

# FUNCTIONALIZED CHOLINE BASED AMINO ACID IONIC LIQUIDS: SCOPE OF BIO-ILs

Shubhankar Bhattacharyya\*, Faiz Ullah Shah

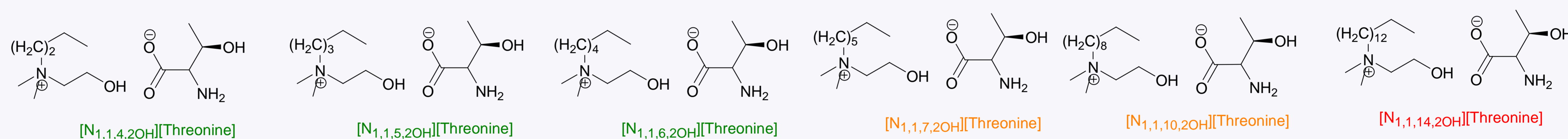
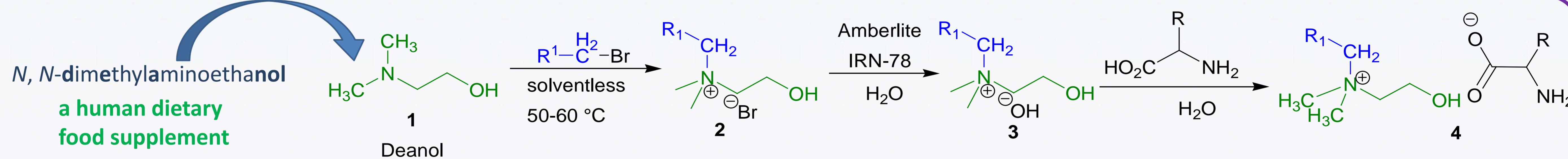
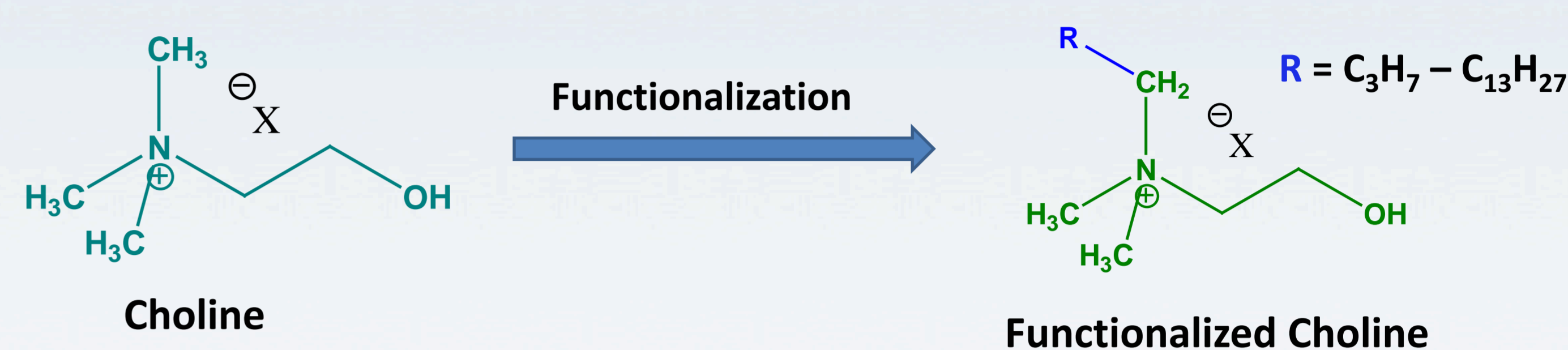
Chemistry of Interfaces, Luleå University of Technology, SE-97187, Luleå, Sweden

