

# Salinity Reduction of Sarawak Brackish Peat Water Sources by Utilizing Electrocoagulation Treatment System with Enhanced Faradaic Efficiency

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## Abstract

Brackish peat water in Sarawak's rural coastal areas poses a serious treatment challenge due to changing salinity and high organic matter. Although electrocoagulation shows potential as a treatment method, its performance and reliability for this specific water source have yet to be thoroughly investigated. As such, this study aims to investigate the Faradaic efficiency of electrocoagulation treatment system in reducing salinity levels of Sarawak brackish peat water. Correspondingly, the objectives of this study include brackish peat water salinity characterization, Tafel analysis of aluminium corrosion, evaluating the effects of seawater percentages and applied voltages on Faradaic efficiency, and water quality analysis. Additionally, this study examines the salinity levels of Sarawak brackish peat water and its effect on aluminium corrosion using Tafel analysis followed by electrocoagulation treatment. The treatment efficiency was assessed through Faradaic efficiency and water quality tests with results compared to the Malaysia National Water Quality Standard. Subsequent, this study has found a linear correlation between salinity and seawater percentage, with salinity peaking at 19,300 mg/l at 100% seawater percentage. Tafel analysis also demonstrated that high seawater percentages could increase aluminium electrode corrosion owing to corrosion potential ( $E_{corr}$ ) reaching -1,256.82 mV and corrosion current density ( $I_{corr}$ ) rising to 308.607  $\mu$ A at 100% seawater. This study has also reported an optimal Faradaic efficiency of 95.63% was achieved at 10 V and 30% of seawater percentage. Moreover, the electrocoagulation system effectively reduced salinity levels which deemed suitable for domestic consumption under Class I of Malaysia National Water Quality Standards (NWQS). Overall, this study demonstrated the potential of electrocoagulation system as a

## 1. Introduction

Coastal peatlands in Sarawak are increasingly facing a shift in water quality as peat water sources becomes brackish due to seawater intrusion [1]. According to Wahab et al. [2], peat water originates from tropical peatlands which are water saturated ecosystems dominated by thick layers of partially decomposed plant matter accumulated under anaerobic conditions. In Sarawak, peat swamp forests produce a characteristics peat water that is naturally acidic, dark in colour, and rich in dissolved organic carbon, particularly humic and fulvic acid. Additionally, peat water presents inherent challenges for conventional water treatment methods due to its high organic content and low pH [3].

Brackish peat water, a distinctive and complex water resource prevalent in regions such as Sarawak, is formed through the interaction between freshwater from peatlands and brackish water resulting from tidal incursions [4]. The abundant dissolved organic matter and humic substances within peat soils imbue the water with dark coloration and acidic properties which complicate treatment by creating a matrix of variable salinity and complex organic contaminants Rahman et al. [5]. Salinity, in particular, plays a pivotal role in determining water suitability across various applications. High salinity levels could detrimentally affect water usability by accelerating corrosion in distribution systems by impeding agricultural productivity as well as compromising ecosystem balance [6]. Consequently, reducing salinity is essential not only for improving water quality but also for mitigating associated operational and environmental risks.

Electrocoagulation has emerged as a promising treatment technology for such complex waters [7]. Its mechanism involves the destabilization of suspended and dissolved contaminants, including humic substances and salts, through the generation of electrocoagulation flocs [8]. As reported by Zaied et al. [9], electrocoagulation treatment system has demonstrated significant effectiveness in removing both salinity and humic substances from various water sources due to its ability to destabilize and eliminate suspended and dissolved impurities through floc formation. Despite its effectiveness across different water sources, electrocoagulation systems often face challenges in terms of electrode fouling and passivation which degrades its performance and efficiency over time [10]. These issues arise from material deposition on the electrode surface which subsequently leads to passivation effects [11]. The accumulation of solids on the electrodes not only reduces the system overall efficiency but also increases energy consumption and operational costs [12].

According to Sahu et al. [13], Tafel analysis test could evaluate the resistance to localized corrosion and the rate of electrode degradation and passivation. The corrosion curves generated from such studies typically include distinct regions, such as the active corrosion zone and the flade potential, where current density decreases [14]. Although Tafel analysis has been employed to evaluate the resistance to localized corrosion and quantify the rate of electrode degradation, the resulting corrosion curves reveal complex behavior, including distinct active corrosion zones and regions of decreased current density, that are not yet fully understood in the context of electrocoagulation treatment [15], [16], [17], [18]

