Adsorption & desorption of Chromium Cr (VI) On Activated Carbon Derived from Orange Peels

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Outline

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Adsorption

Adsorbent + Adsorbate
(Cr VI)
Adsorption

Adsorbent + Adsorbate (Cr VI)

Cr+6 ions
Desorption

Adsorbent + Desorbed metal (Cr VI)
Introduction

Industrialization, urbanization, & technological advancements resulted in contamination of heavy metals in Pakistan. There are about 800 tannery industries, ranked as the highest pollutants containing...
Chromium is one of the highly toxic heavy metals and a priority pollutant.

Hexavalent chromium (Cr\(^{6+}\)) is more toxic than Cr\(^{3+}\) and considered of most concern because of its proven carcinogenicity in humans.

Cr poses a high risk to public health and ecosystem because of its persistence nature, carcinogenicity, and bioaccumulation.

International Agency for Research on Cancer (IARC) report published in 2018 suggest that chromium is Group 1 occupational carcinogen.
Problem statement
Problem statement

- Cr+3 is an essential metal necessary to sustain life.
- Cr+6 is carcinogenic and toxic metal. It deteriorates the water quality.
- Use of cost-effective and ecofriendly technique to remove & recover the metal for re-use.
Hypothesis
Hypothesis

If Orange peel derived activated carbon is used as adsorbent, it would be effective due to its ability to remove Cr from wastewater and the easy desorption would also aid in recovery of chromium to be reused.
Mining; An Energy Intensive supply chain

**Exploration**
Determine the presence of mineral source

**Drilling/Blasting**
Use of heavy machinery and explosives

**Machinery**
Machinery run on fossil fuel that utilizes energy

**Pulverization**
Accounts for 40% of mining’s energy

**Processing**
Cycle to ensure the metal is economically recovered from the ore.

**Water**
Water to separate minerals requires a lot of energy
Energy conservation

Adsorption & Desorption cycle

Treat wastewater (Cr removal)

Cr recovery & reuse of adsorbent

Added to value chain products

Energy requirement for mining is reduced
Methodology

Sun dried Orange Peels → Carbonized → Activated carbon (Adsorbent) → Cr + Adsorbent

Adsorption by UV Spectroscopy

AC with Cr adsorbed + Desorption liquid → Desorption

Chromium is recovered
Adsorbent can be reused
CHROMIUM REMOVAL USING ORANGE PEELS

The adsorption of Cr (VI) was found to be maximum for OPAC bio sorbent and its highest removal yield (66.8%) (Tovar et al., 2018).

DESORPTION OF CHROMIUM

The result showed that desorption efficiency of HCl for Cr(VI) ions was about 76.1% (Bayuo et al., 2020).

BATCH EXPERIMENTATION FOR Cr REMOVAL

The result showed that for increase dosage removal of Cr increased from 30% in 30 min of time to 100% in 30 min of time (Giri et al., 2021).

ORANGE PEEL AS NATURAL ADSORBENT

The results showed that the adsorption capacity was observed to be 80.43% for Cr(VI) using orange peels (Pavithra et al., 2021).
Findings

- Adsorption–desorption studies performed for the removal of chromium (VI) ions from wastewater using orange peels.
- Selected adsorbent is useful considering the economic and environmental aspects of wastewater treatment.
- Wastewater is a rich source of valuable chemicals of industrial importance. Their economic recovery is crucial for sustainability.
- Recovery of Chromium and its reuse reduces the requirement of energy for mining.
Thank you