

# Characterization of salts from Portuguese salt pans for therapeutic applications

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Saltwater and dissolved salts have long been used for healing therapies. Evaporites are formed by seawater evaporation, leading to minerals like halite (NaCl), sylvite (KCl), gypsum ( $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ ) and anhydrite ( $\text{CaSO}_2$ ). Halite has recognized different medical applications, such as an antiseptic in saline solutions for wounds. In dermal therapies, salts provide benefits such as exfoliation, hydration, detoxification, antimicrobial properties, inflammation reduction, and mineral absorption. Salts can penetrate skin cells, addressing inflammation and promoting skin health. Therapies using salts, offer an alternative to medications, such as in osteoarthritis, by enhancing bone health and reducing pain. However, improper use may cause dryness on sensitive skins. Pelotherapy uses muds and salts for inflammation relief and muscle relaxation. Iontophoresis enhances salt absorption through the skin using low electric currents, offering targeted pain relief. Although research on salts in dermatology and cosmetic applications remains limited, interest in their potential is growing. The present study serves as a starting point to evaluate the therapeutic applications of salts collected from salt pans in Portugal, specifically from the Ria de Aveiro and Ria Formosa lagoons, exploring their combined use in pelotherapy and iontophoresis treatments.

A comprehensive set of analyses was conducted, including mineral phases identification by X-ray diffraction (XRD), major elements composition by X-ray fluorescence (XRF), particle size distribution by Sedigraph, and particles morphological characterization and semi-quantitative chemical analysis using a scanning electron microscope (SEM-EDS). Physicochemical parameters (i.e., pH, electrical conductivity (EC), organic matter content (OM), moisture (M)) were determined, along with technological tests (abrasiveness index, oil absorption, Atterberg limits, specific surface area) and thermal properties (cooling time and specific heat).



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**FIGURE 1**

(a) study areas location in Portugal;  
(b) traditional saltpan in Aveiro;  
(c) semi-industrial saltpan in Tavira.