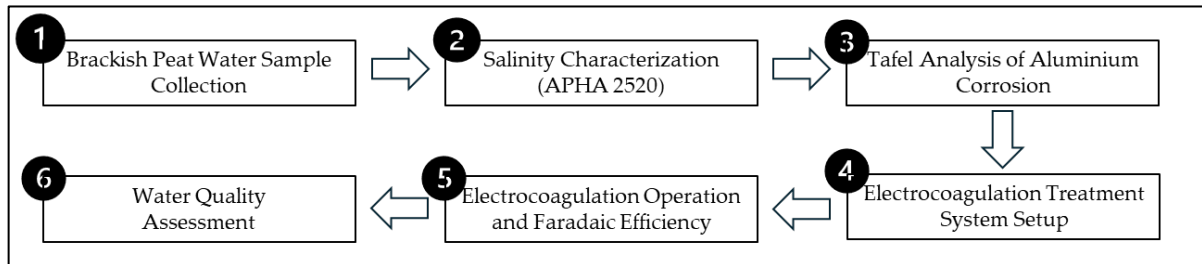
Faradaic efficiency denotes the proportion of electrical charge that is effectively utilized to drive the target electrochemical reaction. In electrocoagulation systems, it serves as a critical parameter to assess the efficiency of coagulant generation from electrode dissolution. Despite its importance, Faradaic efficiency remains a frequently overlooked aspect in many published studies which limits a full understanding of electrocoagulation system performance and optimization potential. This oversight is further complicated by findings from Trompette and Lahitte [19], who reported that anion-specific interactions could cause Faradaic efficiency to exceed or fall below 100% which highlights the complexity and variability of electrochemical behaviour in real systems. Besides, a study carried out by Chow et al. [20] also identified a significant research gap concerning the quantification and optimization of Faradaic efficiency in electrocoagulation systems under varied operational conditions. Mahmood et al. [16], while examining polarity reversal and hydrodynamic conditions, did not directly quantify Faradaic efficiency, thus, reflecting a broader absence of standardized evaluation methodologies. Both Jang et al. [21] and Liu et al. [22] advanced understanding of electrocoagulation efficiency by exploring electrode materials and hybrid configurations, yet both studies overlooked direct quantification of Faradaic efficiency. This omission represents a critical gap due to the fact that Faradaic efficiency is essential for correlating electrical input with treatment yield and optimizing the energy cost-effectiveness of scalable electrocoagulation systems.

Although the electrocoagulation treatment system is well documented for its pollutant removal efficiencies, the interplay between electrode degradation, operational parameters, and Faradaic efficiency of salinity reduction in Sarawak brackish peat water has not been comprehensively explored. As such, this study aims to investigate the Faradaic efficiency of salinity reduction for the treatment of Sarawak brackish peat water by utilizing electrocoagulation treatment system. Correspondingly, the objectives of this study are to (i) characterize the salinity levels of Sarawak brackish peat water, (ii) conduct Tafel analysis of aluminium corrosion, (iii) analyze the

effects of seawater percentage and applied voltage on Faradaic efficiency of electrocoagulation system, and (iv) perform water quality analysis in terms of salinity levels only.

## 2. Methodology

Fig. 1 illustrates the workflow of this experimental study, beginning with sample collection and culminating in final water quality assessment. It also highlights each key step, particularly salinity characterization, Tafel polarization testing, electrocoagulation treatment, and subsequent evaluation of water quality.



**Fig. 1** Workflow of the experimental procedure from sample collection to final water quality analysis

### 2.1 Characterization of Salinity Levels of Sarawak Brackish Peat Water

This study was conducted in Metang Terap Village, located in Lundu, Kuching, Sarawak, Malaysia at geographical coordinates 1.6901° N and 109.8787° E. The study location was strategically selected due to its proximity to coastal peatland areas which significantly affected by seawater intrusion [23]. In this study, peat water samples were directly collected from Metang Terap Village in order to emphasize its importance as a representative area for regions affected by seawater infiltration. Additionally, seawater samples were sourced from nearby coastal waters of the Lundu river, serving a saline reference to replicate natural seawater intrusion scenarios. The salinity levels for this study were measured in accordance with the standards set by the American Public Health Association (APHA) 2520 guidelines by utilizing an electrometric method with a Hanzhan EZ-9910 salinity meter. In order to simulate different degrees of seawater intrusion, brackish peat water samples were produced by combining peat water and seawater in specific volumetric ratios, as outlined in Table 1 and shown in Fig. 2.

**Table 1** Preparation of brackish peat water samples varied salinity levels

Seawater Percentage (%)	Peat Water Volume (ml)	Seawater Volume (ml)	Salinity Levels (mg/l)
0	200	0	352
10	180	20	2,083
20	160	40	4,314
30	140	60	5,647
40	120	80	7,498
50	100	100	8,493
60	80	120	9,051
70	60	140	9,425
80	40	160	9,745
90	20	180	10,198
100	0	200	19,300

