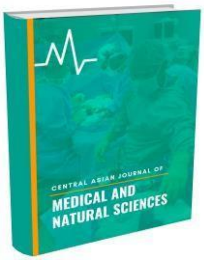

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Article

The Study Focuses on Advanced Chemical Treatments for the Removal of Pb and Cd From Industrial Effluents in Mosul.

Hamsa Zeyad[1], Ayman Albanna *, Arqam Alomari[3]

1, 2 College of Environmental Sciences, University of Mosul, Iraq
3 College of Agriculture and Forestry, University of Mosul, Mosul, Iraq.
* Correspondence: hamsa.22evp8@student.uomosul.edu.iq

Abstract: The study looks at the ability of ammonium molybdate to remove lead and cadmium from industrial wastewater in Mosul. It uses a 2% solution, which often produces contaminated sewage. Standard curves for Pb and Cd were generated using atomic absorption spectroscopy, which showed good linearity for absolute metal concentrations in environmental samples The study found considerable variation in metal concentrations across sites, with Cd concentrations ranging from 0.0303 to 0.2128 ppm/ml and Pb concentration ranged from 0.0303 to 0.2128 ppm/ml from 0.00591 to 8.6604 ppm/ml The severe case of heavy metal pollution in normal water It was revealed that the application of Ammonium molybdate treatment resulted in significant decreases in the concentrations of complex reactive compounds and Pb and Cd Follow-up analyzes showed that the average concentrations of Pb and Cd, with significant decreases at specific sites. The study highlights the effectiveness of ammonium molybdate in precipitation and removal of heavy metals from wastewater, suggesting its potential for industrial pollution control and pollution control strategies. It recommends further research to consider long-term environmental sustainability and explore integrated approaches to wastewater management, thereby enhancing environmental protection and regulation a compliance has increased.

Keywords: Heavy metal pollution, Atomic Absorption, Remediation, Chemical complex

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1. Introduction

Industrial expansion in Mosul has led to a sharp rise in pollution, especially heavy metals such as lead and cadmium, which pose serious threats to the environment and human health, and require effective measures a method of treatment [1, 2]. Ammonium molybdates are a cost-effective, effective solution for decontamination of various processes [3]. Ammonium-molybdate is a simple and effective method of water treatment in Mosul, because it forms insoluble solids with Pb and Cd, and allows removal with rain This method is ideal for large amounts of water flowing through a flow stream quickly without sophisticated equipment or high energy costs In addition to being the best choice, it involves the issues of sludge production, which is a challenge that it is common with many pharmaceutical methods [4,5]. Ammonium molybdate, a low precipitant, simplifies waste management and reduces the cost of sludge disposal, making it increasingly important for sustainable industrial practices And the low environmental impact is consistent with international pollution control standards that use methods that reduce secondary pollution and enhance environmental sustainability the first meets regular option [6]. The study investigates the use of ammonium molybdate in the treatment of industrial wastewater contaminated with Pb and Cd in Mosul. It analyzes rainfall patterns, optimal operating conditions, and compares this method with conventional methods. The aim of the study is to demonstrate the potential of ammonium molybdate as a transformative solution for industrial management of heavy metal pollution, contribute to environmental management and improve water quality in industrial areas.

2. Materials and Methods

The study site and sample collection were as follows:

Wastewater samples were collected from an industrial landfill in Mosul for analysis of heavy metal contamination, treated of each sample was frozen, thawed and sent to the laboratory for analysis to prevent chemical changes [7].

Treatment Chemical formulation:

Ammonium molybdate tetrahydrate was dissolved in deionized water to form a 2% ammonium molybdate solution, which was selected for its high reactivity with copper and cadmium and acted as a solvent [8].

Experimental setup:

Control and test setup samples were prepared, and treated with 2% ammonium molybdate solution at 25°C for one hour to ensure proper mixing for effective interactions [9, 10].

Developing a standard curve for atomic absorption spectroscopy (AAS) requires a specific curve for a specific analytical method:

The analyzes determined the concentrations of Pb and Cd in wastewater samples and were determined using standard solutions at different concentrations. The absorbance of each standard was measured using AAS, and standard curves were constructed. These curves are important for defining metal concentrations in treated and untreated wastewater in order to compare and calculate removal efficiencies [11].

The process of quantifying metals involves analyzing the amounts of various metals in different materials:

Initially, the concentrations of copper and cadmium in samples were determined by AAS before treatment After ammonium-molybdate treatment, the samples were separated and reassayed with AAS.

Analytical Procedure:

After treatment, the samples were filtered with a 0.45 μm membrane to remove particles and precipitates, ensuring that only dissolved metals were measured Standard curves for Pb and Cd on AAS were analyzed on filtered samples in [12].

