DIPARTIMENTO DI SCIENZE
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Water and Waste Environmental Engineering LAB

Seminar of ***CHEMICAL-ENVIRONMENTAL ENGINEERING***

SIMAU Department –Polytechnic University of Marche –

July 11th, 2025 - Room 155/1 at 15.00

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Seminar Title

Nature-inspired physicochemical process: Jellyfish mucin for efficient removal of nanoplastics from water

This study investigates the synergistic effect of jellyfish mucus and commercial coagulants on the removal of microplastics (MPs) and nanoplastics (NPs) from water. The results reveal that combining low doses of jellyfish mucus (0.8 and 2 mg L^{-1}) with commonly used coagulants, such as ferric chloride ($FeCl_3$) and polyaluminum chlorohydrate (PAC) significantly enhances the removal efficiency of MPs and NPs (>90%) and reduces particle settling times to <5 minutes. Mechanistic insights demonstrate that jellyfish mucus facilitates entrapment and bridging mechanisms, which play a key role in the aggregation and removal of plastic particles. Zeta potential measurements further confirm the neutralization of particle surface charges, with optimal conditions observed at 2 mg L^{-1} jellyfish mucus and 2.5 mg L^{-1} coagulant. Additionally, the Deryagin–Landau–Verwey–Overbeek theory explains these interactions, highlighting the entrapment and bridging effects for polystyrene nanoplastics (PS-NPs) and polymethyl methacrylate nanoplastics (PMMA-NPs), while a significantly higher interaction energy for carboxylate-modified PS microspheres (PS-CA-MPs) suggests the involvement of additional forces. This study underscores the promising role of jellyfish mucus-coagulant synergy in enhancing the removal of NPs and MPs from water, offering a sustainable and effective alternative to conventional water treatment technologies for plastic pollution mitigation.