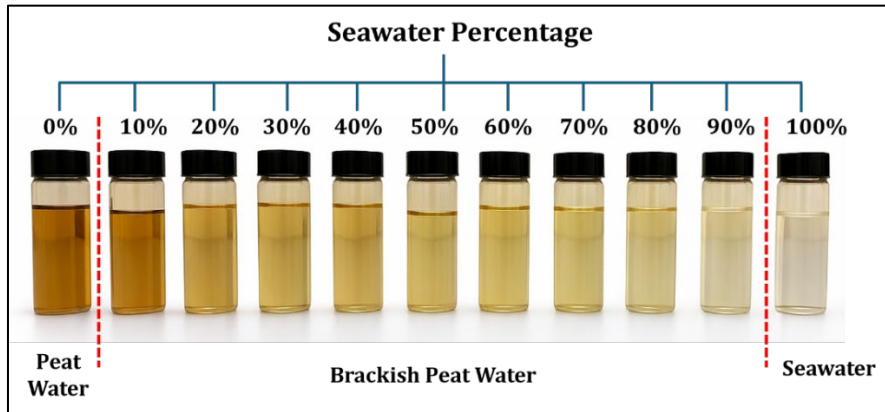


Fig. 2 Brackish peat water samples at varied seawater percentages (0% to 100%)

## 2.2 Tafel Analysis of Aluminium Corrosion in Sarawak Brackish Peat Water

In this study, electrochemical experiments were performed by using a ZIVE SP1 Potentiostat/Galvanostat/EIS electrochemical workstation. The experimental setup, depicted in Fig 3, utilized a standard three-electrode configuration.

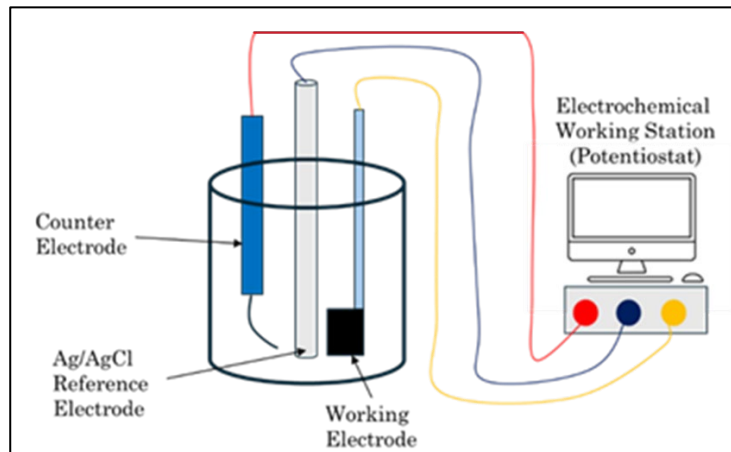
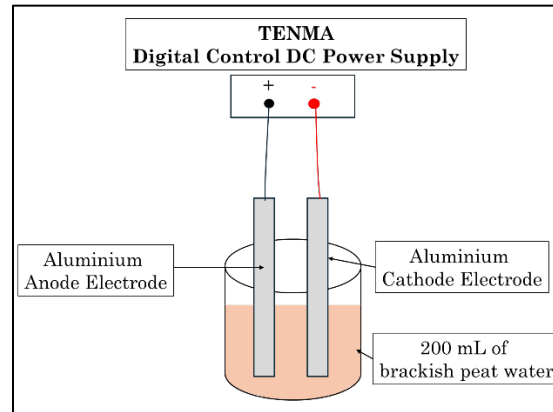


Fig. 3 Schematic representation of the electrochemical cell setup for corrosion analysis using a potentiostat

As shown by Fig. 3, the experimental setup included an aluminium specimen as the working electrode (WE), a saturated silver/silver chloride (Ag/AgCl) electrode as the reference electrode (RE), and a platinum wire as the counter electrode (CE) [16]. In order to ensure accuracy and consistency in measurements, all electrodes were thoroughly cleaned before each experiment. The aluminium working electrode was polished with sandpaper to remove any oxide layer that may have formed during the analysis [24]. The corrosion behavior of aluminium in brackish peat water mixed with varying proportions of seawater was analyzed using Tafel polarization techniques. Electrolyte solutions, each with a volume of 50 ml, were prepared by blending peat water and seawater in specific ratios to achieve targeted salinity levels. Potentiodynamic polarization scans were conducted within a range of  $-250$  mV to  $+250$  mV relative to the OCP at a scan rate of  $1$  mV/s. This potential range and scan rate were carefully chosen to capture both anodic and cathodic reactions while minimizing disturbances to the system's natural behavior. The resulting Tafel plots were created by plotting the logarithm of the current density,  $\log J$ , against the electrode potential,  $E$ , with potential measured relative to the Ag/AgCl reference electrode.

## 2.3 Faradaic Efficiency of Electrocoagulation System for Sarawak Brackish Peat Water Treatment

A custom-designed electrocoagulation reactor was utilized for the treatment of brackish peat water. The system features two (2) square aluminium electrodes, each with dimensions of  $3$  cm by  $3$  cm, yielding a combined effective surface of  $9$  cm<sup>2</sup>. The configuration of the reactor is depicted in Fig. 4, while Table 2. outlines the operational conditions for the treatment process.



