

## Lithium enrichment optimization from Dead Sea end brine by chemical precipitation technique

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**Abstract:** Lithium and its compounds are widely utilized in many applications like batteries, aircraft alloys, ceramics, nuclear reactors, medicine, and metallurgy additives due to its exceptional physical and chemical properties. The Dead Sea is known to be rich in several minerals and is considered as a saturated lake for many valuable elements like potassium and magnesium and a trace amounts of precious elements including lithium. Though, the high ratio of  $Mg^{2+}$  to  $Li^{+}$  in the Dead Sea water is one of the main challenges to extract lithium. This paper presents a promising approach for optimizing chemical precipitation from Dead Sea evaporation End Brine containing high  $Mg^{2+}/Li^{+}$  ratio. The process can be carried out in the presence of magnesium, calcium, sodium and potassium chlorides. By comparing the effect of different precipitating reagents on the percentage of lithium extracted, tri-sodium phosphate (TSP) was found to be a promising Li precipitating reagent. The effects of operating conditions on the lithium phosphate ( $Li_3PO_4$ ) precipitation behaviours were evaluated. The highest percentage of lithium extracted was reached when seven grams of TSP were added to 1-liter samples of the Dead Sea evaporated end brine at 450 rpm stirring speed. Statistically, temperature and stirring time, were found to have a negligible effect on the percentage of lithium extracted. The optimization process enriched lithium concentrations from 30-40 mg/L in the brine to 1000-1700 mg/kg in the obtained solid precipitate and more than 40% of the lithium present in the brine was extracted. The effectiveness of the followed procedure and conditions was proven by testing on synthetic brine. The average percentage of lithium extracted from the synthetic brine was 55% and Li concentration was enriched over 50 times larger than its initial concentration. The novelty of the current work is not only by the results obtained but also the successful application of the method on an environmental complex bri