Recent Advances in
Petrochemical Science
ISSN: 2575-8578

Juniper Publishers
key to the Researchers

Mini Review
Volume 7 Issue 3 - April 2022
DOI: 10.19080/RAPSCI.2022.07.555711

Recent Adv Petrochem Sci

Nanotechnology and Petrochemical Industry

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Submission: April 13, 2022; **Published:** April 26, 2022

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Abstract

Nanotechnology has been magnificently employed in so many applications such as electronics, medical and healthcare, environmental remediation, etc. Conversely, this technology is an active field of research in the petrochemical industry. This short review had examined and evaluated the role of nano sensors, nanomembranes, nanocomposites, and nanofluids in a very brief approach. Development in the fundamental research, comprising the novel synthesis approaches of nanomaterials and extension of applications of existent nanomaterials will endure assisting the progress in the application of nanomaterials in the petrochemical industry.

Keywords: Nano sensors; Nanomembranes; Nanocomposites; Nanofluids; Petrochemical

Introduction

The petrochemical production has been encountered new-fangled inquiries carried out by gradually more exacting provisions on the environmental protection and energy conversion, varied sources of the raw materials, combination and optimization of the supply chain, pressure of the product cost reduction, individualized customer needs, and so on [1]. Owing to the increasing demand for these parameters, the various tasks might be figured out by innovative technological progress in different sectors by science and advanced technology. Because of superior nanometer-scale ranging from 1 to 100nm and exceptional features, nanotechnology has revolutionized several fields, comprising the petrochemical [2]. Nanotechnology can build up and control the material at the molecular level which makes it possible to formulate something which has excellent features including high strength, lightweight, and some important proficiencies such as mechanical, optical, electrical, and heat conductivity [3]. In this short review, we will discuss the role of different nanomaterials such as Nano sensors, nanofluids, nanocomposites, nanocoating, nanomembranes, and nano catalysts in petrochemical science.

Nano Sensors in Petrochemical Industries

The significant role of a sensor is to deliver a reliable report concerning the composition of the material used for the sensing. Therefore, a device designed for sensing should function frequently and reversibly, limited of not troubling the analytes, furthermore, the perfect gas sensor should be accessible at an economical cost and be free of errors [4]. Nagaraju and the team have synthesized and reported ZnO thin films in the range of 16-20nm, as a sensor for the detection of the monoaromatics hydrocarbons for instance benzene, toluene, ethylbenzene, and xylene (BTEX), which are the cluster of dangerous contaminants and emerge from the sources like oil and gas extraction fields, glue and petrochemical industries. In petrochemical industries, to produce styrene, ethylbenzene is the main intermediate compound. One another hydrocarbon, existing in vapor or liquid state is also broadly used in the petrochemical industries. The gas sensing investigation revealed that ZnO thin film shows the best response for the BTEX gases [5].

Nanomembrane in Petrochemical Industries

The gas separation based on the membranes is a somewhat well-established unit operation, in the petrochemical production, with various applications such as monomer regaining in polyolefin and polyvinyl chloride manufacturing, ethylene regaining in ethylene oxide manufacturing, syngas H_2/CO ratio tuning for oxo-alcohol manufacturing, etc. [6]. Muntha and coworkers have

compiled an impressive report showing in detail the use and advances of polymeric nanofiltration membranes in different fields including the petrochemical industry [7]. In another report, the organic solvent nanofiltration membranes were synthesized from polybenzimidazole that shows outstanding chemical stability in comparison to the recognized polymeric membranes for instance polyimide. The outcomes show that the prepared membranes were more stable and have the capability for applications in chemically tough situations bring into being in processes extending from pharmaceutical to petrochemical productions [8].

Nanocomposites in Petrochemical Industries

The polymer nanocomposites have brought new applications of polymer into our everyday survives. The ease for usage, cost-effectiveness, and frequent applicability of plastic have made their use nearly everywhere. In petrochemical industries, the epoxy coat is extensively used for the exterior application however vinyl-based or water-based intumescent coat is useful to the interior. The necessity for the fireproofing thickness fluctuates in petrochemical industries tries based on the applications [9]. In catalytic chemistry, the selective oxidation of C-H bonds is a significant reaction and found as of great importance in the chemical industry, drug production progression, and petrochemical industry. Tan and the team synthesized the microporous cobalt porphyrin covalent polymer facilitated Co_3O_4@PNC nanocomposites and reported as a new sort of proficient C-H oxidation catalysts with excellent promising in petrochemical industries as well [10].

Nanofluids in Petrochemical Industries

Because of the need for heat exchange for the various industries such as food, automotive, pharmaceutical, oil, and gas, petrochemical industries, etc. heat exchangers are used. In the new era, the plate heat exchangers are the newest creation of heat exchangers and are extensively used in different productions. for the enhancement of thermal efficacy of plate heat exchangers and tools, out of so many methods, the latest one is to use nanofluids as a working fluid which are available as solid nanoparticles in the form of suspension in ordinary heat transfer fluids. These fluids develop the improvement of these kinds of exchangers [11]. In a report, MgO-oil-based nanofluids were investigated experimentally as well as statistically. The synthesized nanofluid is a blend of base fluid i.e., the corn oil and MgO nanoparticles. The outcomes achieved from the usage of nanofluid were related with the pure oil base fluid as a hot medium. It was perceived that the usual heat transference rates for the nanofluids are much greater in comparison to pure corn oil, therefore considered as the efficient heat transfer nanofluids in the various industries [12].

Conclusion

In conclusion, nanotechnology has the potential to transform the technology landscape of the petrochemical industry. This short review outlined the role of nano sensors, nanomembranes, nanocomposites, and nanofluids with a very brief discussion. Although the substantial improvement has been made, there is still a long way to go to attain factual smart procedure manufacturing. In view of this background, comprehensive research of the synthesized nanomaterials should be accompanied in advance they enter the petrochemical industry as a promising alternative.

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How to cite this article: Dolly R, Akash K, Deepika J. Nanotechnology and Petrochemical Industry. Recent Adv Petrochem Sci. 2022; 7(3): 555711.
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DOI: 10.19080 RAPSCI.2022.07.555711