Potential Lifespan Increase of Membranes used for Wastewater Treatment by Electrocoagulation

Dr. Wafa Al Rawahi , Dr. Dr.Abdul Rahim Al Umairi, Ghusoon Al Siyabi, Al-Jalila Al Shukili, Omima Al Subhi, Anoud Al Qari
Chemistry Section, Applied Sciences Department, Higher College of Technology, University of Technology and Applied Sciences. Oman.

ABSTRACT

Electrocoagulation technology can treat pollutants without the need for coagulants. Coagulation takes place when current is applied and is capable of eliminating small particles. Additionally, electrocoagulation may reduce waste residue accumulation. In this project, treatment of domestic wastewater (DWW) by electrocoagulation (EC) was investigated. The samples were supplied from the HAYA domestic wastewater pre-treatment plant. Experimental studies were conducted to determine the optimum operating conditions, that achieved the maximum removal, such as electrode type, treatment time, turbidity. This study focusses on having electrocoagulation process treatment within the process of membrane using iron Fe electrode. Water treatment using electrocoagulation will be conducted before going to membrane to improve the efficiency of the membrane and facilitate the process of the treatment. The nitrate and phosphate removal reached 59% and 45% respectively at 60 min in a continuous process. The highest removal of iron was in continuous process around 90% at 5 min. And for Mg removal, it reached 20% at 60 min with digestion with a currant of 220 mA and 1 cm electrode distance. The % Removal of metals increase with the increase in the voltage. The removal of Fe, Mg, phosphate reached to 41%,89% and 98% respectively.

INTRODUCTION

- Domestic wastewater treatment is critical today. It is easier to ensure that all wastewater is managed properly so that it can be returned to the atmosphere, water bodies or lakes safely and hygienically.

- **Wastewater treatment**

❑ It is a process that eliminates toxins from wastewater, promoting a safe environment and public health. It involves managing wastewater to preserve the environment, public health, economic, social, and political stability.

❑ Treatment facilities can handle residential, municipal, and industrial wastewater, with leachate treatment plants and other facilities falling under this category.

