High-efficiency cell disruption and astaxanthin recovery from *Haematococcus pluvialis* cyst cells using room-temperature imidazolium-based ionic liquid/water mixtures

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Energy-saving, high-efficiency cell disruption is a critical step for recovery of thermolabile antioxidant astaxanthin from *Haematococcus pluvialis* cyst cells of rigid cell-wall structure. In this study, as room-temperature green solvents, 10 types of 1-ethyl-3-methylimidazolium ([Emim])-based ionic liquids (ILs) were compared and evaluated for their abilities to disrupt *H. pluvialis* cyst cells for astaxanthin/lipid extraction. Among the 10 ILs tested, 3 [Emim]-based ILs with HSO_4, CH_3SO_3, and $(CF_3SO_2)_2N$ anions were selected based on astaxanthin/lipid extraction performance and synthesis cost. When pretreated with IL/water mixtures, intact cyst cells were significantly torn, broken or shown to release cytoplasmic components, thereby facilitating subsequent separation of astaxanthin/lipid by hexane. Under optimized mild conditions (6.7% (v/v) IL in water solution, 30 °C, 60 min), almost complete astaxanthin recoveries (> 99%) along with moderate lipid extractions (~82%) could be obtained.