DESIGN AND VALIDATION OF THE MIXING SYSTEM IN A CHEMICAL REACTOR FOR CONVERSION FROM DOF TO DOTP PRODUCTION

Goal of the project

The project was aimed at designing a new mixing rotor for a chemical reactor, in order to satisfy the new operating conditions and requirements for a two-phase liquid-solid fluid instead of the single-phase (liquid) initial design.
The project started with a preliminary numerical analysis of the existing two-blade rotor working with a liquid-solid mixture. The results showed a severe and unacceptable sedimentation of the solid phase, which would lead in poor chemical reaction kinetics.
A new mixing solution was therefore required, and this project was set to provide such a solution by replacing the existing rotor with a new one, while maintaining the same rotation speed and mechanical power.

Short description of the project

The project had several tasks , including assessment of the existing rotor, design of a new rotor, technical drawings for the new rotor, numerical and in-situ performance validation.

Project implemented by

The project was implemented by an interdisciplinary team (Mechanical Engineering and Chemical Engineering) from the Politehnica University Timișoara and Oltchim S.A. Rm. Vâlcea.

Implementation period

April-December 2017

Main activities

The first task of the project was to assess the existing mixing solution, and to establish the hydrodynamic requirements for a new mixing rotor that prevents sedimentation of the solid phase. This was done using advanced three-dimensional two-phase flow numerical simulation. Then, using the modern inverse design approach, a three-blade rotor was designed.

The new mixing solution installed and tested in-situ.

The new rotor performance was validated using numerical simulation. It was found that a two-rotor solution, provide the required homogeneous liquid-solid mixture, while completely avoiding sedimentation.

Results

The hydrodynamically designed rotor was further simplified technologically, while preserving the mixing performance, resulting in the solution manufactured at SC Popeci Utilaj Greu, Craiova.

Applicability and transferability of the results

The complex methodology for analysis and design of mixing rotors for liquid-solid chemical reactors can be further extended and applied for other operating conditions and reactor geometries.

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Research Centre

Research Centre for Complex Fluid Systems Engineering

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