- **The parameters effecting electrocoagulation process**

Operating time, pH, temperature and effect of initial concentration and COD

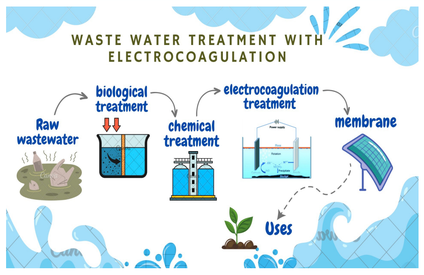


Figure 1: wastewater treatment with electrocoagulation

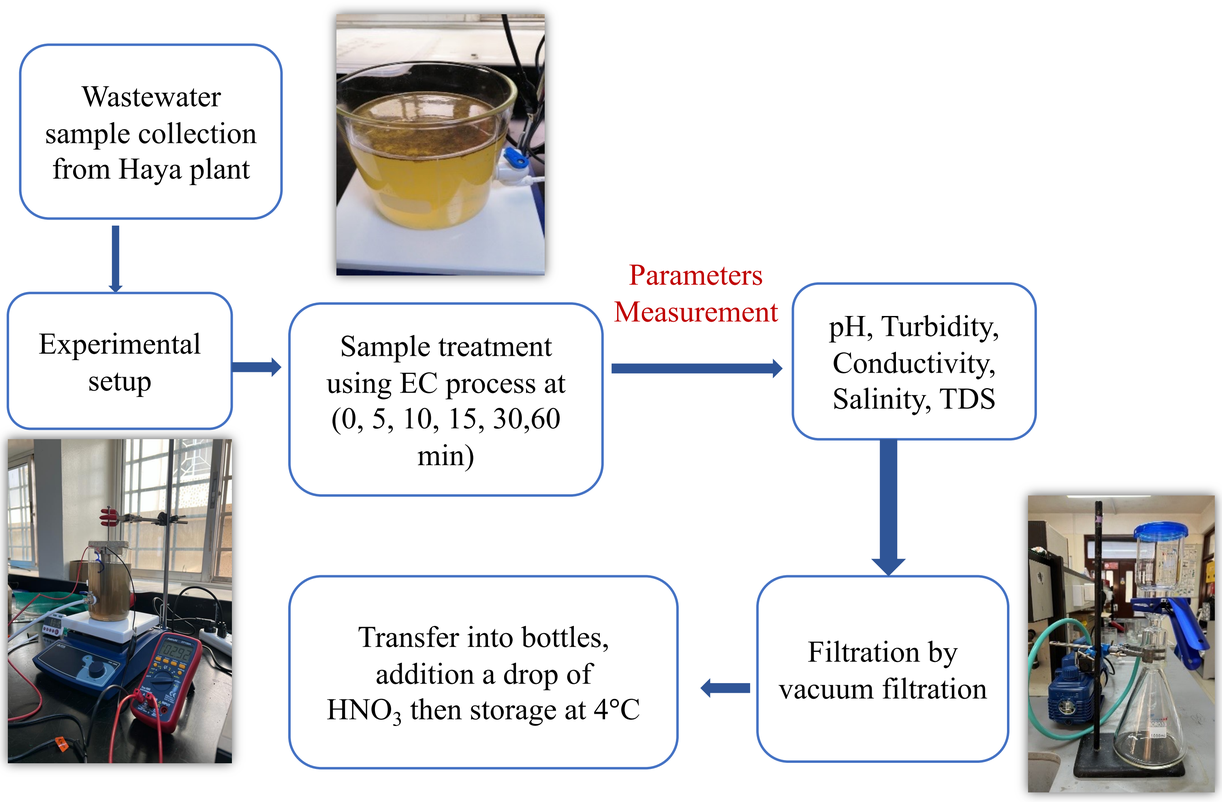
AIM AND OBJECTIVES

The aim is to reduce the pollutants in the wastewater to enhance the lifespan of the membrane during the wastewater treatment process:

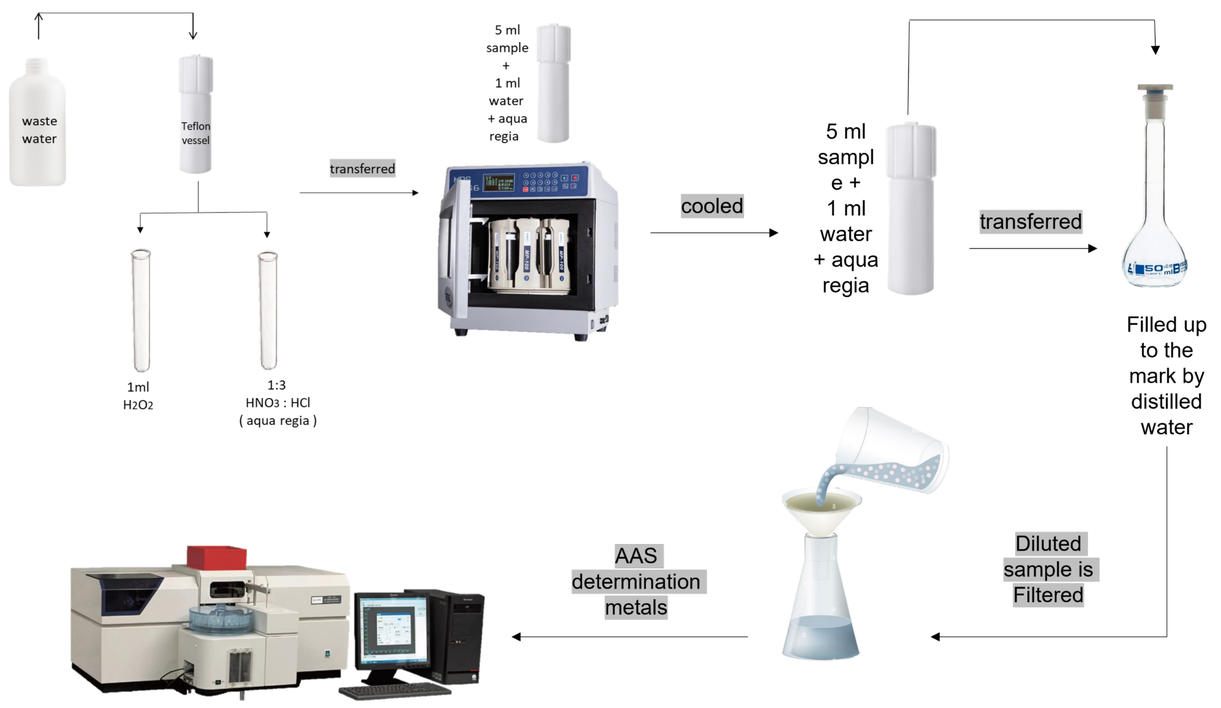
- Designing the experiments
- Preparing the electrodes and the set-up
- Measuring pH, EC, NO_3^- and PO_4^{3-}
- Running electrocoagulation process in batch and continuous time in different voltage

METHODOLOGY

1. Electrocoagulation treatment



2. Wastewater acid digestion using microwave



RESULTS

Figure 2: Effect of EG treatment on the removal of metals with and without digestion at batch and continuous process.

