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Application of exergy analysis in living cells: A case study with Escherichia coli as a biofuel source

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The increasing demand for renewable energy sources has stimulated research in the field of biofuels, with microbial systems being a promising option. Among them, Escherichia coli (E. coli) are a well-known bacterium that has been genetically engineered for the production of various biofuels, including ethanol and butanol. However, the efficiency of these processes is limited by the intrinsic thermodynamic properties of living cells, which can be analyzed using exergy analysis.

Exergy analysis is a powerful tool for assessing the efficiency of energy conversion systems, including biological systems like E. coli cells. Exergy is the measure of the energy available to do useful work, while exergy cost theory quantifies the environmental impact of using such resources.

Exergy is measures of the potential work that can be obtained from a system, taking into account its state and environment. In living cells, exergy can be used to quantify the irreversibilities associated with cellular processes, such as biochemical reactions and transport across membranes. By applying exergy analysis, it is possible to identify the limiting steps in biofuel production and propose strategies for their optimization.

Whilst Exergy cost theory can be used to assess the environmental impact of producing biofuels from E. coli cells. This involves quantifying the exergy cost of the resources used in the production process, such as water and nutrients, as well as the exergy cost of the waste products generated during production. By minimizing the exergy cost, it is possible to reduce the environmental impact of biofuel production from these bacteria.

In this talk, we will present our work on the application of exergy analysis and of the exergy cost theory to E. coli cells as a biofuel resource, highlighting its ability to help in optimizing the biofuel production, improve efficiency and reduce the environmental impact of this industrial process.

We will discuss how these insights can guide the design of more efficient biofuel production systems and how exergy analysis can be extended to other microbial systems and applications.

Overall, this talk will provide a novel perspective on the use of exergy analysis in biotechnology, highlighting its potential to reveal the thermodynamic bottlenecks in living cells and pave the way towards sustainable bioenergy production.

Biography

Assal Selma is from Italy. She studied in University of Trieste, Dept. of Engineering and Architecture. She is very much interested in doing her research work related to bacteria using Biofuel Source.

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