



**DESTRUCTION OF HEAVY AND POISONOUS
METAL IONS (CHROMIUM, LEAD AND ARSENIC)
BY MEANS OF BIOSORBENT PROPERTIES OF
ALGAE**

¹Azimov Yo,X, ²Alibekova M.R. ³Ermatova A.A,
³Kasimov Sh.I, ³Umirova N.O, ⁴Amanlikova S.M.
Gulistan State University

¹Teacher of the Department of Chemistry Gul SU,

²Teacher of the Department of Biology Gul SU,

³Associate Professor of the Department of Kimyo

⁴2- school chemistry teacher.

Abstract: *Extractive substances contained in algae can be used as effective natural biosorbents in the biosorption of ions of heavy and toxic metals (chromium, lead and arsenic). This thesis studies the mechanisms of separation of heavy metal ions from algae-based water. Processes such as ion exchange, calcium formation, and electrostatic interaction provide biosorption efficiency.*

Keywords: *Biosorption, heavy metals, chromium, lead, arsenic, algae, ecological treatment, isothermal models, biosorbent, water environment treatment.*

Main part. Pollution of the aquatic environment with heavy metal ions is one of the environmental problems. In particular, ions of chromium (Cr), lead (Pb) and arsenic (As) enter water bodies through industrial waste and pose a serious danger to living organisms. In order to effectively disinfect these metal ions, biosorbents are studied, including extractive substances contained in algae. [1,2].

The biomass of algae, especially brown, green and red, plays an important role as a natural biosorbent. They contain polysaccharides (alginates, carrageenan, fucoidene), proteins, phenolic compounds, and cell wall structural components capable of binding heavy metal ions. These extractives absorb metal ions and increase their efficiency during separation from water. [3,4].

Study results:

The biosorption process is based on several basic mechanisms. Ion exchange occurs through electrostatic interaction between the functional groups of algae (carboxyl, sulfate, amine and hydroxyl) and metal ions. In addition, heavy metal ions are adsorbed onto the biosorbent surface by calcium formation and complex bonding. In addition to natural conditions, its effectiveness is influenced by factors such as pH, temperature, metal concentration and surface area of the biosorbent.

Chromium ions are commonly found in the Cr (III) and Cr (VI) forms. Although Cr (III) is biologically harmless, Cr (VI) has strong toxicity. Phenolic compounds in algae help neutralize Cr (VI) by returning it to Cr (III). Lead ions combine with algae polysaccharides and separate from the environment. Arsenic ions, especially As (V), undergo biosorption when interacting with cell wall components.

This natural biosorption process is of great importance in environmental protection. Algae-based biosorbents are more environmentally friendly and cost-effective than traditional chemical application methods. They can also be recycled and reused.

Methods for improving the biosorption process

1. chemical modification. As a result of treatment of algae with extractive substances with various reagents (acids, bases or metal complexing substances), it is possible to improve their surface area and bind metal ions. For example, enrichment of alginate or carrageenan polysaccharides with amino acid groups enhances their ability to bind lead and arsenic ions.

2. nanoparticle modification. The combination of algae biosorbents with nanoparticles significantly increases their sorption capacity. For example, biosorbents with iron oxide (Fe_3O_4) nanoparticles can be used to efficiently recover arsenic ions.

3. biological activation. Enzymatic or microbiological treatment of the cell wall of algae can increase their porosity and enhance interaction with heavy metal ions. At

the same time, with the help of special microorganisms, polysaccharides contained in algae are hydrolyzed and active functional groups are formed.

4. Physical treatment - As a result of drying, grinding and treatment of algae with ultrasonic waves, their surface area increases. At the same time, thermal treatment at high temperatures destroys some organic components and increases the ability to biosorption.

Conclusion

The results of this study show that biosorption technology can be used to clean up industrial waste, improve drinking water quality and ensure environmental sustainability. Future research should focus on the development and real-world testing of more efficient methods for modifying biosorbents in algae.

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