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# Comparative analysis of conventional coagulation and electrocoagulation for polluted water treatment

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## INTRODUCTION & AIM

The chemical coagulation (CC) process is a fundamental step in conventional water treatment plants (WTP) for potable water production (**Fig. 1**). However, high footprint, chemicals need, and sludge management can limit its implementation in remote areas (de Jesus et al., 2024). In this scenario, electrocoagulation (EC) could be an option due to its advantages over the CC method.

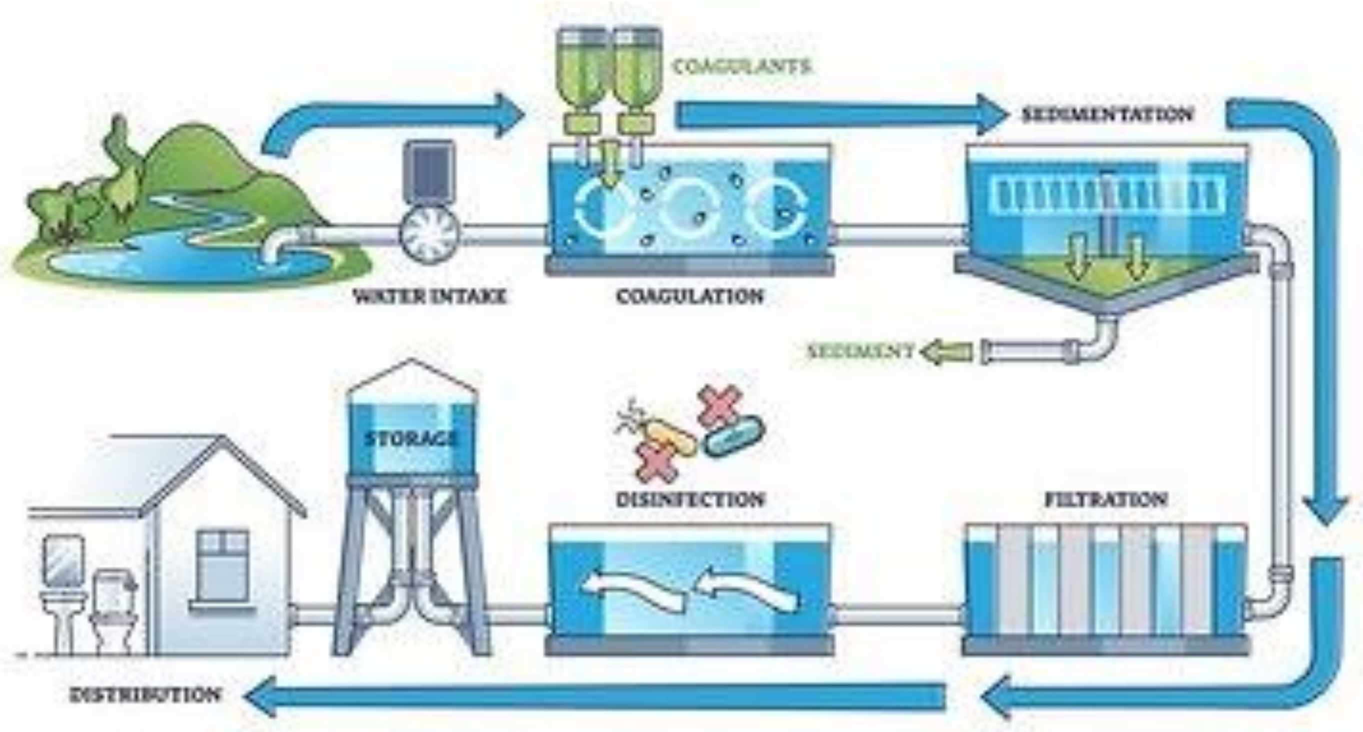


**Fig. 1** – Diagram of a conventional WTP for drinking water production. (de Jesus et al., 2024).

This work comparatively evaluates the chemical coagulation (CC) and electrocoagulation (EC) processes for polluted water treatment.

## METHOD

Polluted synthetic water was prepared (pH = 7, 365–357 mg Pt-Co $L^{-1}$). Jar tests were conducted using aluminum sulfate as a coagulant (100 – 1600 mg $Al_2(SO_4)_3$ $L^{-1}$, pH = 4 – 9). The EC test was performed using a lab-scale device (**Fig. 2**). Aluminum electrode plates (15 x 3 x 2 cm) were connected in parallel, and a distance of 30 mm was maintained. The treatment performance was evaluated based on true color removals (2120-C method – (APHA; AWWA; WEF, 2023).

