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Employing process simulation to integrate sustainable development goals (SDG) to second year chemical engineering module

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ABSTRACT

Separation processes are a core component of chemical engineering education and form a fundamental part of the undergraduate curriculum. At the University of Surrey, separation processes are introduced in the second year through the ENG2111 Separation Process 1 module. This paper presents the design and evaluation of an integrated, simulation-based learning activity in which core separation concepts are embedded within a methanol production case study. The separation module is deliberately aligned with a process simulation project, enabling students to apply separation fundamentals directly to an industrially relevant system. Aspen HYSYS is used as the simulation tool, equipping students with practical skills in process modelling, flowsheet development, and performance evaluation of a methanol production plant. Within this integrated framework, students are requested to devise process simulations for producing grey and bio methanol, optimize separation strategies, assess energy and yield trade-offs, and subsequently propose sustainability-driven design improvements. A key feature of the activity is the requirement for students to explicitly link their design decisions to relevant Sustainable Development Goals (SDGs) relevant to methanol production. Here, for the first time, we proposed “Level of Understanding Score (LUS)” to capture students’ understanding on sustainability. Analysis of representative student work indicated that students successfully applied separation principles to reduce energy consumption, enhance process efficiency, and articulate clear connections between technical choices and sustainability objectives. The results demonstrated that integrating separation module with process simulation and SDG-oriented reflection can effectively support the development of both technical competence and sustainability awareness in undergraduate chemical engineering education

KEY WORDS

Sustainability, simulation, sustaianble development goals, energy, environment

BIOGRAPHY

Dr. Putranto is a Senior Lecturer (Chemical Engineering) and Senior Lecturer (First Year Engineering Teaching) in Faculty of Engineering at University of Sydney. He is a Senior Fellow of Higher Education Academy (SFHEA) and Chartered Engineer with IChemE (CEng MIChemE).

As a Senior Fellow of Higher Education Academy (SFHEA), he has experience in leading academic programs beyond unit/module level, including (1) embedding sustainability into curriculum (2) developing design-based learning (3) developing digital-based approach based on modeling and simulation tools. He has innovated his teaching through co-creation with students, industry, and society.

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