**Fig. 4** Schematic of the electrocoagulation setup designed to reduce salinity in brackish peat water influenced by seawater intrusion

**Table 2** Operating conditions for the continuous electrocoagulation applied to brackish peat water treatment

<b>Constant Variable</b>	
Number of Electrodes	Two aluminium electrodes with dimensions 2 cm × 2 cm × 0.3 cm
Electric Current	5 A
Treatment Time	30 minutes
Inter-electrode distance	1 cm
Volume	200 ml
<b>Variable Parameters</b>	
Seawater Percentages	0% interval up to 100%
Applied Voltage	5 V interval up to 30 V

The anode and cathode mass loss are calculated based on the difference between before and after electrocoagulation treatment of peat water as shown by Equation (1) [16].

$$M_{loss}(g) = M_{before EC} - M_{after EC} \quad (1)$$

The theoretical electrode mass loss is calculated as shown by Equation (2) [24]

$$M_{theoretical}(g) = \frac{ItM}{nFV} \quad (2)$$

Where  $I$  refers to electric current (C/s),  $t$  refers to the treatment time (s),  $M$  refers to the aluminium molecular weight (26.98 g/mol),  $n$  refers to the number of electron charges (aluminium=3),  $F$  refers to the Faraday's constant (96,485 C/mol), and  $V$  refers to the volume of electrochemical cell (m<sup>3</sup>). The calculation for Faradaic efficiency is shown by Equation (3) [16].

$$\Phi = \frac{m_{loss}zF}{MiAt} \quad (3)$$

Where  $m_{loss}$  be the electrode mass loss,  $z$  the number of electron charge (aluminium=3),  $F$  the Faraday's constant (96,485 C/mol),  $M$  the aluminium molecular weight (26.98 g/mol),  $I$  the electric current density,  $A$  the total effective electrode area, and  $t$  the duration of electrocoagulation treatment.

## 2.4 Water Quality Analysis

The treated brackish peat water salinity levels were assessed in comparison to the National Water Quality Standards (NWQS) imposed by the Department of Environment (DOE) in Malaysia, as outlined in Table 3.

**Table 3** NWQS classification criteria on salinity levels for different water usage categories [25]

Class	Designated Use	Maximum Allowable Salinity (mg/L)
I	Conservation of natural ecosystem, drinking water requiring minimal treatment, and aquatic habitats for highly sensitive species	Less than 500
II.A	Drinking water sources requiring conventional treatment Supports aquatic life with moderate sensitivity	Less than 1,000
II.B	Suitable for recreational use involving body contact	Less than 1,000
III	Advanced treatment needed for drinking water Suitable for general fish species and livestock consumption	Less than 1,000
IV	Acceptable for agricultural uses such as irrigation	Less than 2,000
V	Unsuitable for drinking, aquatic, recreational, or agricultural purposes due to excessive salinity	Greater than 2,000

In this study, the changes in salinity levels of untreated and treated brackish peat water were evaluated by using Equation (4) [26].

$$\text{Salinity Reduction Efficiency (\%)} = \frac{C_t - C_o}{C_o} \times 100\% \quad (4)$$

Where,  $C_t$  denotes the final salinity levels of brackish peat water and  $C_o$  denotes the initial salinity levels of brackish peat water sources.

### 3. Results and Discussion

This section presents and interprets the key findings of the study which focusing on the electrocoagulation treatment of Sarawak brackish peat water by utilizing electrocoagulation system. It also covers the performance of the electrocoagulation system, water characterization, corrosion behaviour, Faradaic efficiency, and the final water quality.

#### 3.1 Characterization of Salinity Levels of Sarawak Brackish Peat Water

Sarawak brackish peat water exhibits unique characteristics that influence its treatment, particularly by utilizing electrocoagulation system. Some key water parameters that govern the quality of brackish peat water, namely conductivity and salinity levels are shown by Table 4.

**Table 4** Relationship between seawater percentages, conductivity, and salinity levels in Sarawak brackish peat water sources

