Introduction:

- The performance of adsorption heat pumps is hampered by poor heat transfer in adsorbent beds.
- The large temperature jump method can be used to investigate heat transfer in adsorbent beds even as dynamics is usually the main focus.
- Veselovskaya et al [1] is an example. An overall heat transfer parameter was obtained as a by-product of a dynamics study.
- This heat transfer parameter considers the adsorbent material and its heat exchanger as one entity, combining with the effects of contact resistance.

Aims and Objectives:

- To separate the mentioned overall heat transfer parameter into thermal conductivity and heat transfer co-efficient using the active carbon-ammonia pair.
- Investigate the effect of bulk adsorbent density on these separated entities.

Experimental Work:

- The underlying process in large temperature jump experiments involves keeping a sorbent sample at a steady temperature and then imposing a large step temperature change which induces the sorption process at constant volume and quasi-constant pressure.
- The temperature change is achieved with a series of thermal circulating baths. The heat transfer fluid (water) is passed through a short circuit until it gets to the test cell. The temperature jump used was 40°C to 70°C.
- Temperature measurements of the ammonia gas (T1) and the sample heat transfer fluid (T3) are taken over the course of the test. The pressure change (P1) over the sample is also taken.

Analysis:

- The pressure evolution over the sample is modelled.
- This method can be justified for active carbon-ammonia pair as mass transfer resistance is minimal [2].

Analysis:

- The best fit model to the experimental pressure is then determined by minimising the root mean square error.

Conclusion and future work:

- It is possible to separate thermal conductivity and heat transfer coefficient in large temperature jump experiments. This method is being explored in the determination of rate parameters in thermo-chemical reactions.

References: