REMOVAL OF PVC MICROPLASTICS FROM SEAWATER USING DIRECT ELECTRIC CURRENT

UKLANJANJE PVC MIKROPLASTIKE IZ MORSKE VODE PRIMJENOM ISTOSMJERNE ELEKTRIČNE STRUJE

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SVEUČILIŠTE U SPLITU
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Introduction:

Microplastic pollution is a growing environmental concern because of its persistence in aquatic ecosystems and potential impacts on marine life. Electrocoagulation has emerged as a promising treatment method for microplastic removal, using electrically generated coagulants to promote particle aggregation and separation. This study examines the effectiveness of electrocoagulation with aluminium (AA6063) electrodes for removing PVC microplastics from synthetic seawater at different salinities (10 and 30 ppt).

Experimental part:

Synthetic seawater with salinities of 10 and 30 ppt was prepared and mixed with approximately 5 g of PVC microplastics (average particle size 74 μm). Electrocoagulation experiments were conducted using AA6063 aluminium electrodes under a constant direct current of 0.3 A, an electrode spacing of 2.5 cm, and a stirring speed of 150 rpm at room temperature (25 ± 2 °C). Treatment times were 1, 2, and 3 hours. Removal efficiency was determined gravimetrically by measuring the remaining microplastic mass in the supernatant. The generated precipitate was characterized using optical microscopy and SEM/EDS analysis.

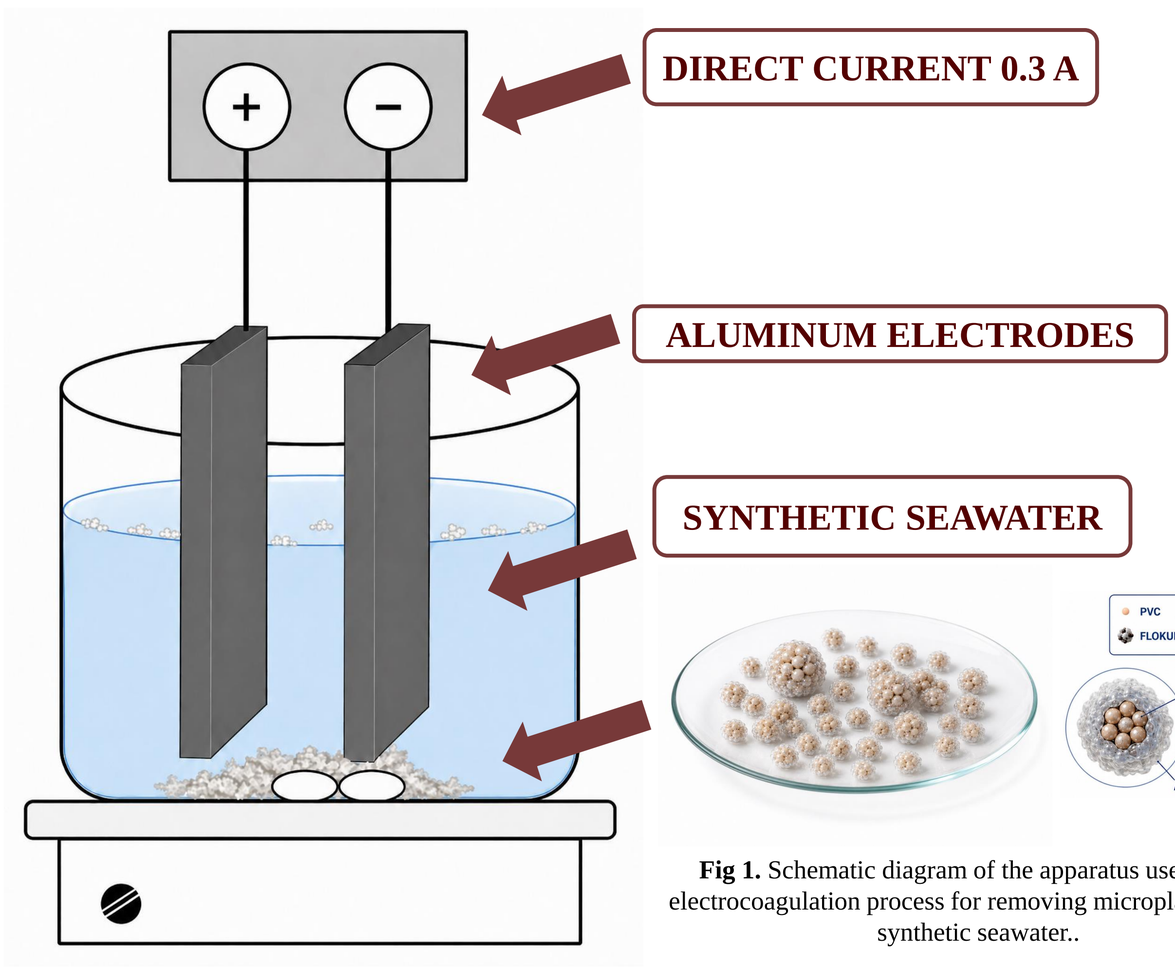

Fig 1. Schematic diagram of the apparatus used in the electrocoagulation process for removing microplastics from synthetic seawater..