Data analysis:

The study investigated the removal efficiency of ammonium molybdate for Pb and Cd from wastewater, compared their concentrations before and after treatment and investigated its significance.

3. Results and Discussion

One study examined the effectiveness of ammonium molybdate in removing lead and cadmium from industrial wastewater in Mosul through 18 sites. Standard curves for Pb and Cd were determined using atomic absorption spectroscopy for absolute quantification.

Standard curves for Pb and Cd were constructed using absorbance measurements from standard solutions at concentrations ranging from 0.5 to 4 ppm. The curves showed good linearity, with R2 values greater than 0.99, indicating a strong correlation between concentration and absorbance, which is important for reliable quantification of metals in environmental samples (Figure1)

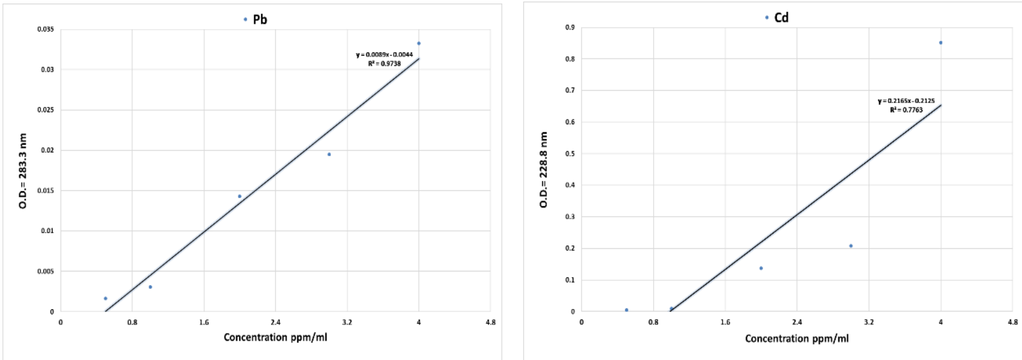

Fig. 1. Standard curves for lead and cadmium show the relationship between wastewater concentration and absorption, allowing accurate quantification of these metals before and after treatment.

An analysis of wastewater samples from 18 industrial sites in Mosul revealed considerable variation in lead and cadmium concentrations before treatment Cadmium concentrations ranged from 0.0303 ppm/mL at 9 to 0.2128 ppm/mL at 16. Lead concentrations varies greatly indicating the impact of various industrial activities on wastewater quality , with the lowest readings at site 12 and the highest at site 7, indicating severe pollution at specific sites(figure 2).

The study highlights the heterogeneous nature of heavy metal contamination in industrial wastewaters and highlights the serious challenges in terms of effective management. It highlights the urgent need for targeted treatment solutions to mitigate the environmental risks associated with heavy metal disposal.

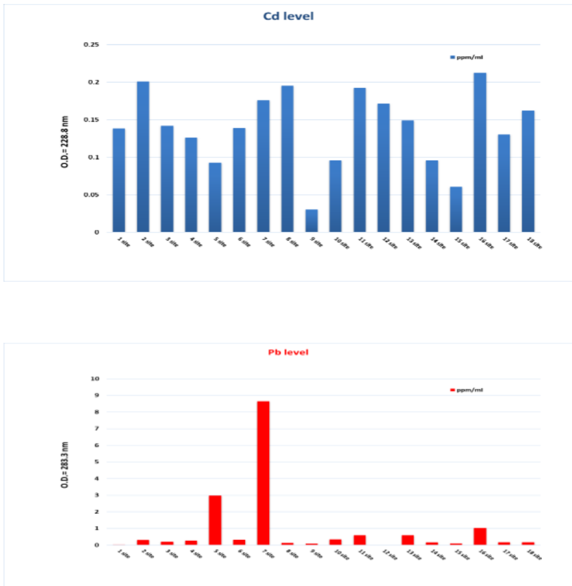

Fig. 2. The study revealed a wide range of heavy metal contaminants at 18 industrial sites in Mosul, highlighting the need for further investigation using nuclear

In the laboratory experiment, a 2% solution of ammonium molybdate was used to treat lead and cadmium from contaminated samples and the solution was extracted into a standard solution of Pb and Cd, forming chemical and metal ions work. These reactions led to the formation of solid chemical precipitates. In the case of cadmium, reaction with ammonium molybdate resulted in precipitation and milkiness, indicating dissociation of cadmium from the solution In the case of copper, interaction gave the solution a yellowish color, effectively removing copper ions. The treatment method significantly reduced the concentrations of Pb and Cd in the samples, indicating its effectiveness in inhibiting heavy metals in industrial effluents. (figure 3).

