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Energy Potential of Salinity Gradient Mixing: Case Study of Mixing Energies of Rivers of Goa with the Arabian Sea

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Abstract : The Indian peninsula is strategically located in the Asian subcontinent with the Himalayas to the North and Oceans surrounding the other three directions with annual monsoons which takes care of water supply to the rivers. The total river water discharge into the Bay of Bengal and the Arabian Sea is 628 km^3/year and 274 km^3/year, respectively. Thus huge volumes of fresh water meet saline water, and this mixing of two streams of dissimilar salinity gives rise to tremendous mixing energies which can be harvested for various purposes like energy generation using pressure retarded osmosis or reverse electrodialysis. The present paper concentrates on analyzing the energy of mixing for the rivers in Goa. Goa has 10 rivers of various sizes all which meet the Arabian Sea. In the present work, the 8 rivers and their salinity (NaCl concentrations) have been analyzed along with their seasonal fluctuations. Next, a Gibbs free energy formulation has been implemented to analyze the energy of mixing of the selected rivers. The highest and lowest energies according to the seasonal fluctuations have been evaluated, and this provides two important insights into (i) amount of energy that can be harvested and (ii) decision on the location of such systems.

Keywords : Gibbs energy, mixing energy, salinity gradient energy, thermodynamics
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