**Abstract:** The success of CO<sub>2</sub> Capture and Storage (CCS) strategy has attracted considerable attention because of CO<sub>2</sub> makes significant to global warming and climate change as a major greenhouse gas. Amino acid ILs are the most interesting and effective sorbents for CO<sub>2</sub> capture due to their low toxicity, biodegradability and fast reactivity towards CO<sub>2</sub>. In general, the ionic nature of amino acid ILs makes them highly soluble in water which may also raise an environmental issue if the cation counterpart happens to be toxic to the organisms inhabiting aquatic ecosystems as well as can become potential atmospheric pollutant. In this regard, choline based ILs are known to be promising scaffolds for the development of less toxic amino acid ILs, however, the existing choline amino acid ILs are highly viscous. Herein, we have modified and explored the choline cation in amino acid ILs while generating a novel series of less toxic green amino acid ILs with reduced viscosity and high CO<sub>2</sub> capture capacity. We have developed simple, economic, clean and environmentally benign methodology for the synthesis of novel choline based amino acid ILs using a commercially available and economical starting material.

The reported work not only presents a new and environmentally benign method for preparation of functionalized choline based amino acid ILs but, the advent of this methodology has also created possibilities in exploring new functionalized choline based cations and utilization of this concept can produce paradigm of new door of research field on “natural-ILs” or “bio-ILs”.

## BACKGROUND

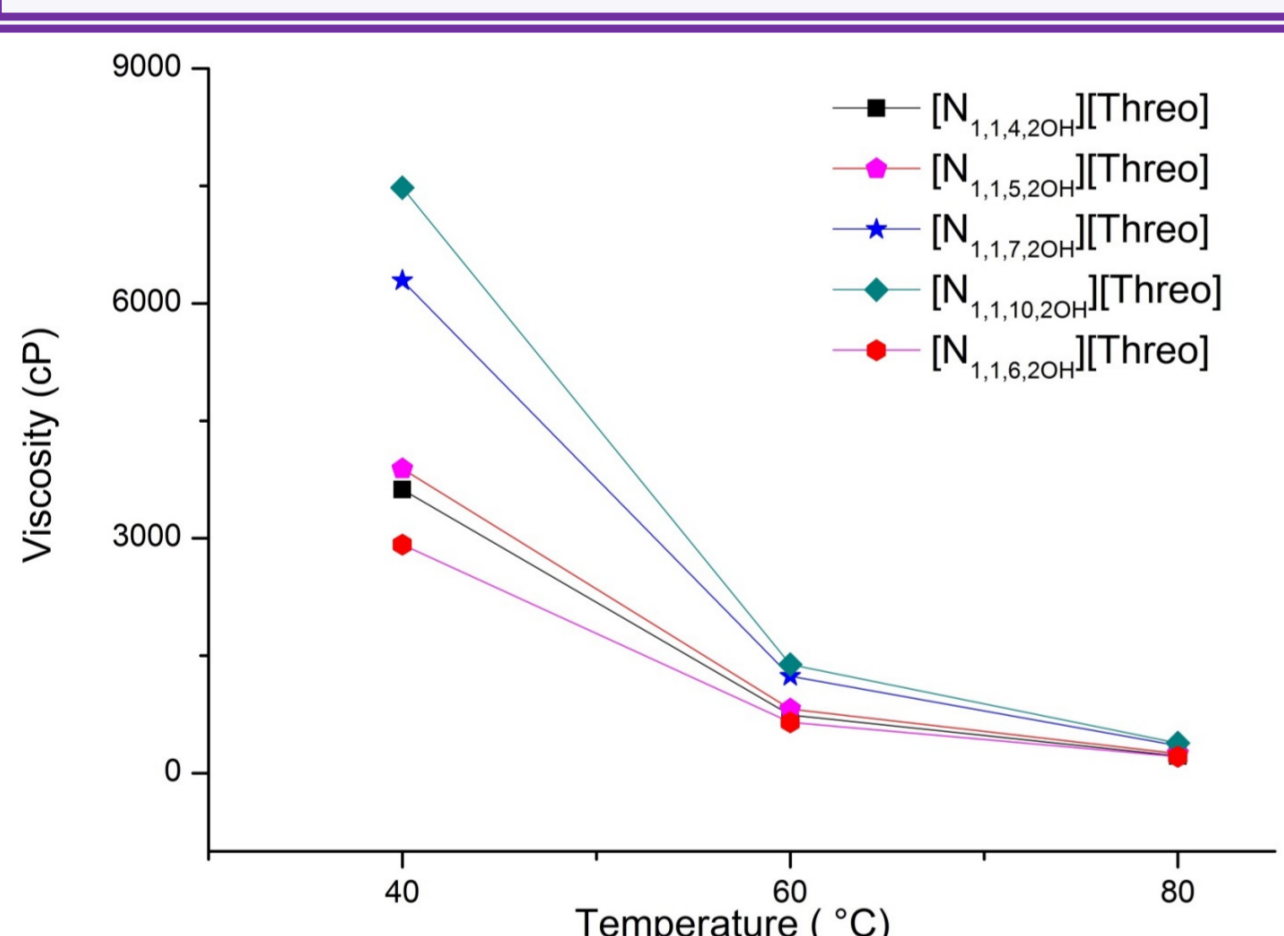
- Due to low vapour pressure, ILs can become potential atmospheric pollutants
- CHOLINE appears with phospholipids that are abundant in cell membranes also precursor molecule for the neurotransmitter acetylcholine
- CHOLINE based amino acid ILs can be promising bio-ILs scaffold for effective CO<sub>2</sub> capture
- Amino acid ILs with CHOLINE cation are very viscous
- Functionalization of CHOLINE cation can reduce viscosity of the ILs.