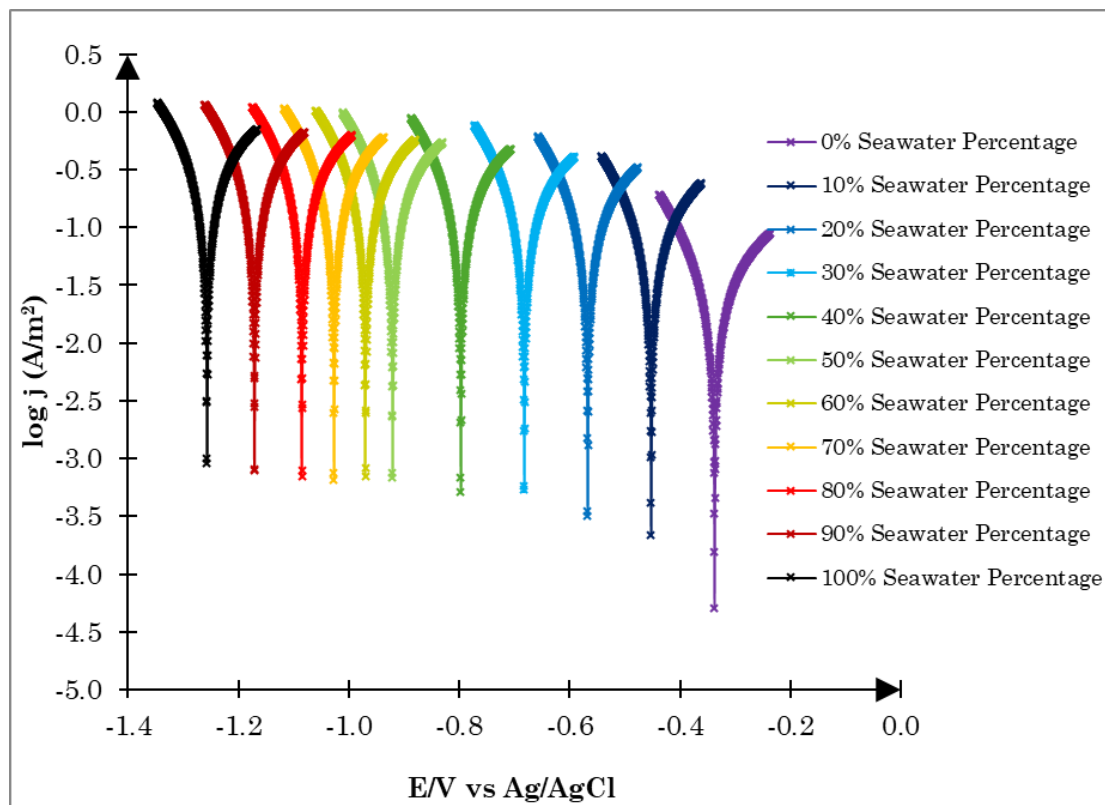
Seawater Percentage (%)	Conductivity ( $\mu\text{S}/\text{cm}$ )	Salinity levels (mg/l)
0	705	352
10	4,244	2,083
20	8,345	4,314
30	11,289	5,647
40	13,269	7,498
50	15,144	8,493
60	16,212	9,051
70	16,888	9,425
80	17,464	9,745
90	18,105	10,198
100	32,867	19,300

As shown by Table 4., this study has found that the salinity and conductivity of brackish peat water are directly linked to seawater percentage. When seawater percentage reaches up to 100%, the salinity level peaks at 19,300 mg/L whereas conductivity exceeds 32,000  $\mu\text{S}/\text{cm}$ . This observation is attributed to the complete dissociation of sodium chloride into sodium and chloride ions, which act as strong electrolytes. For brackish peat water containing 10% to 90% seawater percentage, this study has observed a linear increase in conductivity with

salinity suggests a proportional relationship between ionization and salt concentration. As reported by Espinoza-Quiñones et al. [27], high conductivity could benefit electrocoagulation by promoting sufficient ion availability which facilitates the generation of in-situ coagulants from electrodes.

### 3.2 Tafel Analysis of Aluminium Corrosion in Sarawak Brackish Peat Water

The corrosion behaviour of aluminium plates immersed in brackish peat water with varying seawater levels was evaluated across three distinct ranges of seawater percentages which are 0% to 30%, 30% to 50%, and 50% to 100%, as illustrated by Fig. 5. When the seawater percentages being less than 30%, a notable negative shift in  $E_{corr}$  was observed, ranging from -337.542 mV to -682.572 mV. This increasingly negative potential reflects a heightened tendency for the aluminium surface to undergo electrochemical oxidation, particularly corrosion. The degradation of the passive aluminium hydroxide  $Al(OH)_3$  layer which normally acts as a protective barrier against corrosive attack. The presence of chloride ions,  $Cl^-$ , in saline water are well-known for its aggressive nature which facilitates localized pitting corrosion which refers to a process that initiates at defects in the oxide layer and progressively penetrates the metal. These observations are similar with prior studies conducted by Mahmood et al. [16] and Ingelsson et al. [28], who reported that a moderate chloride ion concentration could destabilize the passive oxide layer, thus, making the metal more vulnerable to dissolution. These findings also suggest that aluminium metal loses its ability to passivate effectively by exposing fresh metallic surfaces to sustained electrochemical attack. In this study, the immersion of aluminium in brackish peat water resulted in a more negative  $E_{corr}$  (-1,256.820 mV vs Ag/AgCl) which indicates a higher corrosion tendency than the -860 mV reported by Mahmood et al. [16]. This is possibly due to aggressiveness nature of brackish peat water which contains acidic organics and chloride ions that disrupt passivation and promote anodic dissolution. The rise in  $E_{corr}$  reflects not only increased reaction kinetics but also a reduction in charge transfer resistance owing to the more conductive environment. These observations are similar to a study conducted by Anwar et al. [29] and Cao et al. [30] in which both highlighted that elevated salinity accelerates the deterioration of passive films, thus, intensifying corrosion.



