Lithium-ion capacitors (LICs) are a hybrid energy storage device combining the energy storage mechanisms of lithium-ion batteries (LIBs) and electric double-layer capacitors (EDLCs), and are considered attractive not only in high-power applications but also as an alternative to rechargeable batteries due to their inherent long cycle life and relatively high energy density. The cycle life testing was performed for commercial-off-the-shelf (COTS) LIC cells procured from three different manufactures, and the cycle life prediction model developed for EDLCs in the previous work was applied to LICs. Based on the resultant capacitance retention trends, the activation energies of degradation ratios were calculated using an Arrhenius equation, whereupon aging acceleration factors were determined. The calculated acceleration factors varied depending on manufacturers, suggesting that a proper aging acceleration factor should be determined for each manufacture cell based on cycle life testing rather than simply applying a rule of thumb which had been accepted for LIBs and EDLCs. The resulting and predicted capacitance retention trends correlated well, verifying that the cycle life prediction model established for EDLCs in the previous work would also be usable for LICs as an alternative to rechargeable batteries.