

**Assessment of marble waste water, and its impact on river Kabul,**

**Khairabad Khyber Pakhtunkhwa**

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The study evaluated the marble effluent from twenty marble industries, and the water from River Kabul as this effluent is commonly discharged into it, in the Khairabad Nowshera KP region. Seven (07) physical parameters, pH, TDS, EC, TSS, temperature, salts and turbidity, were analyzed in the effluent samples from all industries. The results showed that all physical parameters were within the safe limits except for salts and turbidity, they exceeded the safe limit given by Pak EPA. Three out of six marble industries having treated effluent (settling tanks) had salt levels exceeding the safe limit of 200 mg/L. The highest salt levels were found in industry three. Ten out of fourteen industries with no treatment method also had their salt levels surpassing the safe level (200mg/L). Highest levels were found in industry 1, 4 and 17. The turbidity in all five samples of the river Kabul were also above the safe limit with highest found in AMP (On mixing point) samples. All other parameters were within the permissible limit in river Kabul samples. Turbidity in industries with treated effluent also surpassed the safe limit with the highest levels found in industry 15 and 16. Industries with no treatment had their turbidity levels exceeding the safe levels with highest found in industry 1 and 8. Nine chemical parameters alkalinity, total hardness,  $Mg^{+2}$ ,  $Ca^{+2}$ , nitrates, sulphates, chlorides, sodium and NaCl, were also analyzed in wastewater and river Kabul samples. The results of chemical analysis showed that  $Mg^{+2}$  surpassed the safe limit by Pak EPA (100 mg/L) in all effluent samples except for industry 10 and 14 with highest found in industry 11, 13, and 17. The results of river Kabul also showed that  $Mg^{+2}$  surpassed the safe limits of 100 mg/L in all samples with highest number in BMP and AMP samples. All other chemical parameters were within safe limits. 18 elements were also analyzed in effluent samples and samples from river Kabul. The levels of Zn, Cd, Cr, Co, Mn, Pb, and Al were below the detection limit (BDL). The result of other parameters, Sr, Si, Li, Pd, Cu and Ba were all within the safe range given by Pak EPA and NEQs in all samples. Industry 3 had Hg levels surpassing the safe limit of 0.07mg/L. The study emphasizes the pollution of surface water, particularly the Kabul River, from marble effluent causing ecological disruptions, reduced aesthetics, water pollution, and crop failures due to limited awareness and treatment infrastructure. Improved wastewater management, regulatory supervision, and community knowledge are needed to reduce these consequences.

**Keywords:** Wastewater; Heavy metals; physicochemical; marble industries; Khyber Pakhtunkhwa