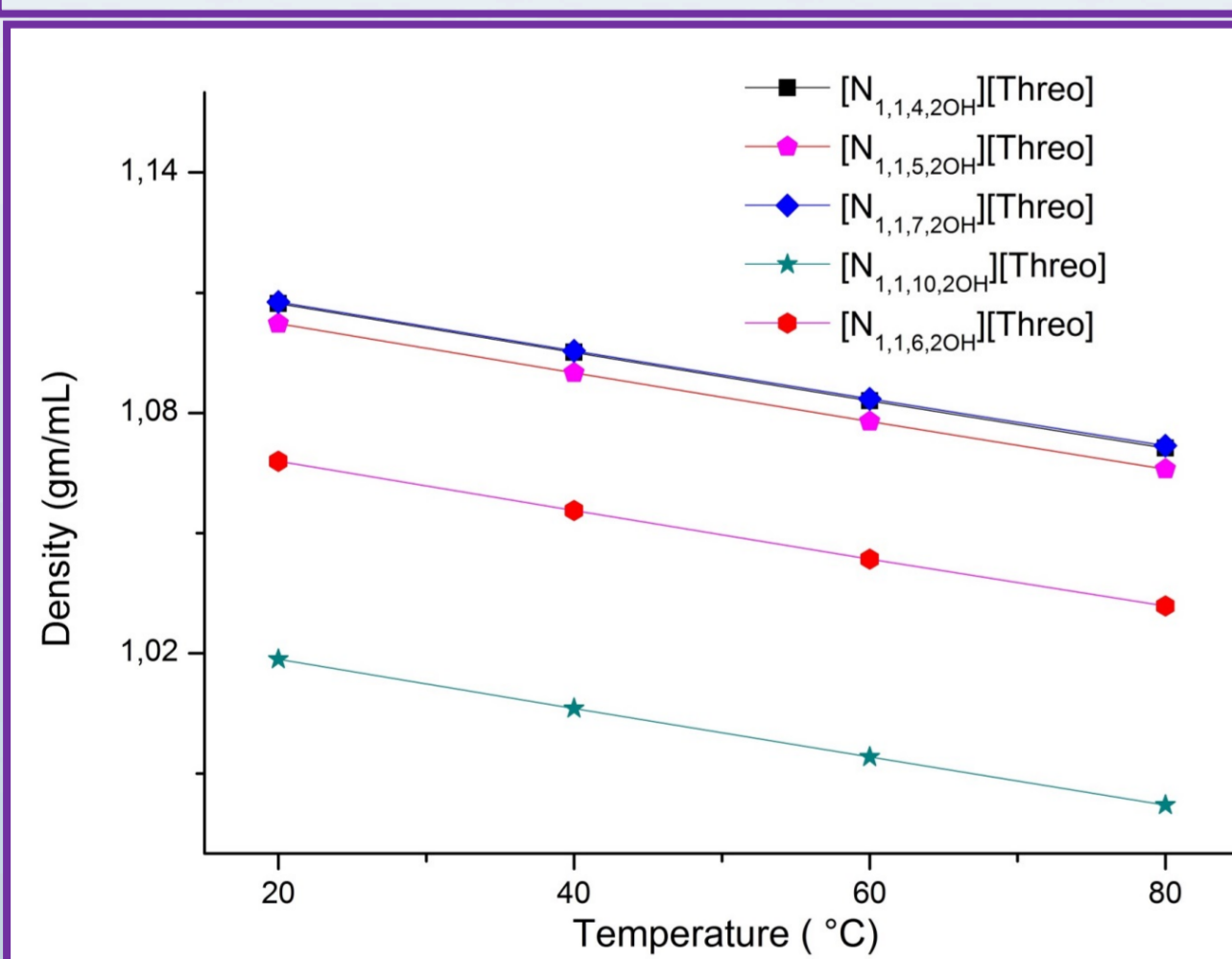
shorter alkyl chain on cation results viscous ILs

