**Literature review map**

Plan out your research with this helpful literature review map, apply these strategies to your own work by filling out your answers to the questions below.

**Themes**What central themes have you identified in the field of research?

**Research chronology**

Show how the research field has developed over time.

Need for new technologies and routes identified. Porous materials to the picture, and zeolites, alumina and silica researched first.

Industrial ammonia capture and storage methods developed, such as precipitation through formation of ammonium sulfate, using permeable membranes and bio fixation.

Above porous materials showed low adsorption capacity. Further research developed polymers, metal organic frameworks, metal organic squares and inorganic composites, which showed high adsorption capacity, but sometimes low structural stability.

Potential is clear. Need to think of routes to improve both adsorption capacities and structural stabilities.

**Debates and disagreements**

Progress is also being observed in the already industrial routes.

Research is expensive – does the research costs associated with investigating porous materials for years counter the costs associated with improving current techniques?

Porous materials are showing potential to replace common industrial routes.

This would provide potential to reduce energy costs, improve efficiency and overall process of ammonia capture and storage.

What are the main debates and disagreements in this field of research?

Methodology

Investigate suitable porous materials for ammonia adsorption

Methodology

Methodology

**The Problem**

nnkvb

Critically evaluate all published high performing porous materials and compare their performances with each other. Provide evidence for new research routes through literature review.

Investigate their structural properties – what exactly contributes to high stability and adsorption capacities

Investigate the current methods used for ammonia adsorption.

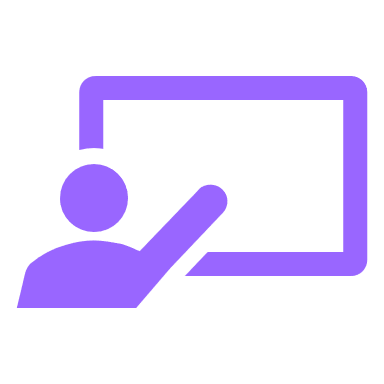
Methodology

Sihai Yang, University of Manchester

* Development of robust stable porous metal organic frameworks for ammonia capture, currently holds the record for the most stable metal organic framework for this application.

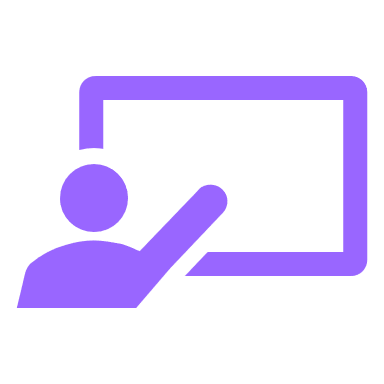
Who are the key researchers in the field? What was their major contribution?

**Key researchers**



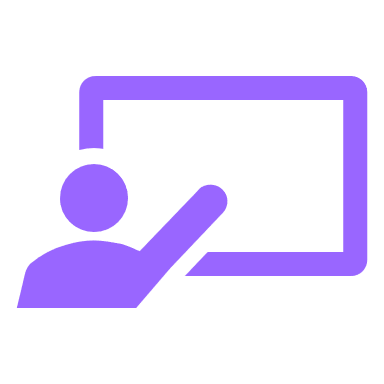
Long and co – workers

* Development of acidic porous polymers showing high stability and high adsorption capacities, one of the best performing porous materials recorded so far.



Hong and co – workers, Korea University

* Holds the world record for the porous material (metal organic framework) with highest adsorption capacity.



What gaps or weaknesses are there in the research field?

**Gaps in the research**

* There is currently no proper evidence on what the factors are affecting the high adsorption capacities and stabilities of porous materials – this is the main aim of this review.
* There is no progress in some areas, despite showing potential, for example, in porous dyes used for ammonia adsorption – why is this the case and why hasn’t it been investigated much is not looked upon.
* The current methods used for ammonia capture and storage is also developing – these routes are however still not that well received by the scientific community – why is this the case?
* Are there any other materials that are suitable for ammonia adsorption? Only more recently many existing porous materials were investigated, such as metal organic squares and hydrogen bonded organic frameworks.