



Proximate Analysis and Heavy Metal Detection in Aquatic Plants of River Satluj, District Kasur

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Abstract: Present study was conducted at five study areas associated with river Satluj including the surroundings of leather tanning industry in District Kasur. Nagar village, Bhakhiwind, Ganda-Singh Wala, Wallaywala and Surroundings of Leather Tanning Industry. Samples of five species of aquatic plants and soil were collected from four study sites of river Satluj and Leather tanning industry at District Kasur. Three samples of each aquatic plant and soil were collected from each site. During the present study the proximate analysis of aquatic plants was as follows, the moisture contents of aquatic plants ranged between (1.7±2.61d to 7.9±2.61a). The protein contents ranged between (2.51±5.57d to 22.14±0.7a). The fat contents ranged between (0.15±2.63d to 6.9±2.77a). The fiber contents of aquatic plants ranged between (1.75±3.28d to 16.14±4.8a). The values of ash contents in aquatic plants ranged between (1.62±8.54d to 23.12±8.54a). The data obtained after heavy metal detection revealed that in roots of most aquatic plants the metal accumulation occurs in order Pb>Cd>Cr. In stems and leaves of aquatic plants the metal accumulation occurs in order Roots>Leaves>Stems. The accumulation of heavy metals in different fragments of aquatic plants occurs in order Roots>Leaves>Stems. During this study the lead limits were observed between (0.28±0.001d to 82.25±0.09a), Cadmium values were recorded between (0.11±0.001d to 9.82±0.05a) and Chromium limits were observed between (0.04±0.001d to 11.61±0.02a).

Keywords: Aquatic plants, Heavy metals, Spectrophotometer

1. INTRODUCTION

During last few decades the concern over the studies on some contaminants like, fertilizers, pesticides and trace metals and their impacts on environmental compartments such as soil, plants and water have attained a great significance. The lithogenic source is the reason of the presence of trace metals in environment and sometimes the concentration of metal fluxes in environment is increased by anthropogenic influences. The industrial activities are mainly included in the anthropogenic influences (Yanina *et al.* 2015).

The aquatic plants is a highly diverse group of plants around the globe. The community of the aquatic plants have a vast and diverse range of macrophytic organisms in it. The ferns, the mosses, the angiosperms, some macroalgae of freshwater and the liverworts have been collectively described as the aquatic plants. Aquatic plants occurs in the seasonally or permanently wet surroundings. In most of the wet lands, the aquatic plants have a remarkable population sizes (Lacoul and Freedman 2006; Chambers *et al.* 2008).

The growth rate of aquatic plants is very rapid in different aquatic bodies like waterways and lakes all over the world (Muhammed *et al.* 2012). The aquatic plants includes submerged, emergent and floating plants. These plants are a good source of food both for humans as well as other aquatic and terrestrial organisms. Some edible aquatic plants are a good source of proteins and nutrients. During the previous few years, the research for the inclusion of aquatic plants in the animal feed is going upgraded day-by-day (Tacon *et al.* 2009).

2. MATERIALS AND METHODS

2.1. Study Area

Present Study Was Conducted At The Various Sites Associated With River Satluj Including The Surroundings Of Leather Tanning Industry In District Kasur. Following Five Sites Of District Kasur, On River Satluj, Was Considered As The Study Sites During The Present Study.

Nagar Village, Bhakhiwind, Ganda-Singh Wala, Wallay Wala And Surroundings Of Leather Tanning Industry.

2.2. Collection of Samples

Samples of aquatic plants, contaminated soil and water were collected from four study sites of river Satluj and Leather tanning industry at District Kasur. Three samples of each aquatic plant and soil were collected from each site.

2.3. Sample Preparation and Test

The samples of aquatic plants were taken to the department of fisheries and aquaculture, UVAS, Ravi Campus Pattoki, for proximate analysis of different parts of aquatic plants (roots, stem and leaf) viz., moisture, ash, crude proteins, crude fats, and crude fibers. Different parts of aquatic plants viz., roots, stem and leaf were taken to laboratory of the department of Fisheries and research center, Manawa, Lahore, for the detection of heavy metals (Pb, Cd and Cr).

