

Company: Deltares, Royal HaskoningDHV, Rijkswaterstaat, Port of Rotterdam, CiTG - ChemE TU Delft

Project: Design of a Gel Product for sedimentation control in the Rotterdam port area

EngD trainee: Atha Bampatzeliou, TU Delft

Chemical Product Design

Sediment tends to accumulate in small channels in port of Rotterdam which obstructs daily ship navigation and requires maintenance with high-cost dredging operations. The goal of this project was to design a gel product that helps in the sedimentation control in the Rotterdam port area and contributes to the reduction of disposal costs, by offering a feasible, stable, and eco-friendly solution.

The design approach followed included:

- 1) Techno-economic evaluation to identify the materials and recipe
- 2) Stability trials to determine critical rheological factors and provide data for CFD study
- 3) Product and application concepts
- 4) Feasibility investigation for the use of Kaumera as a gelation agent and other applications

After evaluating different concepts against set criteria, Xanthan gum (XG) and fine sediment were combined to provide a stiff gel in port areas with speed currents <0.1 m/s for 4 weeks. A sensitivity analysis took place, considering material, manufacturing, application, and transportation costs.

The inline preparation of the gel barrier was the most economically feasible application strategy. With the proposed application method, the CO₂ emissions associated with dredging can be reduced by 40%, saving up to 2400 t CO₂/y. Building a barrier in the port seems a promising application for cost and CO₂ reduction and cost-effective trials could be made to validate the barrier's efficiency in reducing incoming mud. A roadmap for the project development includes prolonging the efficiency of the gel in reducing dredging costs, performing large-scale trials in Deltares flume to test the efficiency and finally a pilot scale trial in port of Rotterdam.