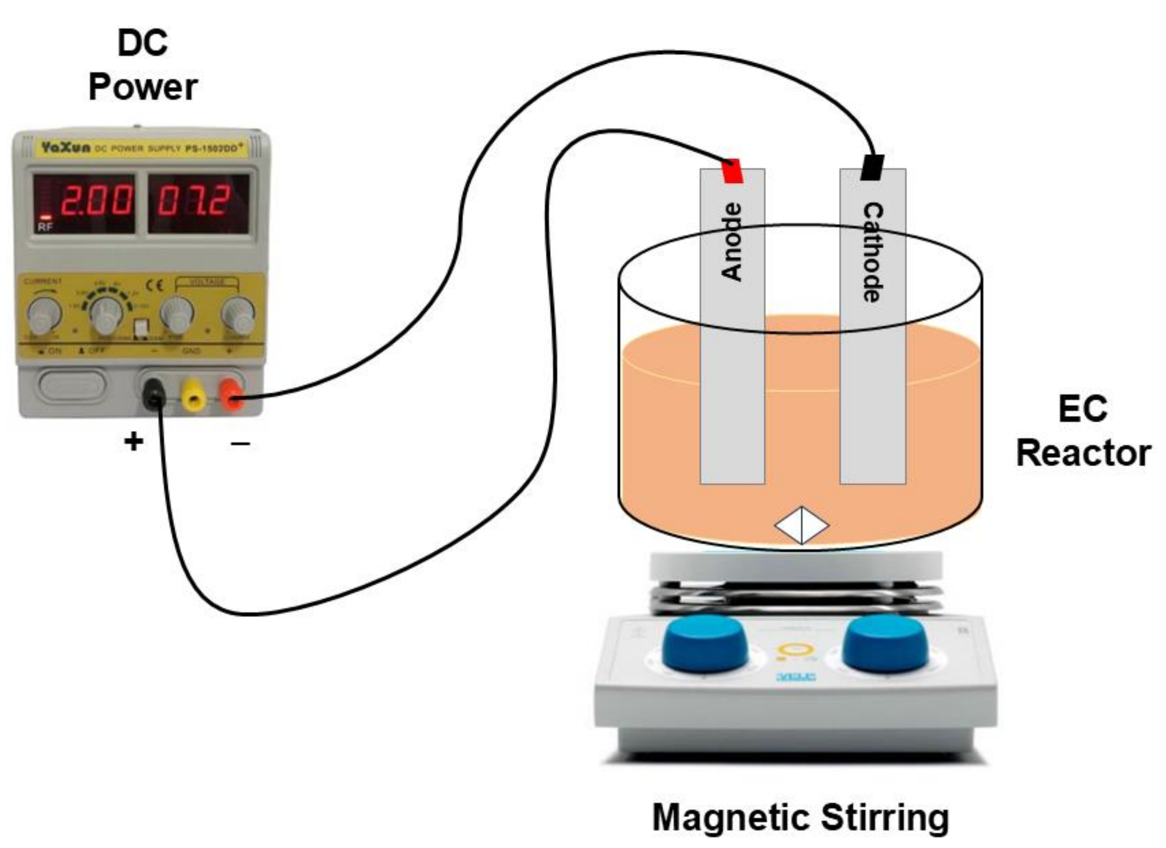


**Fig. 2** – A basic schematic of the EC device. EC = electrocoagulation.

Operating costs were calculated based on chemicals utilization for CC (aluminum sulfate and sodium carbonate) and EC energy consumption under optimum conditions.

## RESULTS & DISCUSSION

**Tab. 1** – Color removal and operating costs of CC and EC processes.

| Process | Conditions | Color removal (%) | Operating costs (USD m-3) |
|---|---|---|---|
| CC | pH = 7.0; 800 mg $Al_2(SO_4)_3$ $L^{-1}$ | 94 | 0.130 |
| EC | pH = 7.0; 350 mA; 40 min | 88 | 0.583 |

The EC method with Al and Fe electrodes has shown removal efficiencies of 52 – 100% of color (Al-Hanif and Bagastyo 2021). In this study, 88% of color was removed.

As expected, EC had higher operating costs due to its higher energy requirements than the CC. In addition, the EC is negatively affected by the low conductivity of polluted water; Therefore, an optimum amount of conductivity that allows the passage of current without excessive electricity consumption is critical (Othmani et al. 2022).

## CONCLUSION

The EC owned higher operating expenses than the CC process. However, EC may be attractive in remote settlements since modular and efficient systems are needed to guarantee drinking water production. No chemicals are required in this process, the treatment is automated, and less sludge is generated. The utilization of alternative energy sources can increase EC's cost-effectiveness.

## FUTURE WORK / REFERENCES

Future studies will focus on integrating EC and membrane-based treatments in modular set-ups. Decentralized water treatments can promote safe potable water, sanitation, and hygiene (WASH) in remote sites. Safe WASH is a prerequisite to health and for developing resilient communities.

Al-Hanif, E. T., and A. Y. Bagastyo. 2021. “Electrocoagulation for Drinking Water Treatment: A Review.” IOP Conference Series: Earth and Environmental Science 623(1): 012016.

Othmani, Amina et al. 2022. “A Comprehensive Review on Green Perspectives of Electrocoagulation Integrated with Advanced Processes for Effective Pollutants Removal from Water Environment.” Environmental Research 215(September): 114294.

de Jesus, José Oduque Nascimento et al. 2024. “Water Treatment with Aluminum Sulfate and Tanin-Based Biocoagulant in an Oil Refinery: The Technical, Environmental, and Economic Performance.” Sustainability 16(3): 1191.