Soil samples were taken to the department of Fisheries and aquaculture, UVAS, Ravi Campus Pattoki, for determination of physico-chemical properties viz., sand, silt, clay, temperature, pH, total alkalinity, electrical conductivity and total dissolved solids. The detection of heavy metals (Pb, Cd and Cr) from the soil samples was done at the above cited laboratories.

The obtained calculations was studied under Analysis of Variance (ANOVA) through SAS 9.1 statistical software and for comparing means LSD and Duncan's Multiple Range Test (DMRT) was applied (Duncan, 1955).

The obtained data will help the aquaculture scientists to understand the status of heavy metals accumulation in aquatic plants, associated soils and water, being parts of freshwater ecosystem.

3. RESULTS AND DISCUSSIONS

3.1. Proximate Analysis of Aquatic Plants

The moisture contents of aquatic plants ranged between ($1.7 \pm 2.61d$ to $7.9 \pm 2.61a$). The highest moisture was observed as ($7.9 \pm 2.61a$) in roots of *Nymphae lotus* at study area 3, Ganda-singh wala while the lowest moisture value was observed as ($1.7 \pm 2.61d$) in roots of *Eichornia crassipes* at study area 3, Ganda-singh wala. The protein contents ranged between ($2.51 \pm 5.57d$ to $22.14 \pm 0.7a$). The highest value of protein was observed as ($22.14 \pm 0.7a$) in stem of *Typha latifolia* at study area 3, Ganda-singh wala while the lowest value was observed as ($2.51 \pm 5.57d$) in roots of *Eichornia crassipes* at study area 5, surroundings of leather tanning industry. The fat contents ranged between ($0.15 \pm 2.63d$ to $6.9 \pm 2.77a$). The highest value of fat was observed as ($6.9 \pm 2.77a$) in leaves of *Typha latifolia* at study area 2, Bhakhiwind while the lowest value was observed as ($0.15 \pm 2.63d$) in leaves of *Potenderia chordata* at study area 5, surrounding of leather tanning industry. The fiber contents of aquatic plants ranged between ($1.75 \pm 3.28d$ to $16.14 \pm 4.8a$). The highest value of fiber was observed as ($16.14 \pm 4.8a$) in leaves of *Nymphaea lotus* at study area 4, Wallay wala while the lowest value of fiber was observed as ($1.75 \pm 3.28d$) in stems of *Eichornia crassipes* at study area 4, Wallay wala. The values of ash contents in aquatic plants ranged between

($1.62 \pm 8.54d$ to $23.12 \pm 8.54a$). The highest value was observed as ($23.12 \pm 8.54a$) in roots of *Eichornia crassipes* at study area 5, surroundings of leather tanning industry while the lowest value was observed as ($1.62 \pm 8.54d$) in roots of *Nymphae lotus* at study area 5, surroundings of leather tanning industry.

3.2. Metal Detection in Aquatic Plants

The data obtained by heavy metal detection (Lead, Cadmium and Chromium) in aquatic plants revealed significant differences ($p < 0.05$) in Pb and Cd and Cr. (Ingole et al. 2000) concluded that the huge magnitude of developing industrialization is responsible for increasing heavy metal pollution. The data obtained after heavy metal detection revealed that in roots most aquatic plants the metal accumulation occurs in order $Pb > Cd > Cr$. In stems and leaves of aquatic plants the metal accumulation occurs in order $Pb > Cr > Cd$. The accumulation of heavy metals in different fragments of aquatic plants occurs in order $Roots > Leaves > Stems$.

3.3. Lead (Pb)

Singh et al. (2012) stated that lead is such a fetal heavy metal which can cause adverse environmental and health effect even in low concentrations. David et al. (2003) narrated that lead is one of the highly toxic heavy metals, as it enters and absorbed in the body directly. Lead has an ability to be stored in

bones, tooth and tissues as well. WHO (2004) stated that standard allowance of lead intake is 0.15 mg/L and if the limit become exceeded then serious health issues like hepatitis and anemia may result. During present study the lead limits were observed between (0.28±0.001d to 82.25±0.09a). The maximum value of lead was observed in roots of *Eicchornia crassipes* at study area 5, surroundings of leather tanning industry while the lowest value was observed in soil samples collected from study area 1, Nagar village.