Results and discussion:

The highest removal efficiencies were achieved after 3 h, reaching 94.05% at a salinity of 10 ppt and 71.68% at 30 ppt. Lower salinity promoted greater floc formation and sedimentation, resulting in more effective removal of PVC microplastics. SEM/EDS analysis confirmed the formation of aluminium-containing precipitates that contributed to particle aggregation and removal.

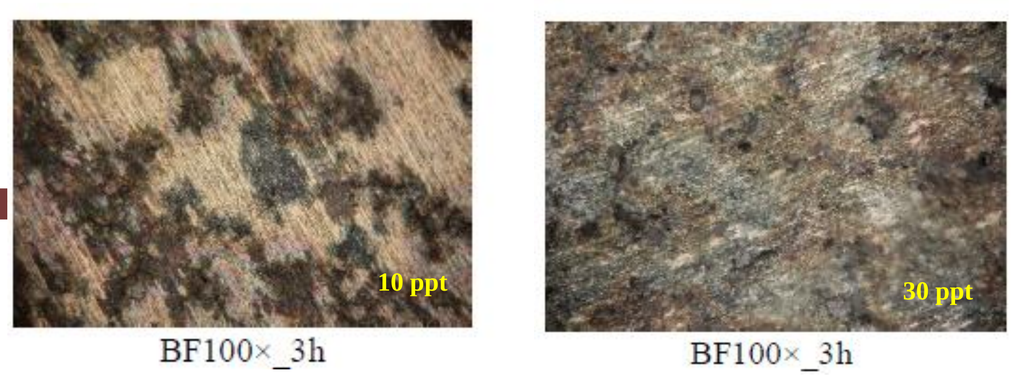

Fig 2. Optical micrographs of anode surfaces after electrocoagulation in synthetic seawater (10 and 30 ppt salinity, 100× magnification).

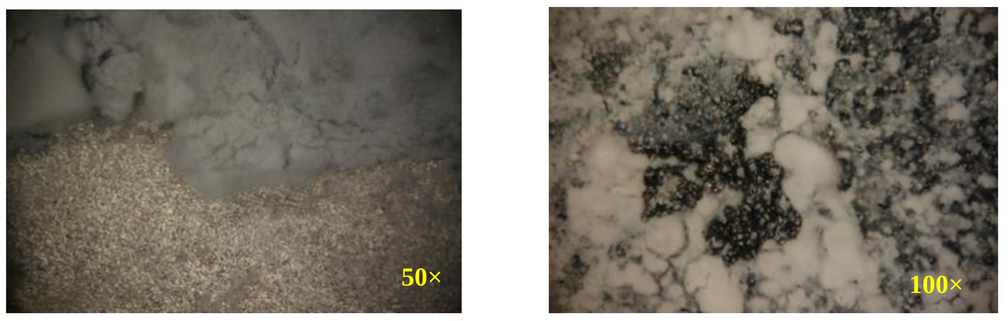

Fig 3. Optical micrographs of cathode surfaces after electrocoagulation in synthetic seawater (30 ppt salinity, 2 h, 50× and 100× magnification).

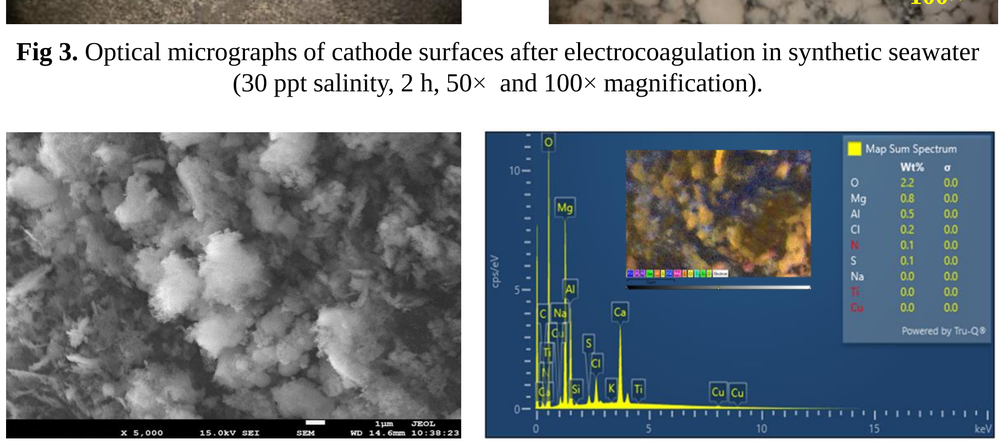

Fig 4. SEM morphology and EDS characterization of the cathodic precipitate formed during electrocoagulation (30 ppt salinity, 2 h).

Fig 5. Dependence of anode consumption and sludge mass on electrocoagulation treatment time at salinities of 10 and 30 ppt.

Table 1. PVC Microplastic Removal Efficiency (%) at 10 and 30 ppt salinity.

R /%		
Time (h)	10 ppt (%)	30 ppt (%)
0	62.48	40.54
1	91.16	43.40
2	93.28	60.51
3	94.05	71.68

Conclusions:

- Direct current enhanced PVC microplastic removal from synthetic seawater.
- Maximum removal efficiencies reached 94.05% (10 ppt) and 71.68% (30 ppt).
- AA6063 aluminum electrodes were effective sacrificial electrodes for electrocoagulation.
- Lower salinity improved flocculation, aggregation, and sedimentation of PVC microplastics.

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