Asian Journal of Scientific Research and Innovations
ISSN: 2715-xxxx (online) | IF: 10.23 | Vol: 1, issue 1
Available: http://asiansciencejournal.org

UDC: 661.152

STUDY OF THE CHEMICAL PROPERTIES OF INDUSTRIAL WASTEWATER TREATED WITH COAGULANTS DERIVED FROM IRON-BEARING ORES OF THE KYZYLKUM DEPOSIT

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Abstract: This paper focuses on the development of novel coagulants utilizing mineral resources from the Kyzylkum region, alongside an evaluation of their fundamental physicochemical characteristics. Additionally, the efficiency of these synthesized agents in removing suspended and colloidal matter from industrial effluents is thoroughly investigated. The study also details experimental findings on producing iron(III) chloride through the hydrochloric acid leaching and decomposition of the base ore.

Keywords: Industrial and wastewater, coagulation reagents, colloidal-dispersed systems, Kizilkum deposit ore.

Modern water treatment relies on complex physicochemical technologies employing a wide range of reagents, filtration materials, and equipment solutions. The quality of targeted water preparation directly depends on the specific physicochemical interactions between the components of the source water and chemical agents. In such cases, predicting the behavior dynamics of impurities during purification can be challenging. To address this issue, the technological properties of water are determined through laboratory testing (trial softening, coagulation, stabilization, etc.). Such analysis minimizes costs and identifies optimal chemical dosages, ensuring superior purification efficiency and revealing the kinetics of suspended matter sedimentation. These data are critically important for designing the dimensions of treatment tanks and calculating water flow rates.

Parameters	Unit of Measurement	Content	MPC	Quantity After Treatment
pH	mg/l	7.64	4.5–9	7.32
Mineralization	mg/l	1360	1000	840
Al	mg/l	0.048	0.04	0.035
Cu	mg/l	0.00125	0.001	0.00089
Zn	mg/l	0.012	0.01	0.0093
Co	mg/l	0.001	0.001	0.00089

Parameters	Unit of Measurement	Content	MPC	Quantity After Treatment
Cr	mg/l	0.022	0.02	0.018

Fig. 1. Results of industrial wastewater analysis

Coagulation plays a primary role in basic water preparation, reducing the concentration of colloids and coarse suspended matter.

In the context of radiation safety, this process serves as an effective co-precipitation method, enabling the binding and removal of radionuclides together with conventional contaminants. In the nuclear industry, this method is applied in two variations — as bulk coagulation or co-precipitation with crystalline phases.

CONCLUSION

1. **Development of new reagents:** Iron-containing ores from the Kyzylkum region were used as a readily available mineral raw material to successfully synthesize effective coagulants (in particular, iron(III) chloride) via hydrochloric acid leaching. Their basic physicochemical parameters were studied, confirming the high reactivity of the resulting compounds.
2. **Wastewater treatment efficiency:** Technological analysis demonstrated the high effectiveness of the developed coagulants in treating industrial wastewater from coarsely dispersed, suspended, and colloidally dispersed systems. Optimal reagent dosages were experimentally established, ensuring maximum intensification of the precipitation and sedimentation processes.
3. **Changes in physicochemical properties:** Analysis of industrial water samples before and after treatment revealed a significant improvement in their hydrochemical parameters. A reduction in total mineralization (salt content) and the concentration of harmful impurities to values meeting Maximum Permissible Concentration (MPC) requirements demonstrates the promise of implementing these coagulants in recirculating water supply systems and environmental safety schemes at industrial enterprises.

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