**Fig. 5** Aluminium plates polarization curves for varied seawater percentage in Sarawak brackish peat water sources

In the high salinity levels that ranged from 50% to 100% seawater percentage, this study has noticed the corrosion potential continued to shift drastically by reaching as low as -1,256.820 mV. Notably, no evidence of stabilization was observed which suggests that the aluminium metal remained under severe corrosion with no

sign of repassivation. This condition represents an electrochemical environment dominated by aggressive chloride ion attack, where the protective oxide layer is either continuously removed or entirely unable to reform [28]. In comparison to the findings by Anwar et al. [29], who reported corrosion potentials ranging from -706 mV to -881 mV in 3.5% to 5.0% NaCl solutions, the present study demonstrates a substantially more negative corrosion potential of -1,256.820 mV at 100% seawater percentage. This pronounced shift indicates a significantly higher degree of passive film degradation under higher salinity conditions.

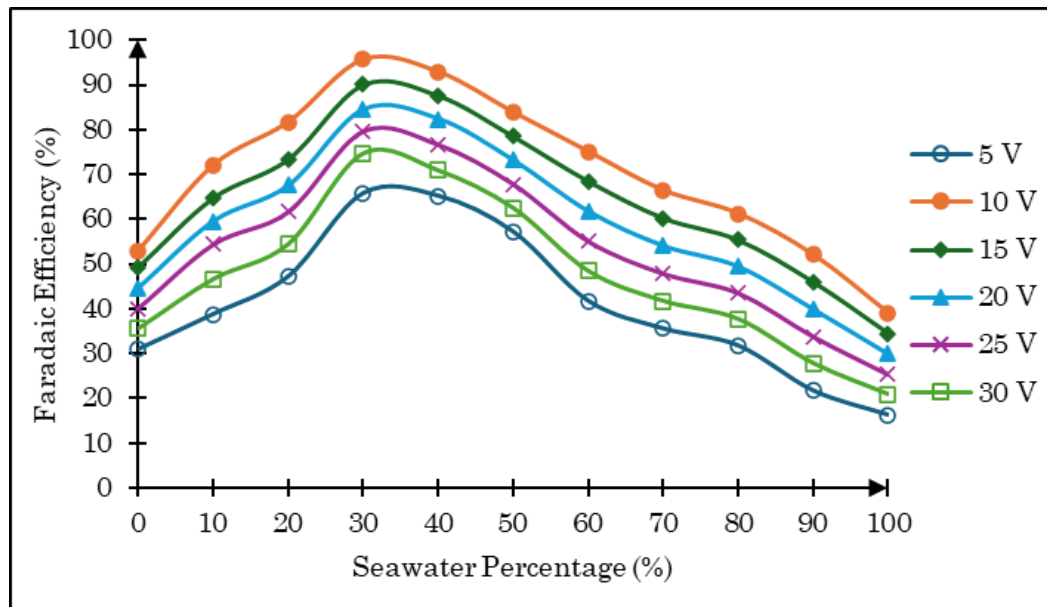
The corrosion current density experienced an increase from 246.258  $\mu\text{A}$  at 50% seawater to 308.607  $\mu\text{A}$  at 100% seawater which reflects an even more pronounced corrosion rate. This rise indicates that electrochemical reactions were significantly intensified which likely due to enhanced ionic mobility and reduced solution resistance in highly saline water sources. These observations correlate well with studies done by Fabris et al. [31] and Anwar et al. [29], who reported that at high chloride concentrations, aluminium surfaces are persistently attacked which eventually prevents the reformation of any stable passive film. In comparison to the present study which recorded an increase in corrosion current density from 246.258  $\mu\text{A}$  at 50% seawater to 308.607  $\mu\text{A}$  at 100% seawater, Fabris et al. [31] similarly observed a rise in  $I_{corr}$  with increasing chloride concentrations along with a maximum value of approximately 92.3  $\mu\text{A}/\text{cm}^2$ . Although both studies confirm that higher salinity levels intensify electrochemical activity, the significantly higher  $I_{corr}$  values observed in this study suggest a greater corrosion intensity owing to more aggressive testing conditions as well as increased material susceptibility to saline-induced degradation. As highlighted by Farooq et al. [32], higher electrical conductivity in saline solutions enhances both anodic and cathodic reaction rates. This effect facilitates a continuous electrochemical loop that expedites the degradation of aluminium surfaces. The higher mobility of  $\text{Cl}^-$ ,  $\text{Na}^+$ , and other ions will support more frequent charge exchanges at the electrode interface which subsequently accelerating the corrosion process [32].

### 3.3 Faradaic Efficiency of Electrocoagulation System for Sarawak Brackish Peat Water Treatment

In this study, the relationship between applied voltage, seawater percentage, and Faradaic efficiency has revealed critical insights into the electrochemical mechanisms of electrocoagulation treatment system by using aluminium electrodes, as shown by Table 5 and Fig. 6. At an applied voltage of 10 V and 30% of seawater percentage, the electrocoagulation treatment system has achieved a peak Faradaic efficiency of 95.63% along with 0.267 g of aluminium weight loss. This is possibly due to an optimal balance between electrolyte conductivity, ion availability as well as controlled reaction kinetics. A study conducted by Ingelsson et al. [28] reported a peak Faradaic efficiency of 78.9% at 15 V using synthetic saline water but observed a decline at higher voltages due to parasitic reactions. Moreover, Mahmood et al. [33] achieved a higher Faradaic efficiency, yet their study lacked evaluation in complex natural water sources. In contrast, the present study demonstrated a superior Faradaic efficiency of 95.63% under moderate voltage of 10 V in organically rich brackish peat water sources.

