Effective Sea Water Splitting – Myth or Reality

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Abstract:

The photocatalytic hydrogen production from water splitting is a promising way to fulfil the current energy demand in an eco-friendly and sustainable manner. Conventionally deionized water (DI) has been used as the solvent for PC water splitting, however seawater is the ideal solvent for practical applicability. The presence of various ions (Na^+, K^+, Mg^{2+}, Ca^{2+}, Cl^-, Br^-, SO_4^{2-}, and CO_3^{2-}) in seawater restrict its usage, as these ions lead to unwanted side reaction. In some instances, charge carrier activity and photo catalyst durability decrease when the solvent is changed from DI water to seawater, while there are few other reports that in fact showcase an augmentation in PC hydrogen production with seawater.[1] These contradicting reports in the literature clearly suggest that the role of the ions in PC efficiency is non-trivial. The majority of systems thus far evaluated for seawater splitting have a neutral inorganic metal oxide-based catalyst. Presented here is a *charged* semiconductor has been evaluated as it serves as both a semiconductor with photo-activity and ionic sites that help in ion exchange and modulating the catalysis of an ionic electrolyte. It consists of a modified carbon nitride that has been obtained after an ion thermal treatment of the starting material. Polymeric carbon nitride has been considered a promising photo catalyst for water splitting during the last decade, as it is metal-free, cheap, easy to prepare, and carries proper band alignment for water reduction and oxidation.[2] In this study, the simulated seawater water splitting has been done using this charged semiconductor, and the role of various ions in modulating the photocatalytic activity has been evaluated. The data from this study shows that the presence of bivalent cations enhance photocatalytic activity up to 10 times when the ionized organic semiconductor is utilized. Presented will be a detailed study where a variety of techniques have been exploited to systematically understand the unique nature of the catalyst and how ions affect its PC activity for water splitting.

References

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