Longer alkyl chain on cation results viscous or solid ILs

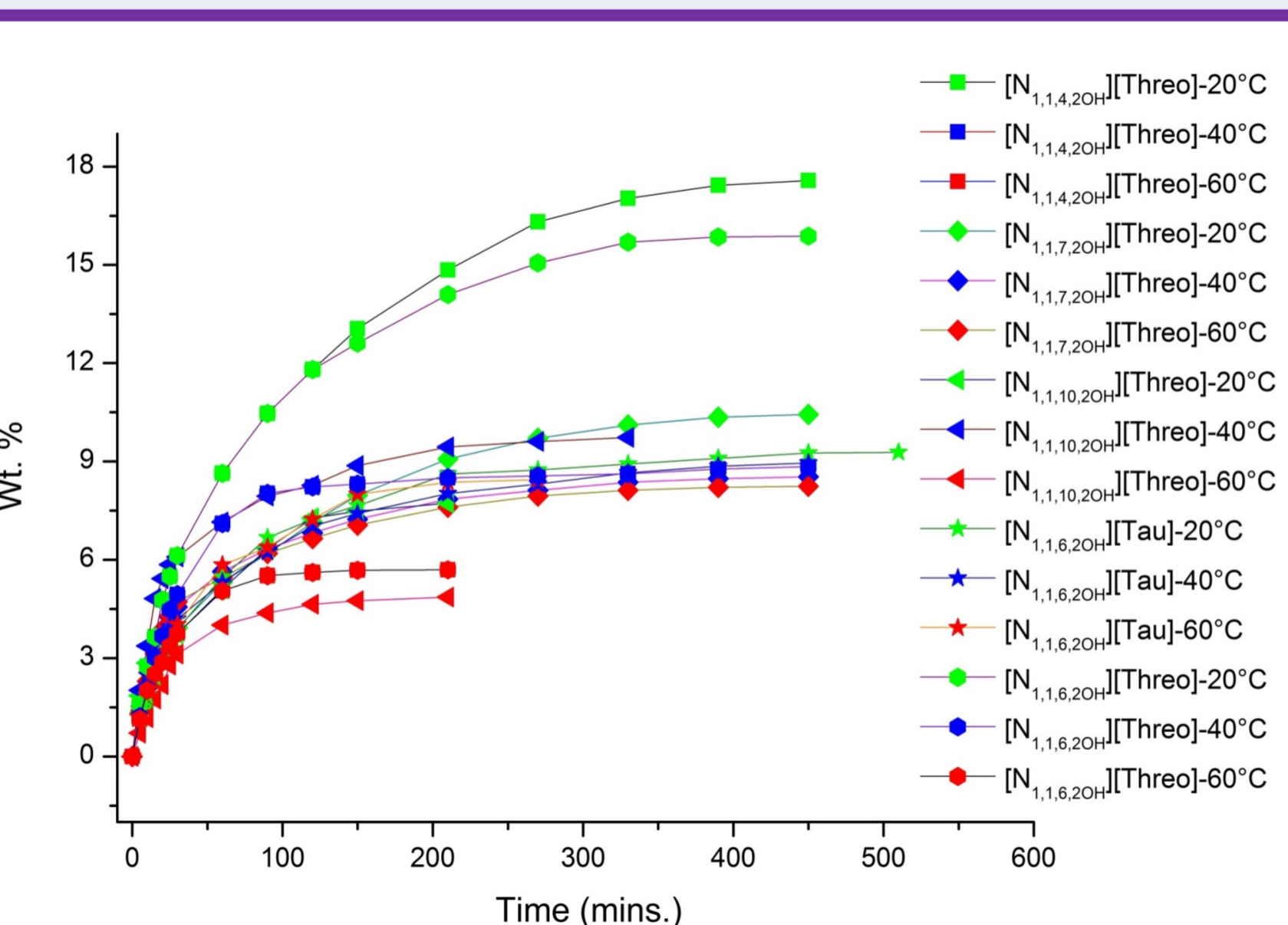
## Viscosity as function of temperature for selected ILs



