

Abstract

Appropriate and reliable CO₂ capture methods are need of the hour to combat rising CO₂ emissions and climate change. Ionic liquids ([Emim][BF₄] and [Emim][OAc]) are excellent options for ecologically acceptable carbon capture in this study. The alkyimidazolium-based ionic liquids are highly capable for the carbon capture study. The reactions between 1-ethyl-3-methylimidazolium bromide ([Emim] Br and tetrafluoroborate ([BF₄]) or acetate ([OAc]) ions produced [Emim][BF₄] and [Emim][OAc]. FTIR spectroscopy was used to characterize the ionic liquids' chemical composition and purity. The extensive carbon capture studies are performed in a high-pressure tank to assess [Emim][BF₄] and [Emim][OAc] CO₂ absorption and selectivity. The following study shows that [Emim][BF₄] and [Emim][OAc] can absorb (1.70mol/L) at 10Bar and 1.40(mol/L) CO₂ at 10 bar respectively, making them viable carbon capture materials. This research advances our understanding of ionic liquids in carbon capture and highlights their promise as sustainable CO₂ emission solutions. To fully mitigate climate change with these ionic liquids, optimization methodologies and realistic implementations are needed.