Alkaline hydrolysis of polymers
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Project summary

Hydrolysis of common mode of polymer degradation, which is accelerated both at high and low pH. Of significant interest for polymers used in the construction industry is the alkaline hydrolysis (high pH) as all cement based materials have high pH at high humidity. For example can flooring adhesives on concrete or screeds hydrolyse if the humidity is high, causing odorous emissions.

We have developed a laboratory based method using isothermal calorimetry to measure both the rate and the extent of hydrolysis as a function of pH, temperature and other parameters. The method relies on that alkaline hydrolysis in strong bases is always accompanied by neutralization, and this process has an almost constant enthalpy change (heat production), while the hydrolysis itself has close to zero enthalpy change. As we know the enthalpy of neutralization we can thus follow hydrolysis processes minute by minute, quantifying the amount of hydrolysis events (breaking of ester bonds) that have taken place.

This line of research started with a successful attempt to assess the difference in hydrolysis susceptibility between different flooring adhesives (see Anderberg and Wadsö 2007) and continued with a FORMAS project which has resulted in a paper in which the method is tested and shown to work (Wadsö and Karlsson 2013). We now continue studying for example copolymer dispersions. The figure shows result from measurements on a copolymer dispersion at different alkalinitities. The thermal power is proportional to the rate of hydrolysis.

References