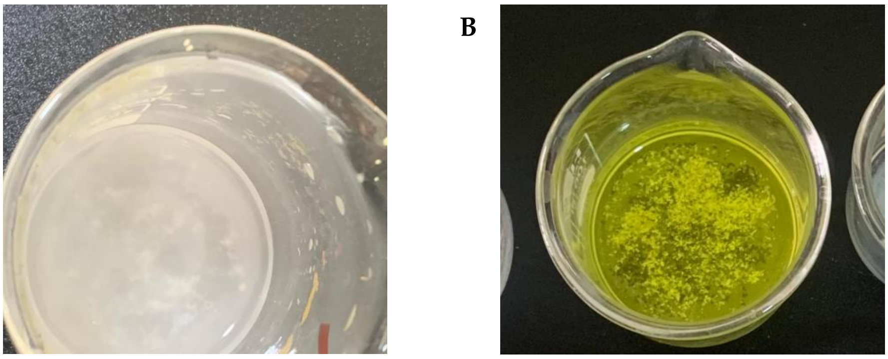

Fig 3. A. The interaction between ammonium molybdate and cadmium produces water droplets and milk & B. Ammonium molybdate and lead solidify, turn yellow, and precipitate from solution.

Ammonium molybdate was added to wastewater samples and analyzed by atomic absorption spectroscopy. That treatment resulted in a 95% reduction in heavy metal concentrations, with significant reductions in Cd concentrations at Sites 1 and 16, and Pb at Sites 1 and 7. This procedure resulted in the removal of cadmium and copper from engineering it thoroughly separated it from the dirty waters, and it showed its power The significant reduction in all sites confirms the stability and reliability of this treatment modality. These data indicate that ammonium molybdate can be used on-site to treat water contaminated with hazardous levels of lead and cadmium, thereby enhancing environmental safety and compliance with regulatory standards.

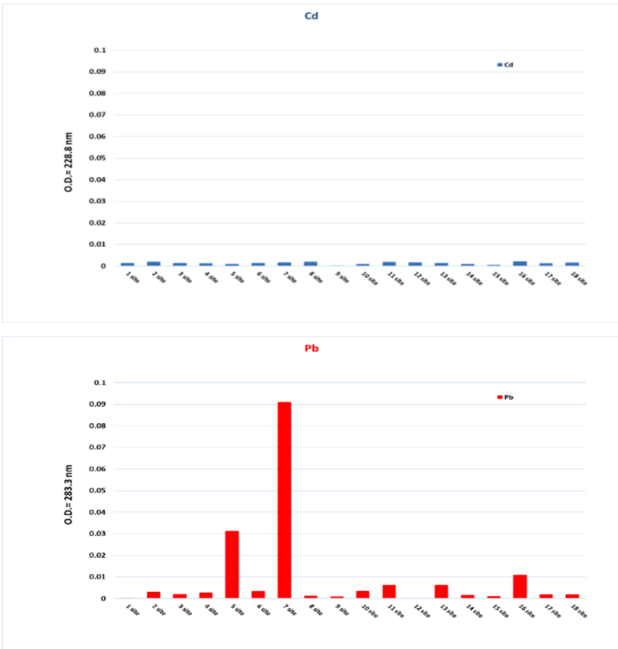

Fig. 4. The ammonium-molybdate treatment significantly reduced cadmium and lead concentrations in industrial areas of 18 Mosul, showing a 95% efficiency in precipitation and removal of these contaminants from wastewater.

Ammonium-molybdate treatment effectively treated lead and cadmium-contaminated industrial wastewater, resulting in an average reduction of 95% at 18 sites [13]. The significant decrease in ammonium-molybdate heavy metal levels highlights its potential as a potent inhibitor under industrial conditions [14]. Ammonium-molybdate can reliably release heavy metals from wastewater to groundwater, reducing potential environmental and health risks, as contamination always results in quantity testifies to it [10]. The study shows that the use of ammonium molybdate in pollution control strategies can effectively reduce environmental damage, especially in places like Mosul [15, 16]. Further studies could examine the long-term effects of these treatments on local ecosystems and develop integrated wastewater management systems combining chemical and biological remediation methods.

4. Conclusion

this study concludes that ammonium molybdate is a highly effective precipitating agent for reducing heavy metal contamination, particularly Pb and Cd, in industrial wastewater. Its effectiveness in lowering heavy metal concentrations by up to 95% underscores its potential as a practical and efficient solution for managing industrial waste containing heavy metals. Furthermore, the study suggests that the use of ammonium molybdate not only provides advantages in terms of precipitation efficiency but also contributes to more sustainable environmental management by reducing the negative impacts associated with heavy metal pollution. Further research is recommended to investigate the long-term effects of ammonium molybdate use, particularly concerning residue accumulation in local ecosystems and its potential application on a larger scale across various industries.

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