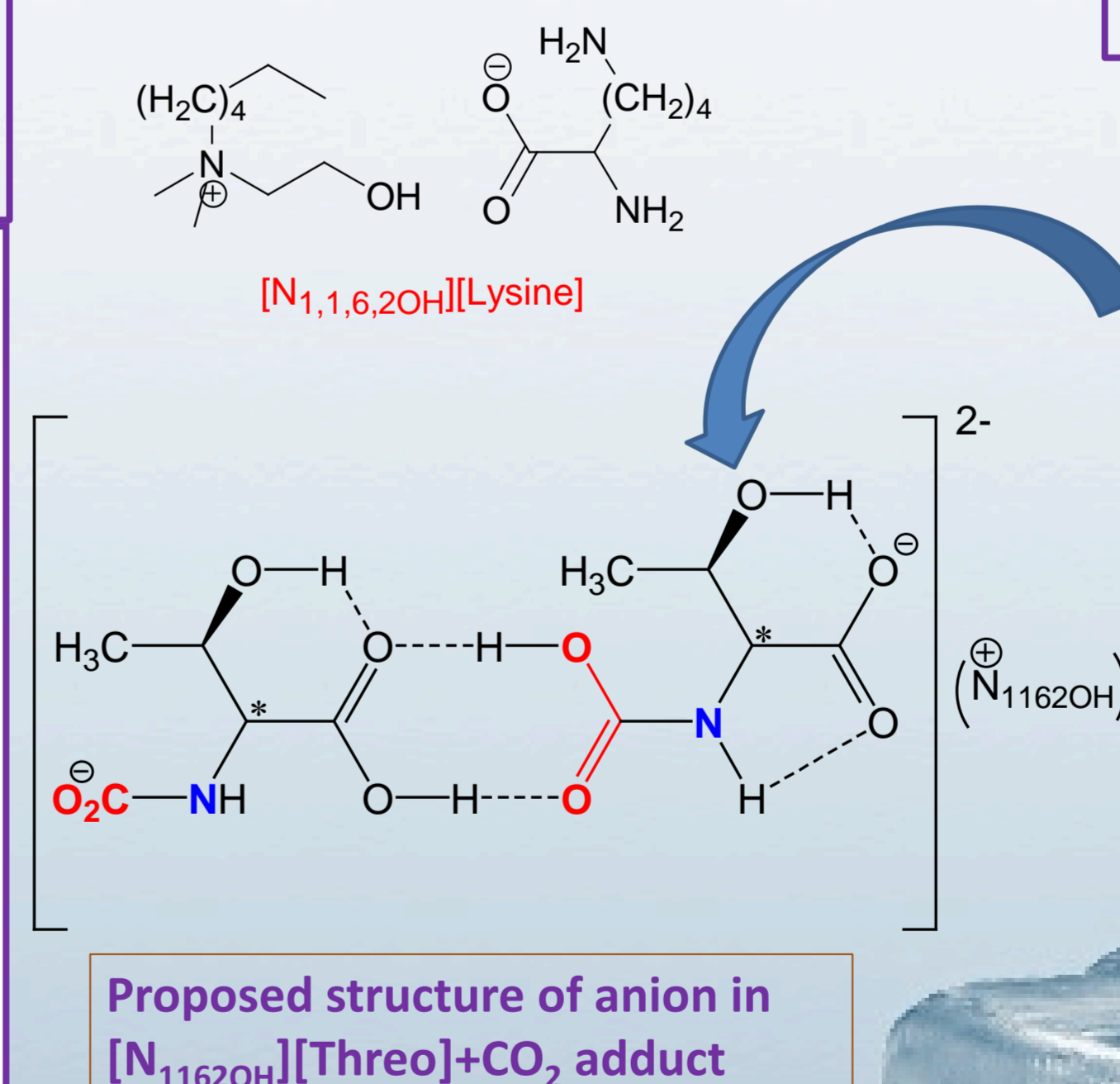
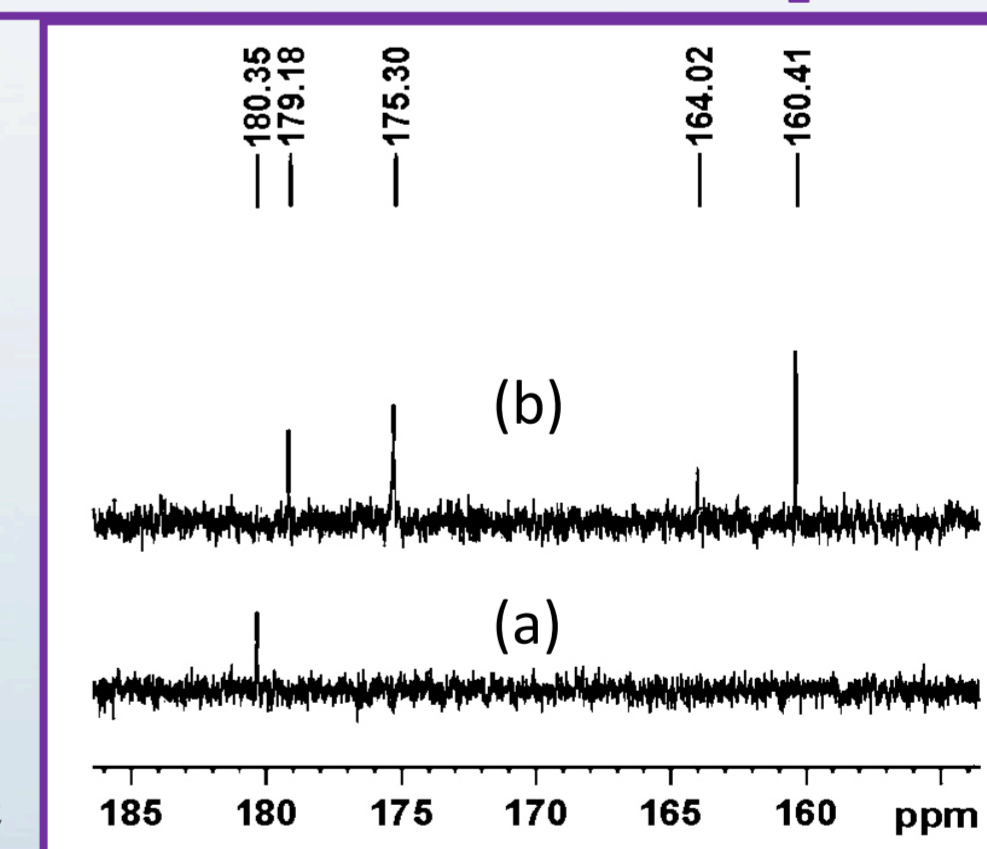
## Density as function of temperature for selected ILs



