CHAPTER 2. Objectives

2.1. Reason for this study

As populations increase in the developing world, so do waste management problems, and so does the need for more cement and concrete for housing and the infrastructure of development. Therefore, use of cement has long been the basis for society development. The cement industry in the UE produces about 170 million tonnes of cement each year, contributing significantly to economy, as is also acknowledges of its responsibility to manage the environmental impact associated with the manufacture of its products.

The cement industry is able to use waste as alternative fuels and raw materials to reinforce competitiveness and at the same time contribute to solutions to some of society's waste problems in a way which valorises the waste and is beneficial to the environment. Involved in worldwide efforts to reduce CO_2 emissions, cementitious construction materials are increasing more and more the use of so-called Supplementary Cementitious Materials (SCMs), either originate from different industries or have a natural origin, leading to *low-CO_2 cements* that consume less natural resources as well as fossil fuels.

In addition, hazardous wastes, deserving special attention to heavy metals, are a small fraction of total waste generated but its potential contribution to environmental pollution is really high, even more when considering that society is used to landfills as deposit wastes. Currently, cementitious solidification/stabilization is recognized as the best demonstrated available technology by the US Environmental Protection Agency (USEPA) for the disposal of most toxic elements. Therefore, the present study has the aim to contribute in such research by evaluating the role of cementitious materials in terms of heavy metals immobilization and release, particularly of vanadium, noting possible changes in system's dynamics.

2.2. Principal objective

- Studying vanadium retention mechanisms in cementitious systems.

2.3. Specific objectives

- Studying vanadium retention mechanisms on portlandite;
- Studying vanadium retention mechanisms on hydrated tricalcium silicate (C_3S) pastes;
- Studying hydration mechanisms and products for calcium oxide to form portlandite;
- Studying hydration mechanisms and products for calcium oxide in a vanadium aqueous solution;

2.4. Study development

I. Literature review of:

   I.I. C_3S hydration mechanisms;

   I.II. C_3S or cement pastes behaviour when doped with heavy metals;

II. Hydrated C_3S pastes manufacture and characterisation, together with characterisation of portlandite and calcium oxide substrates.

III. Pertinent experiments performance, characterisation of obtained products and final test conditions assessment.

IV. Results interpretation along with geochemical modelling.

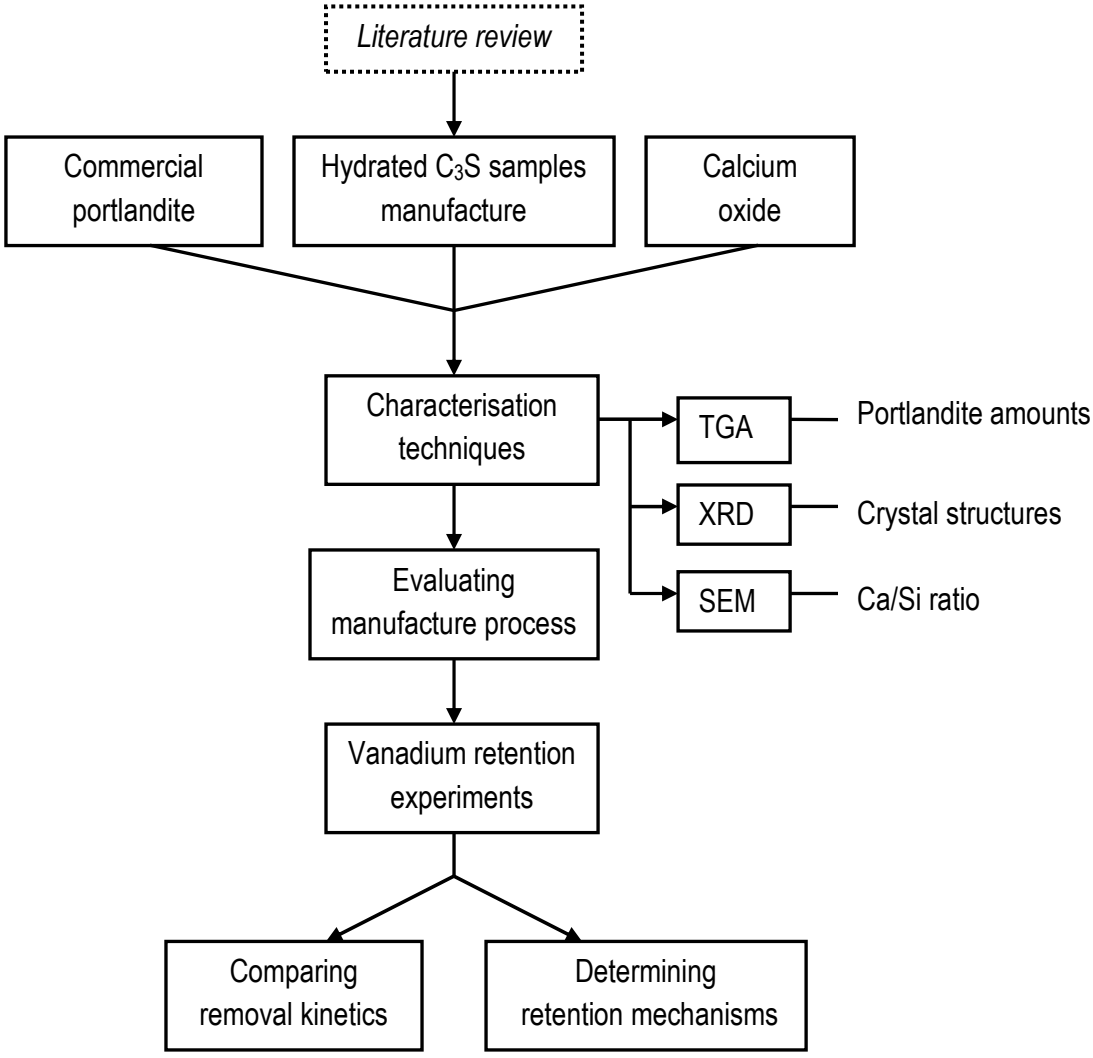

Figure 2.1. Study development.

2.5. Annex content

As already noted, the present work aims to study the retention of vanadium oxyanions in cementitious materials. But, while performing sorption experiments, leaching tests have been done simultaneously although in the present state no final conclusions can be considered. Hence, it must be taken into account that release experiments as long-term tests are important in order to know how vanadium could impact if cementitious materials are exposed to the environment conditions. Although the leaching results are not the expected ones, they are presented with the corresponding discussion in Chapter 8 as Annex – Leaching experiments, as well as the materials and methods considered for such experiment. The reasons why no release mechanisms can be established are specified also in mentioned Annex.