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Challenges and innovations in chemical reaction engineering

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Abstract
Process improvements, new technology and innovations are required to address the driving forces and technical challenges faced by the refining, chemical and petrochemical industries.
Economically speaking, R&D projects must be executed with a high degree of efficiency and, from a scientific standpoint; we must produce top quality results. In other words, we must produce more and better results with a shorter time between lab and industrial implementation; This is, obviously, an extremely difficult but not impossible task. This is primarily achieved by: Emphasizing process intensification through multi-functional reactors, integrating catalysis and reaction engineering, Promoting collaborations through strategic R&D.

Keywords: refining, commercialization, intensification, catalysis, multi-functional reactors

1. Introduction

The chemical industry influences all our lives daily. Past success of the chemical industry was accomplished by discovery and commercialization of novel products and development of manufacturing processes. By evolving world changing scientific innovations will offer the chemical industry a great opportunity, to contribute to enabling technologies and manufacture many new products, our challenge is to benefit from these opportunities.

In case of biotechnological opportunities, the recent advances in biological sciences will lead to development of many new products such as novel pharmaceuticals, food additives and vitamins, bio chemical's, biopolymers and biofuels, due to significant increase in application of chemical technology towards the production of penicillin increase the productivity of large biochemical reactors. Since most of the biological reactions are conducted in cells, engineer's task is to design large biochemical reactors and their operating procedures. Since most of biological reactions are conducted in dilute aqueous solutions, an engineer need to develop novel, economical separation processes such as filtration, centrifugation, crystallization and membrane and chromatographic separation. At present fermenters followed by a series of separation and purification operations. So it is important that chemical engineers master an understanding of metabolic engineering which uses genetically modified or selected organisms to manipulate the biochemical pathways in a cell to produce a new product to eliminate unwanted reaction or to increase yield of a desired product.

Experience with chlorofluorocarbon (CFCs), insecticides such as DDT, herbicides and fertilizers taught us that extended stability of these products may lead to unexpected harmful results. An important challenged will be to develop novel products that have limited stable life and decompose so that they do not persist in this environment.

The development of new processes always generates challenging design and operation problems and provides engineers with an opportunity to make important contributions. In case of novel material opportunities, one important consideration is use of novel catalyst which enable synthesis of novel products, increase the yield and selectivity of desired product, use less expensive reactants, minimize the formation of byproducts and decrease energy consumption. There fore major challenge will be to develop new processes or step -up technologies that increase yield and/ or selectivity, use cheaper raw materials, decrease energy consumption, minimize the product separation and purification needs and lower capital investment.

Another important challenge is to enhance the reliability of design and scale up of multiphase reactors, such as fluidized bed reactors and bubble columns. A reliable scale-up procedure. A reliable scalp -up procedures will enable conducting much exothermic reaction in fluidized bed reactors rather than the much more expensive multi-tube reactors.

Other challenges includes, participation in the development of alternative fuels, to provide society with profession guidance and advice about the feasibility and merit of proposed technological solutions, to identify these problems, to figure out how we can solve them using CRE methodology and to generate the resources needed to their development and commercialization.

The petroleum refining, petrochemical and chemical industries face an array of difficult technical challenges, including environmental issues Process improvements, new technology and innovations are required to address the driving forces and technical challenges faced by the refining, chemical and petrochemical industries.

Economically speaking, R&D projects must be executed with a high degree of efficiency and, from a scientific standpoint; we must produce top quality results. In other words, we must produce more and better results with a shorter time between lab and industrial implementation; this is, obviously, an extremely difficult but not impossible task. This is primarily achieved by: Emphasizing process intensification through multi-functional reactors, integrating catalysis and reaction engineering, Promoting collaborations through strategic R&D.

With respect to accelerating innovation, collaborations with

universities can offer major advantages. Universities usually work at the cutting edge of new technology and consequently, these collaborations can considerably reduce the gap between basic and exploratory applied research throughput methodologies will revolutionize catalyst development in the coming years. Most likely, this new approach will be more useful for catalyst optimization than for catalyst discovery. In order to have access to combinatorial and high throughput methodologies, we will probably choose to work with a smaller startup company before adopting this approach for in house experimentation. From a business standpoint, it is becoming evident that through advanced catalysts we have an opportunity to grow our revenues substantially. In order to do so, larger investments and more resources are required; throughput methodologies will revolutionize catalyst development in the coming years. Most likely, this new approach will be more useful for catalyst optimization than for catalyst discovery.

2. Conclusion

In order to have access to combinatorial and high throughput methodologies, we will probably choose to work with a smaller startup company before adopting this approach for in-house experimentation.

If we do this and let the upcoming innovations change the chemical industry such that when old burns it to ashes and then rises from them youthfully to begin a new life.

3. References

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