

**ASSESSMENT OF PHYSICAL AND CHEMICAL  
PARAMETERS OF SOAN RIVER AND ITS IMPACT ON  
GROUND WATER**



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fulfillment of the requirement for the degree of BS in  
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## ABSTRACT

This study was conducted to examine the characteristics of river Soan and its impacts on ground water. The research work was carried out in two steps. In the first step wastewater samples were collected from the selected sites from river Soan and industrial points. Physico-chemical parameters were assessed by using standard methods. The results obtained were in the following order: pH ranged from 5.9 to 8 and 5.3 to 10.1, conductivity 0.53 to 3.66  $\mu\text{S}/\text{cm}$  and 0.64 to 4.34  $\mu\text{S}/\text{cm}$ , total dissolved substances 360 to 2510 mg/L and 450 to 2990 mg/L, total suspended solids 210 to 1220 mg/L and 180 to 1850 mg/L, Cations including sodium ranged from 44.8 to 78.1 mg/L and 37 to 788 mg/L, potassium 4.8 to 27.7 mg/L and 6.1 to 31.0 mg/L, calcium 72.8 to 7.8 mg/L and 53.4 to 677.0 mg/L, magnesium 5.50 to 6.63 mg/L and 5.44 to 6.45 mg/L and anions including chloride ranged from 8.27 to 46.085 mg/L and 7.09 to 28.36 mg/L, sulphates 12.52 to 266.44 mg/L and 76.610 to 641.12 mg/L. Heavy metals (HMs) were also assessed in the same wastewater samples by using standard methods through Atomic absorption spectrophotometer. The concentrations of HMs were found to be in the order; obtained that chromium ranged from 0.05 to 2.05 mg/ and 1.00 to 1.21 mg/L, manganese 1.06 to 2.05 mg/L and 0.02 to 2.21 mg/L, cadmium 0.01 to 1.76 mg/L and 0.01 to 0.89 mg/L, zinc 1.30 to 3.17mg/L and 1.05 to 3.52 mg/L, copper 0.03 to 2.05 mg/L and 0.38 to 2.45 mg/L, lead 0.06 to 1.50 mg/L and 1.04 to 1.37 mg/L, nickel 0.02 to 0.34 mg/L and 0.22 to 0.32mg/L and iron 0.02 to 3.01 mg/L and 0.01 to 2.85 mg/L. The results obtained were compared with Maximum permissible limits (MPL) of Pakistan Environmental Protection Agency (Pak-EPA). It was found that the river Soan is highly polluted due industrial effluents which are discharged without any treatment. In the second step, representative drinking water samples were collected from different sources (wells, pressure pumps and hand pumps) in order to examine the physico-chemical properties and HMs concentrations which are effected by river Soan. pH, TDS and conductivity were analysed on the spot, while sodium ( $\text{Na}^+$ ), potassium ( $\text{K}^+$ ), calcium ( $\text{Ca}^{+2}$ ), magnesium ( $\text{Mg}^{+2}$ ), chloride ( $\text{Cl}^-$ ), sulfate ( $\text{SO}_4^{-2}$ ) and TSS were analyzed by

using standard methods. HMs including chromium (Cr), manganese (Mn), cadmium (Cd), zinc (Zn), copper (Cu), lead (Pb), nickel (Ni) and iron (Fe) were also analyzed. The values of different parameters of drinking water from different sources indicated that their levels are above the World Health Organization (WHO) permissible limits. On the basis of findings, it is concluded that drinking water of the study area may pose a serious threats to the health of the inhabitants living near river Soan. So, Environmental Protection Agency (EPA) should check the illegal practices of dumping of industrial effluents into the river, may be stopped immediately by strict imposition of national environmental quality standards in order to minimize the associated environmental risks.

**Keywords:** River Soan, Physico-chemical properties, Heavy metals, Drinking water, Rawalpindi

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## Abbreviations

AgCl	Silver Chloride
AgNO <sub>3</sub>	Silver Nitrate
BaCl <sub>2</sub>	Barium Chloride
Ca	Calcium
Cd	Cadmium
CDA	Capital Development Authority
Cr	Chromium
Cu	Copper
EPA	Pakistan Environmental Protection Agency
K	Potassium
K <sub>2</sub> CrO <sub>4</sub>	Potassium Chromate
L	Liter
Mg	Magnesium
mg	milligram
Mn	Manganese
N	Normality
Na	Sodium
NaCl	Sodium Chloride
NaNO <sub>3</sub>	Sodium Nitrate
NEQ's	National Environmental Quality Standards
Ni	Nickel
NIH	National Institute of Health

Pb	Lead
PEPC	Pakistan Environmental Protection Council
PEPA	Pakistan Environmental Protection Act
pH	Negative Log of Hydrogen Ion Concentration
TDS	Total Dissolved Solids
TSS	Total Suspended Solids
U.V	Ultra Violet
V	Volume
WHO	World Health Organization
Zn	Zinc