3.4. Cadmium (Cd)

Wolverton and Rebecca (1978) stated that cadmium is a highly toxic heavy metal for human life. Its exceeded limits can cause cancer, liver diseases, kidney diseases and cardiovascular issues and even very low concentrations can cause serious health issues. During present study the cadmium values were recorded between (0.11±0.001d to 9.82±0.05a). The maximum value of cadmium was observed as (9.82±0.05a) in roots of *Nymphaea lotus* at study area 5, surroundings of leather tanning industry while the lowest value was noted as (0.11±0.001d) in the soil samples collected from the study area 1, Nagar village.

3.5. Chromium (Cr)

Chandra et al. (1997) stated that chromium is found naturally in animals plants and rocks. Although chromium is required by the biological systems of animals and humans as it cause breakdown of fats, proteins and sugars. It taken in excess then it causes serious health damages. During the present study, the chromium limits were observed between (0.04±0.001d to 11.61±0.02a). The maximum value was observed as (11.61±0.02a) in roots of *Potenderia chordata* at study area 5, surroundings of leather tanning industry while the lowest value was observed as (0.04±0.001d) in soil samples collected at study area 1, Nagar village.

3.6. Physico-Chemical Parameters of Soil

Latha, (2016) concluded that water and sediment pollution has adversely affect the aquatic ecosystems by the discharge of industrial effluents in the natural water sources. The results of soil physico-chemical parameters revealed significant differences ($p < 0.05$) in pH, electrical conductivity, alkalinity, total dissolved solids, sand, silt and clay. The level of pH in soil ranged between (5.9±0.01a to 7.89±0.01d). The highest value was observed as (7.89±0.01a) at study area 3, Ganda-singh wala while the lowest value of pH was observed as (5.9±0.01d) at study area 5, surroundings of leather tanning industry. The electrical conductivity of soil ranged between (1989±0.66a to 2138±0.66d). The highest value for soil electrical conductivity was noted as (2138±0.66a) at study area 3, Bhakhiwind while the lowest value was noted as (1989±0.66d) at study area 4, Wallay wala. The alkalinity level of soil samples ranged between (114±0.77a to 187±0.77d). The highest value was observed as (187±0.77a) at study area 5, surroundings of leather tanning industry while the lowest value of alkalinity was observed as (114±0.77d) at study area 2, Bhakhiwind. The level of total dissolved solids ranged between (1810±0.81a to 2002±0.81d). The highest value was observed as (2002±0.81a) at study area 4, Wallay wala while the lowest value of total dissolved solids was observed as (1810±0.81d) at study area 1, Nagar village. The sand composition in soil samples collected from the study areas ranged between (92.56±0.03a to 57.21±0.03d). The highest value was observed as (92.56±0.03a) at study area 4, Wallay wala while the lowest value of sand was observed as (57.21±0.03d) at study area 5, surroundings of leather tanning industry. The silt composition in soil samples ranged between (22.38±0.05a to 35.77±0.05d). The highest value for silt composition was noted as (35.77±0.05a) at study area 1, Nagar village while the lowest value was noted as (22.38±0.05d) at study area 4, Wallay wala. The composition of clay in the soil sample collected from the study areas ranged between (2.79±0.07a to 3.67±0.07d). The highest value was observed as (3.67±0.07a) at study area 3, Ganda-Singh wala while the lowest value of clay was observed as (2.79±0.07d) at study area 4, wallay wala.

4. CONCLUSION

During the present study, the results showed that natural ecosystems of country are in tremendous pollution pressures. The obtained data will help the aquaculture scientists to understand the status of heavy metals accumulation in aquatic plants, associated soils and water, being parts of freshwater ecosystem. The aquatic plants have proved themselves for lowering the heavy metal pollution from associated water and soil.

SUGGESTIONS

As aquatic plants are efficient in absorbing and accumulating the heavy metal traces from water. It is suggested to use the aquatic plants for lowering the heavy metal pollution from associated water and soil of freshwater ecosystems and wetlands. The proximate analysis of aquatic plants showed that these plants can also be used as animal feed supplement to decrease the protein loads from feed manufacturing industry.

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