

Module 3 solution: Experimental design for a safety study

Questions 1 and 2

The following experiments are proposed:

1. DSC of the initial charge (solution of A) allowing for the determination of the thermal stability (Energy potential ($Q'_{\text{dec}} \rightarrow \Delta T_{\text{ad, dec}}$) and estimation of TMR_{ad}) of the reactor contents heated to 140 °C. This also give a useful information on the possibility to interrupt the process at this stage if required e.g. in case of malfunction, or other logistic problems.
2. Performance of the reaction as described in the procedure in a reaction calorimeter, for the determination of the heat of reaction (Q'_{rx}), maximum heat release rate (q'_{max}) and the thermal accumulation (X_{acc}) allowing for the calculation of the MTSR.
3. DSC sample of the reaction mass before heating to 150 °C allowing for the determination of the thermal stability at this stage (Energy potential ($Q'_{\text{dec}} \rightarrow \Delta T_{\text{ad, dec}}$) and estimation of TMR_{ad}). The reaction is probably not yet completed and some reaction energy will be measured
4. DSC sample of the final reaction mass after the holding time at 150 °C allowing for the determination of the thermal stability at this stage (Energy potential ($Q'_{\text{dec}} \rightarrow \Delta T_{\text{ad, dec}}$) and estimation of TMR_{ad}), here only the decomposition (if it exist) will be characterised.
5. DSC sample of the wet filter cake for the determination of the thermal stability Energy potential ($Q'_{\text{dec}} \rightarrow \Delta T_{\text{ad, dec}}$) and estimation of TMR_{ad}). This allows the assessment of heat accumulation conditions in the filter.