## Time-course CO<sub>2</sub> absorption study (in mol) of choline based amino acid ILs as function of time at 20°C (green), 40°C (blue) and 60°C (red)

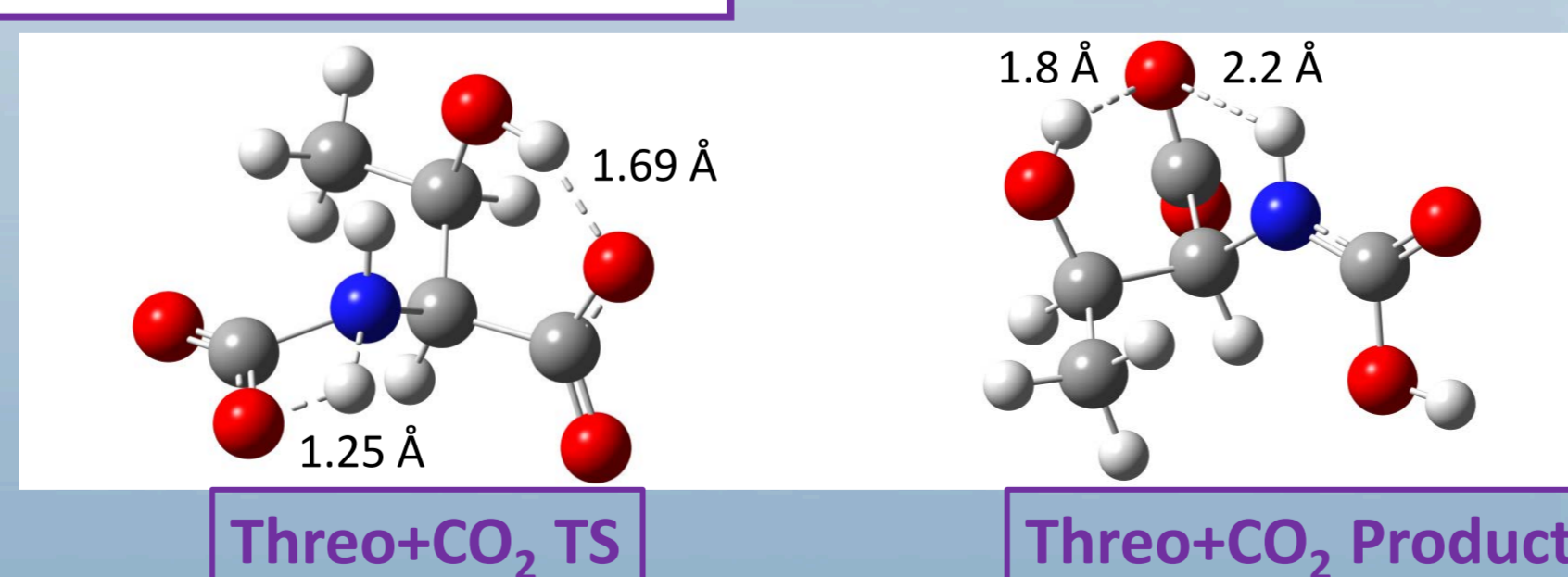
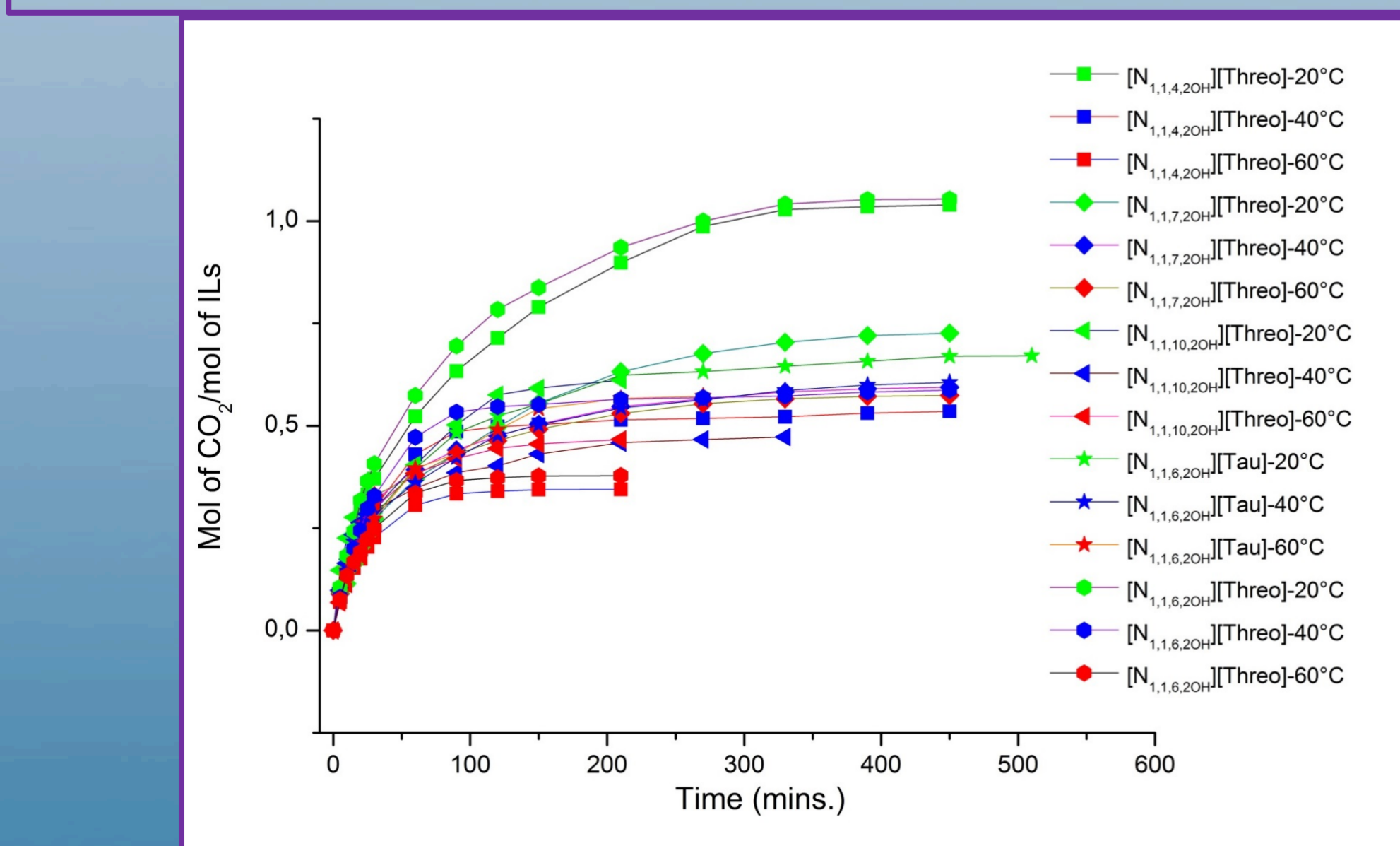


## <sup>13</sup>C NMR study of [N<sub>11620H</sub>][Threo] (a) before and (b) after CO<sub>2</sub> capture



Proposed structure of anion in [N<sub>11620H</sub>][Threo]+CO<sub>2</sub> adduct

## Time-course CO<sub>2</sub> absorption study (in mol) of choline based amino acid ILs as function of time at 20°C (green), 40°C (blue) and 60°C (red)



## Acknowledgement:

The Norrbotten Research Council is gratefully acknowledged for the financial support of this project

## Conclusions:

Functionalized choline based amino acid ILs can be promising scaffold for Bio-ILs. The results obtained warrants further optimization of structure can led to low viscous bio-ILs with high CO<sub>2</sub> capture capacity.