**Table 5** Aluminium electrodes mass loss at varied voltages and seawater percentages for brackish peat water treatment by using electrocoagulation system

Voltage (V)	Seawater Percentage (%)										
	0	10	20	30	40	50	60	70	80	90	100
Aluminium Electrodes Mass Loss (g)											
5	0.087	0.108	0.132	0.184	0.182	0.160	0.117	0.099	0.089	0.061	0.046
10	0.148	0.201	0.228	0.267	0.260	0.234	0.210	0.186	0.171	0.146	0.109
15	0.138	0.181	0.205	0.252	0.245	0.219	0.191	0.168	0.155	0.129	0.096
20	0.125	0.167	0.189	0.236	0.230	0.205	0.173	0.151	0.138	0.112	0.084
25	0.112	0.152	0.172	0.223	0.214	0.190	0.154	0.134	0.122	0.095	0.071
30	0.099	0.130	0.152	0.209	0.198	0.175	0.135	0.117	0.105	0.078	0.058



**Fig. 6** Variation of faradaic efficiency with seawater percentage at different applied voltages by using electrocoagulation treatment system with aluminium electrodes

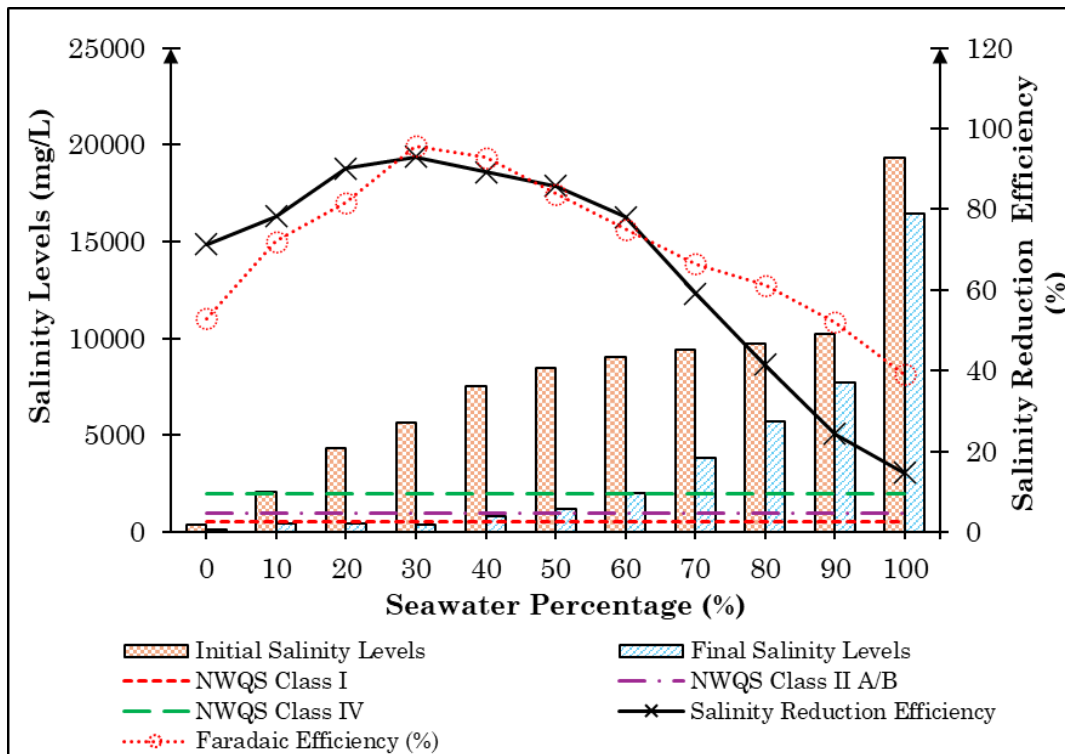
As reported by Ingelsson et al. [28], the presence of chloride ions in aqueous environments significantly enhances the anodic dissolution of aluminium electrodes during electrocoagulation. This occurs through the formation of soluble aluminium-chloro complexes, which facilitate the release of  $Al^{3+}$  ions into the solution [6]. Additionally, the application of an appropriate voltage provides the necessary overpotential to drive the anodic reaction effectively while minimizing the risk of unwanted side reactions. However, findings from the present study indicate that deviations from the optimal electrochemical conditions can result in substantial Faradaic efficiency losses.

