**BACKGROUND**

Treatment of wastewater from HMs is becoming a concern of an increasing prominence. Trace amounts of toxic HMs would contaminate large volumes of water, an issue that makes the removal of these ultra-trace pollutants from wastewater a ‘challenge’. Green adsorbents play a crucial role in water remediation nowadays.

**OBJECTIVES**

- To study the adsorption capability of date pits (DPs) (raw; RDP and burnt; BDP) as a green adsorbent in removing Cu²⁺ ions from aqueous solutions.
- Fractional factorial design (2ᵏ⁻¹, FFD) is used to optimize the adsorption conditions (Scheme 2);
- Significant variables will be used to maximize the % HM removal;
- To propose an adsorption mechanism following the characterization of the adsorbent using FTIR, TGA, SEM/EDX.

**GOALS AND OBJECTIVES:**

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**MATERIALS and METHODS**

**Software:**

- Minitab®17 software (Minitab Inc., State College, Pennsylvania, USA)
- ZEN* 2.3 lite Digital Imaging Software (Carl Zeiss, Germany)

**Adsorbent Preparation:**

- Date pits (DPs) have been washed with distilled water and then hot distilled water many times then dried.
- Dried DPs were crushed and grinded into a fine powder.
- Half of the grinded DPs quantity were burnt in the furnace at 700°C for 30min.

**Experimental Design:**

- The effect of pH, AD, HMC and CT have been studied comparing them (pH and AD) affect HM removal positively while the interaction between them (pH and AD) affect negatively.
- Responses of each HM adsorption% were comparing with the factors has been concluded by regression equation.

**RESULTS and DISCUSSION**

**Figure 1:** ICP-OES results in a bar chart comparing the adsorption% of each HM for raw and burnt DPs.

**Figure 2:** Pareto Chart for fractional factorial design after adsorption of Cu²⁺ by BDP.

**Figure 3:** SEM micrographs of (A) RDP and (B) BDP in 5000x magnification.

**Figure 4:** TGA of crushed RDP.

**Figure 5:** EDX analysis of (A) RDP and (B) BDP in 3000x magnification.

**Significance:**

- Water security in Qatar has a top priority as one of the national grand challenges.
- Features of wastewater in Qatar are very unique as it originally coming from desalinated water, a very expensive source indeed.
- Absence of certified laboratories targeting ultra-low organic and inorganic contaminants is a key challenge.

**Post-project Plans:**

- Apply to large scale.
- We have already started removing other species like anions, dyes, etc.

**CONCLUSION**

- The effect of pH, AD, HMC and CT have been studied and optimized by conducting a 2³⁻¹ design.
- Results showed that each of pH and AD affect HM removal positively while the interaction between them (pH and AD) affect negatively.
- The relation between adsorption of copper ions (Y) with the factors has been concluded by regression equation.

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