection to children and stray animals from falling in the ponds.

Fazilia Trust Pakistan along with its highly qualified team of experts, development practitioners and scientists with a futuristic vision aims to implement latest biotechnologies to bring change in the life of the people living in substandard environments. In the field of environment Fazilia Trust Pakistan aims to provide biological solutions for treatment of waste-

water and waste-organic matter for re-use, rehabilitation of contaminated soils. The plant in Garhi Afghana is an initial step by Fazilia trust Pakistan to improve the environmental conditions in rural areas. Highly professional team comprising of technical experts have been used for the construction of bio remediation plant in Garhi Afghana.

Wastewater is a valuable resource and its sustainable reclamation through inexpensive constructed wetlands amplify the potential benefits like, reliable source of irrigation, conservation of nutrients & reduction in the need for artificial fertilizers, increment in crop yields and additional source of incomes through spinoff activities such as protein rich poultry feed harvesting, aquaculture, sericulture & mushroom cultivation etc. FTP intends to resolve these water issues of Pakistan by introducing this natural method.

The other major contributions of Fazilia Trust in the field of water purification are a water supply scheme in Garhi Afghana which provides water to 500 households for drinking purposes. Fazilia Trust Pakistan is also opening "Yousaf Riaz Institute of Bioremediation" at Taxilla foreseeing the need for developing human resource in the field of Bioremediation and the latest biotechnologies for the first time in Pakistan with practical approaches resonating with the economic conditions of the country. This institute would be equipped with a state of art laboratory, library and research centre. Courses like bio remediation solid waste management, domestic/industrial effluent treatment, related nanotechnologies, environmental economics and environment would be taught in this institute in order to improve the environmental conditions in Pakistan.

Pakistan now a days is facing serious water shortage. The whole country produces about 2 billion gallons/day waste water, which is mainly thrown, with a few exceptions, untreated into rivers and water bodies, putting a heavy cost on people of the country. Fazilia Trust Pakistan recognizing the growing water requirements and abrupt environmental changes of the world in general and Pakistan in particular has placed a mile stone in the journey towards water management and environment by carrying out major steps involving participation of the community to construct water resources, introducing/adopting biological methods of waste water treatment which does not require mechanical means or energy but uses naturally occurring microorganisms (yeast, fungi, or bacteria) and plants to break down, or degrade,

hazardous substances into less toxic or nontoxic substances and as a result provide a biological remedy to abate or clean up contamination. Natural bioremediation has been occurring from millions of years, however, through scientific studies bioremediation process has been well documented and understood, and developed into a technique which can be applied successfully for the treatment of domestic or industrial effluents. Simple and economically viable technology to reclaim the used water in an environment friendly manner which fulfill the drinking and agricultural needs of the people.