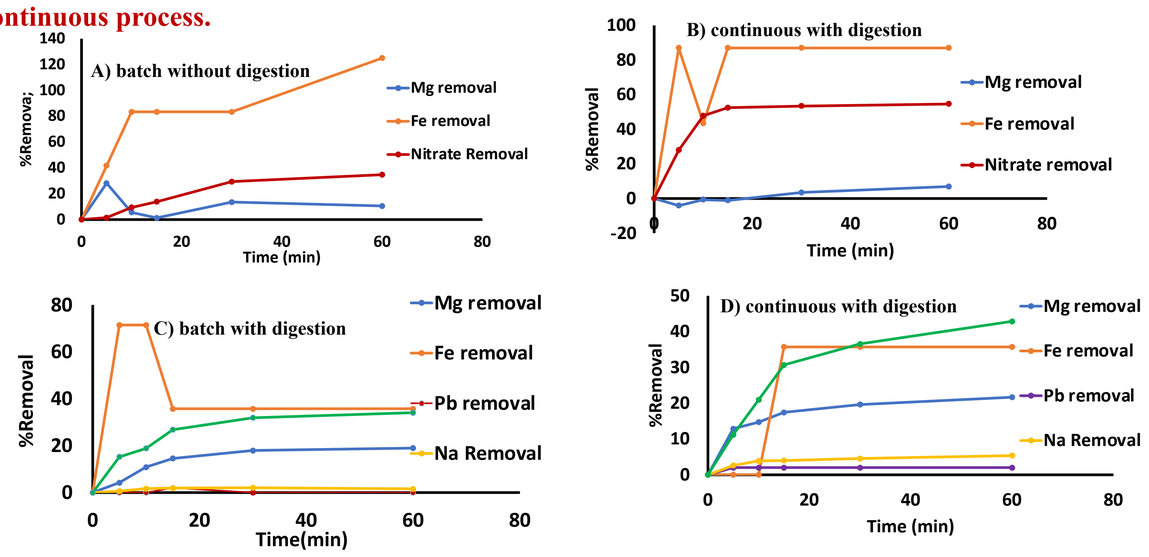


Figure 3: Effect of using different voltage in % removal of metals in EG treatment.

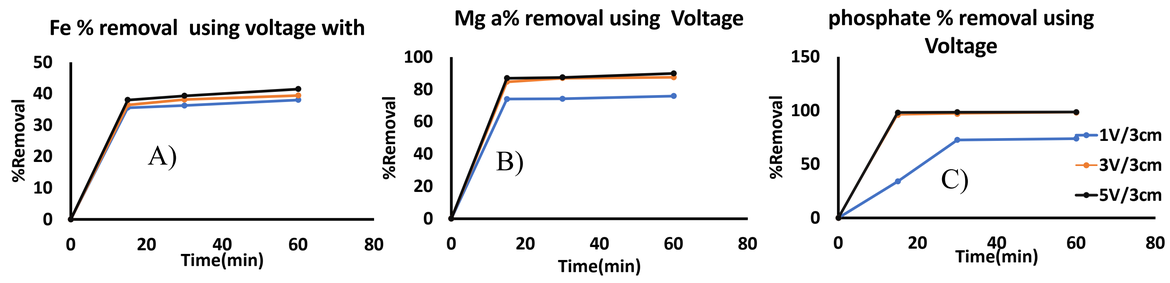


Table 1: Wastewater treatment batch process

Time	pH	Conductivity (mS/cm)	Turbidity (NTU) Before filtration	Turbidity (NTU) After filtration	TDs(g/L)	Salinity'
0 min	7.19	5.67	81.5	12.6	3.06	3.07
15 min	8.08	4.93	92.7	2.65	2.67	2.67
30 min	8.43	5.07	75.6	1.83	2.6	2.6
60 min	8.55	5.09	100	0.63	2.55	2.55

Table 2: Wastewater treatment continuous process

Time	pH	Conductivity (mS/cm)	Turbidity (NTU) Before filtration	Turbidity (NTU) After filtration	TDs(g/L)	Salinity'
0 min	7.92	5.68	22.1	1.91	3.01	3.01
15 min	8.3	5.15	46.9	1.04	2.66	2.66
30 min	8.4	5.23	75	0.39	2.35	2.35
60 min	8.32	5.24	179	0.19	2.12	2.12

RESULTS & DISCUSSION

- The highest removal of metals was in continuous process without digestion. Where nitrate removal reached 59% at 60 min in continuous process.
- Batch process, it reached 39% at 60 min.
- faster removal of iron was in continuous process around 90% at 5 min.
- Mg removal was almost the same in batch and continuous process without digestion.
- Slight removal of Pb and Na due to their low concentration in both processes.
- Phosphate removal increased from 35% in batch to 45% in continuous at 60 min with digestion.
- Phosphate has the highest removal which reached to 98% at 5V, 3cm.
- The %removal of Mg increased to 89%.
- Table 1shows the pH was almost neutral and there was a little change in conductivity around 5 mS/cm. and, there is slight decrease in turbidity, TDs, and salinity.
- There is no change in pH during the EC process which is approximately neutral and there is a slight decrease in the conductivity. Turbidity and salinity decreased with time (Table 2).

FUTURE WORK

Scaling up electrocoagulation process for wastewater treatment to improve the removal of pollutants, and and making the electrocoagulation process more efficient and effective by improving the design of electrodes, improving operating conditions, developing new materials used for the electrodes and using multi-electrodes. In addition to that, use renewable energy sources such as solar energy or wind energy to generate the electric current needed for this process and reduce the cost in general.

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