In the present study, limiting the applied voltage to 5 V could result in suboptimal overpotential and Faradaic efficiency losses which is also consistent with Ingelsson et al. [28], who reported that cell potentials as high as 11.8 V were required to sustain current flow under severe passivation conditions. Additionally, Ingelsson et al. [28] reported that Faradaic efficiency could drop from 100% to as low as 15% when inadequate voltage failed to overcome passivation and triggered side reactions. This insufficient driving force hinders the kinetics of the aluminium oxidation process and simultaneously increases the contribution of non-Faradaic processes such as double-layer charging and other capacitive effects which do not contribute to coagulant production [33]. Consequently, the Faradaic efficiency under these conditions was recorded at a reduced value of 65.76%, indicating that a significant proportion of the input current was not utilized in the intended electrochemical reaction. When the voltage was increased to 30 V, although a higher overpotential was achieved, the study observed a continued decline in Faradaic efficiency, reaching 74.73%, alongside a measured electrode mass loss of 0.209 g.

This reduction is attributed to the dominance of parasitic side reactions, particularly water electrolysis, which becomes increasingly significant at elevated voltages Ingelsson et al. [28]. In such cases, a considerable portion of the electrical energy is consumed in the evolution of oxygen and hydrogen gases rather than the dissolution of the aluminium anode. These parasitic reactions not only lower the current efficiency but also introduce turbulence and pH fluctuations that can alter the coagulation dynamics [33].

### 3.4 Water Quality Analysis

This study has conducted an analysis of water quality to evaluate the salinity levels in treated brackish peat water mixed with varying proportions of seawater by comparing the results against the National Water Quality Standards (NWQS) of Malaysia, as illustrated in Fig. 7.



**Fig. 7** Salinity reduction and faradaic efficiency at varied seawater percentages of untreated and treated brackish peat water sources in relation to the Malaysia National Water Quality Standards (NWQS)

The study has indicated that treated brackish peat water with seawater percentages below 30% is suitable for domestic use owing to the salinity levels remain under Class I threshold of 500 mg/l, as defined by NWQS. This highlights its significant potential for managing salinity in Sarawak regions, where moderate seawater intrusion is prevalent. The electrocoagulation treatment system's high Faradaic efficiency of 95.63% underscores its efficacy in mitigating salinity issues in brackish peat water treatment. Unlike Mao et al [30], who reported lower salinity removal efficiencies without addressing Faradaic performance, this study achieved compliance with NWQS Class I standards by maintaining salinity levels below 500 mg/L at seawater intrusion up to 30%. While Abdul Rahman [5] identified salinity concerns in Sarawak's peatlands, the study did not present a treatment method with Faradaic efficiency analysis.

#### 4. Conclusions

An experimental study was conducted to investigate the effects of seawater percentage and voltage on the Faradaic efficiency of electrocoagulation treatment for Sarawak brackish peat water. The characterization of brackish peat water revealed a strong correlation between salinity levels and seawater percentage, with salinity peaking at 19,300 mg/l at higher seawater percentages. Additionally, Tafel analysis of aluminium corrosion indicated that higher seawater percentages significantly increased the susceptibility of aluminium electrodes to corrosion. At 30% seawater, the corrosion potential ( $E_{corr}$ ) shifted to -682.572 mV, with a corrosion current density ( $I_{corr}$ ) of 187.722  $\mu$ A. The study also observed that the peak Faradaic efficiency of 95.63% was achieved at 10 V and 30% seawater. This was attributed to an optimal balance between electrolyte conductivity and controlled reaction kinetics. Furthermore, the electrocoagulation system demonstrated significant effectiveness in reducing salinity levels to values suitable for domestic consumption at seawater percentages below 30%. Overall, the study concluded that the electrocoagulation system holds substantial potential as a viable treatment for salinity reduction in Sarawak brackish peat water, especially under conditions of optimal Faradaic efficiency.

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#### Conflict of Interest

The authors confirm that there are no competing interests associated with the publication of this manuscript.

## Author Contribution

The authors acknowledge their respective roles in the preparation of this manuscript as outlined below. **Conceptualization:** Nazeri Abdul Rahman, Calvin Jose Jol, Allene Albania Linus; **Supervision:** Nazeri Abdul Rahman; **Validation:** Nazeri Abdul Rahman, Calvin Jose Jol, Allene Albania Linus; **Methodology:** Nazeri Abdul Rahman, Calvin Jose Jol, Allene Albania Linus; **Software:** Nazeri Abdul Rahman, Calvin Jose Jol, Allene Albania Linus, Airul Azhar Jitai, Dayang Fadhilatul Aishah Abang Abdul Hamid; **Writing – Original Draft Preparation:** Nazeri Abdul Rahman, Calvin Jose Jol, Allene Albania Linus; **Writing – Reviewing and Editing:** Nazeri Abdul Rahman, Calvin Jose Jol, Allene Albania Linus, Arif Parabi, Chieng Kwong Ming, Anthonette James; **Data Curation:** Astisza Syahla Ludmilla Parabi, Nur Syazwa Shamsol, Sebastian Belun John, Elyza Farhana Kushairy. All authors have examined the findings and given their approval for the final manuscript version.

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